

TOWN OF WRENTHAM HAZARD MITIGATION PLAN 2018 PLAN UPDATE

*FINAL PLAN
APPROVAL PENDING ADOPTION
ISSUED BY FEMA*

PREPARED FOR:

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ACKNOWLEDGEMENT AND CREDITS

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Public Meeting Participants and Community Stakeholders

Special thanks to the public meeting participants and community stakeholders who provided feedback.



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III. EXECUTIVE SUMMARY

Hazard Mitigation planning is a proactive effort to identify actions that can be taken to reduce the dangers to life and property from natural hazard events. In the communities of the Boston region of Massachusetts, hazard mitigation planning tends to focus most on flooding, the most likely natural hazard to impact these communities. The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA funding for hazard mitigation grants, to adopt a local multi-hazard mitigation plan and update this plan in five year intervals.

A. PLANNING PROCESS

This is an update of the original Wrentham Hazard Mitigation Plan, which was approved by FEMA on October 19, 2010. Planning for the Hazard Mitigation Plan update was led by the Wrentham Local Hazard Mitigation Planning Team, composed of staff from a number of different Town Departments. This team met on November 6, 2017, March 23, 2018, and June 19, 2018 and discussed where the impacts of natural hazards most affect the Town, goals for addressing these impacts, updates to the Town's existing mitigation measures and new or revised hazard mitigation measures that would benefit the Town.

Public participation in this planning process is important for improving awareness of the potential impacts of natural hazards and to build support for the actions the Town takes to mitigate them. The Town hosted two public meetings. The first was on May 2, 2018 with the Planning Board and the second on June 19, 2018 with the Board of Selectmen, and the draft plan update was posted on the Town's website for public review. Key town stakeholders and neighboring communities were notified and invited to review the draft plan and submit comments. [\[Insert Public Comments\]](#).

B. RISK ASSESSMENT

The Wrentham Hazard Mitigation Plan assesses the potential impacts to the Town from flooding, high winds, winter storms, brush fire, geologic hazards, extreme temperatures, and drought. Flooding, driven by hurricanes, northeasters and other storms, clearly presents the greatest hazard to the Town. These are shown on the map series (Appendix B).

The Wrentham Local Hazard Mitigation Planning Team identified 77 Critical Facilities. These are also shown on the map series and listed in Table 21, identifying which facilities are located within the mapped hazard zones.

A HAZUS-MH analysis provided estimates of damages from Hurricanes of 1% and 0.2% Annual Chace at \$11 million and \$42 million, respectively. Earthquakes of magnitudes 5 and 7 analysis provided \$210 million and \$1.5 billion respectively in property damages. Flood damage for the 1% and the 0.2% Annual Chance Flood at \$2.2 million and \$2.8 million respectively.

C. HAZARD MITIGATION GOALS

The Wrentham Local Hazard Mitigation Planning Team identified the following hazard mitigation goals for the Town:

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.
2. Prevent and reduce the damage to public infrastructure resulting from all hazards.
3. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
4. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
5. Encourage the business community, major institutions and non-profits to work with the Town to develop, review and implement the hazard mitigation plan.
6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.
8. Take maximum advantage of resources from FEMA and MEMA to educate Town staff and the public about hazard mitigation.
9. Consider the impacts of climate change, both adaptation and mitigation. Incorporate the Municipal Vulnerability Preparedness workshop results in hazard mitigation and all municipal planning.

D. HAZARD MITIGATION STRATEGY

The Wrentham Local Hazard Mitigation Planning Team identified a number of mitigation measures that would serve to reduce the Town’s vulnerability to natural hazard events. Overall, the hazard mitigation strategy recognizes that mitigating hazards for Wrentham will be an ongoing process as our understanding of natural hazards and the steps that can be taken to mitigate their damages changes over time. Climate change and a variety of other factors impact the Town’s vulnerability now and in the future. Local officials will need to work together across municipal lines and departments and with state and federal agencies in order to understand and address these changes. The Hazard Mitigation Strategy will be incorporated into the Town’s other related plans and policies.

E. PLAN REVIEW & UPDATE PROCESS

The process for developing Wrentham’s Hazard Mitigation Plan 2018 Update is summarized in Table 1 below.

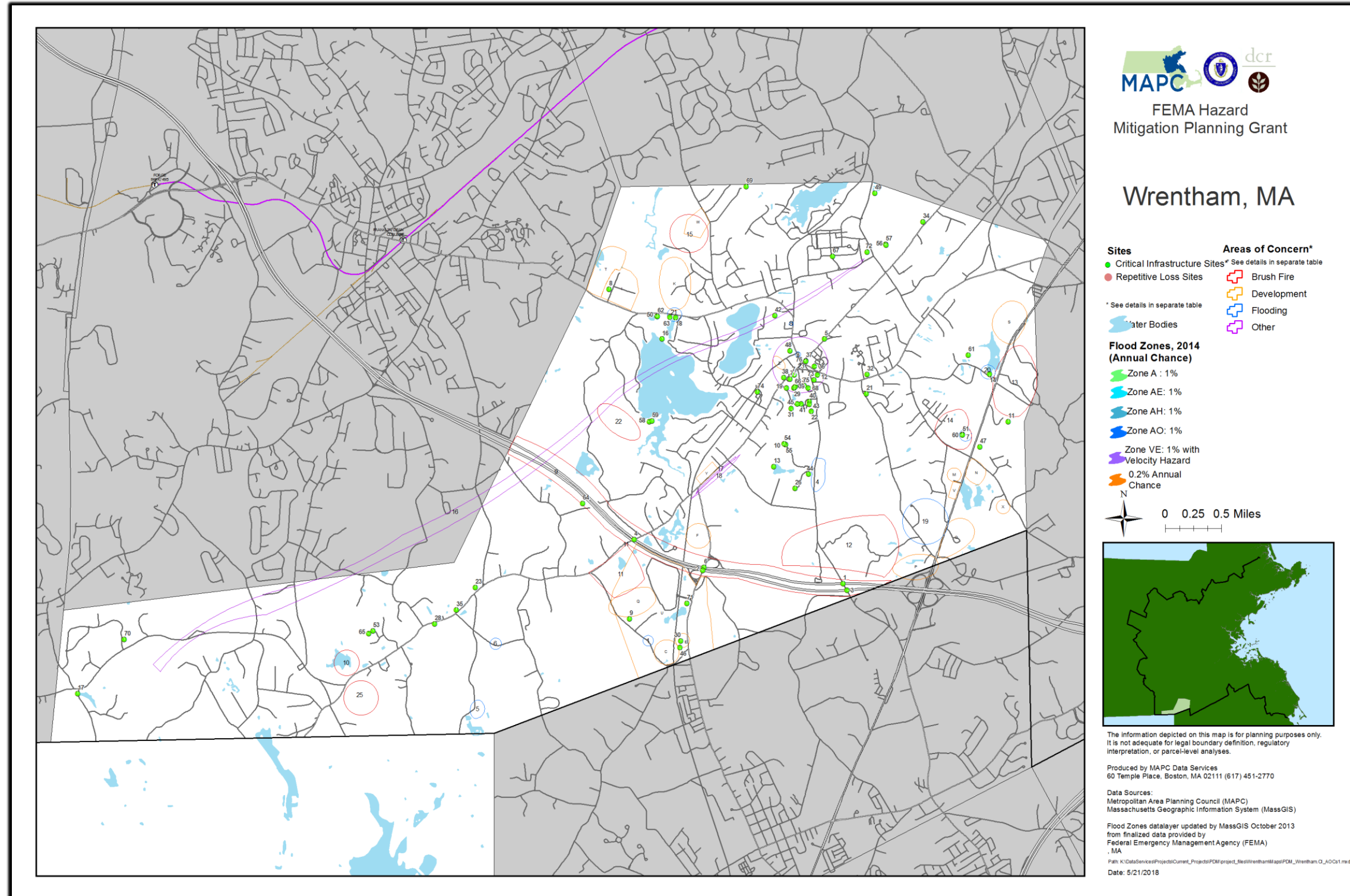
Table 1 Plan Review and Update Process

Chapter	Reviews and Updates
III – Public Participation	The Local Hazard Mitigation Planning Team placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at the first local committee meeting. During plan development, the plan was discussed at two public meetings hosted by the Emergency Management Team. The plan was also available on the Town’s website for public comment. [Public Comments Summary]
IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. Town staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.
V - Goals	The Hazard Mitigation Goals were reviewed and endorsed by the Wrentham Local Hazard Mitigation Planning Team.
VI – Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect current mitigation activities in the Town.
VII & VIII – Hazard Mitigation Strategy	Mitigation measures from the 2010 plan were reviewed and assessed as to whether they were completed, in-progress, or deferred. The Local Hazard Mitigation Planning Team determined whether to carry forward measures into the 2018 Plan Update or modify or delete them. The Plan Update's hazard mitigation strategy reflects both new measures and measures carried forward from the 2010 plan. The Local Hazard Mitigation Team prioritized all of these measures based on current conditions.
IX – Plan Adoption & Maintenance	This section of the plan was updated with a new on-going plan implementation review and five year update process that will assist the Town in incorporating hazard mitigation issues into other Town planning and regulatory review processes and better prepare the Town for the next comprehensive plan update.

Moving forward into the next five year plan implementation period there will be many more opportunities to incorporate hazard mitigation into the Town's decision making processes.

Though not formally done in the 2010 Plan, the Town will document any actions taken within this iteration of the Hazard Mitigation Plan on challenges met and actions successfully adopted as part of the ongoing plan maintenance to be conducted by the Wrentham Hazard Mitigation Implementation Team, as described in Section IX, Plan Adoption and Maintenance.

Figure 1 Existing Features: Critical Facilities, Development Sites, Open Space, & Local Hazard Areas



IV. INTRODUCTION

A. PLANNING REQUIREMENTS UNDER THE FEDERAL DISASTER MITIGATION ACT

The Federal Disaster Mitigation Act, passed in 2000, requires that after November 1 2004, all municipalities that wish to continue to be eligible to receive FEMA funding for hazard mitigation grants, must adopt a local multi-hazard mitigation plan and update this plan in five year intervals. This planning requirement does not affect disaster assistance funding.

Federal hazard mitigation planning and grant programs are administered by the Federal Emergency Management Agency (FEMA) in collaboration with the states. These programs are administered in Massachusetts by the Massachusetts Emergency Management Agency (MEMA) in partnership with the Department of Conservation and Recreation (DCR).

Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of their member communities. The Town of Wrentham received a grant from the Federal Emergency Management Agency (FEMA) under the Pre-Disaster Mitigation (PDM) Program and hired the Metropolitan Area Planning Council (MAPC) to assist the Town of Wrentham to update its local Hazard Mitigation Plan, which was adopted on October 19, 2010.

B. WHAT IS A HAZARD MITIGATION PLAN?

Natural hazard mitigation planning is the process of determining how to systematically reduce or eliminate the loss of life and property damage resulting from natural hazards such as floods, earthquakes, and hurricanes. Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries, and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects, and other activities.

C. PREVIOUS FEDERAL/STATE DISASTERS

The Town of Wrentham has experienced 21 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 2 below. The majority of these events involved flooding, while six were due to hurricanes or nor'easters, and four were due to severe winter weather.

Table 2 Previous Federal/State Disaster Declarations

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)

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DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (10 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
(1998)	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
	Hazard Mitigation Grant Program	Statewide
Tropical Storm Irene (August 27-28, 2011)	FEMA Public Assistance	Statewide
Hurricane Sandy (October 27-30, 2012)	FEMA Public Assistance	Statewide
Severe snowstorm and Flooding (February 8-09, 2013)	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide
Blizzard of 2015 (January 26-28, 2015)	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide
Winter Storm Riley and Flooding March 3-6, 2018	Hazard Mitigation Grant Program	Statewide

Source: database provided by MEMA

D. FEMA FUNDED MITIGATION PROJECTS

Town of Wrentham has not received funding from FEMA for mitigation projects under the Hazard Mitigation Grant Program (HMGP).

E. COMMUNITY PROFILE

Wrentham is a small, semi-rural community located outside the fringe of the Boston and Providence metropolitan areas. The town, incorporated in 1673, is very proud of its New England heritage and has actively sought to preserve this type of atmosphere over the years. Its large tracts of open space areas, recreational facilities and lake regions make Wrentham an attractive place to spend leisure time. The community is proud of its attempts to balance conservation and development and therefore maintain a high quality of life for all its residents. Wrentham is popularly known now for the Wrentham Outlets, a large shopping facility that contains outlet stores and restaurants.

Wrentham is located in southeastern Massachusetts and is bordered by Norfolk on the north; Foxborough on the east; Plainville on the southeast; Cumberland, Rhode Island, on the south; Bellingham on the west; and Franklin on the northwest. Wrentham is 25 miles southwest of Boston, and 20 miles north of Providence, Rhode Island. Wrentham is situated in the Greater Boston Area, which has excellent rail, air, and highway facilities. State Route 128 and Interstate Route 495 divide the region into inner and outer zones, which are connected by numerous "spokes" providing direct access to the airport, port, and intermodal facilities of Boston. Major highways in Wrentham include state route 140; U.S. Route 1; and Interstate Route 495, the outer belt around Boston, which forms an interchange with Interstate Route 95 in the neighboring towns of Mansfield and Foxborough. Commuter rail service to Back Bay Station and South Station, Boston, is available in the neighboring towns of Franklin and Norfolk. Wrentham is not affiliated with a regional transit authority. The Norfolk Airport, a General Aviation (GA) facility, is easily accessible. Regional facilities in Wrentham include the Care Kings Daughters & Sons Home, Maples Convalescent Home, Maples Nursing & Retirement Center,

Serenity Hill Nursing Home, and the Inc. Sheldonville Nursing Home.

Wrentham belongs to the South West Advisory Planning Subregion of the Metropolitan Area Planning Council. Wrentham is also a member of the I-495/Metrowest Partnership (also known as the Arc of Innovation). The town is governed by a Board of Selectmen with a Town Administrator. The town operates under the open town meeting format. The 2010 population was 10,955 people and there were 3,869 housing units.¹

The town maintains a website at <http://wrentham.ma.us>

Challenges facing Wrentham when planning for natural disasters include:

- 20% of the housing units are old (built before modern building codes)
- 14.5% of the units are renter-occupied
- 3.6% of households do not own a car, posing challenges for evacuations
- 0.8% have limited English skills

Table 3 Wrentham Characteristics (Projected 2016)

Population = 11,483 <ul style="list-style-type: none"> • 5.2% are under age 5 • 28% are under age 18 • 12.9% are over age 65 • 0.8% speak English less than “very well” (over age 5) • 3.6% of households have no vehicle Number of Housing Units = 4,052 <ul style="list-style-type: none"> • 14.5% are renter-occupied housing units • 20% of housing units were built before 1940

Source: U.S. Census, 2010 and American Community Survey 2016.

The Town of Wrentham has several unique characteristics to keep in mind while planning for natural hazards:

- A defining characteristic of Wrentham is that it is divided into four different watersheds for the headwaters of the Charles, Ten Mile, Taunton, and Blackstone Rivers, but no major streams.
- Wrentham’s drinking water supply lies entirely within the town, so flood and stormwater management as well as smart growth development are critical to prevent contamination with flooding and prevent quantity issues with drought.
- Another defining characteristic of the town are the tree-lined streets. Although these trees are vulnerable to high winds and ice storms, they are a tradeoff the town is willing to have.
- The town has proactive municipal officials that frequently share information and coordinate on a regular basis. An example of this was the first data collection session for the PDM plan, at which representatives of six different departments were present.
- Wrentham is home to historic structures and sites that are irreplaceable and bring economic value to the town.
- Wrentham contains several major roadways that provide emergency routes for evacuation and for routes to medical facilities.
- Wrentham has some bridge crossings and dams that could be at risk in the event of flooding.

¹ Narrative based on information provided by the Massachusetts Historical Commission and is taken from the Community Profile on the website maintained by the Department of Housing and Community Development.

- Wrentham would be a good candidate for flood-related grants due to the potential impact to property, transportation emergency routes, economic/historic resources, and the ability to solve the flooding problems through structural measures such as culvert upgrades, dam and bridge upgrades or flood proofing. The cost-benefit analysis would likely be in the town's favor.
- Much of the critical infrastructure in the town is located in clusters, some near floodplains. These facilities are therefore at higher risk during natural hazards.

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V. PLANNING PROCESS & PUBLIC PARTICIPATION

This is an update of the original Wrentham Hazard Mitigation Plan, which was approved by FEMA on October 19, 2010. MAPC employs a six step planning process based on FEMA’s hazard mitigation planning guidance focusing on local needs and priorities but maintaining a regional perspective matched to the scale and nature of natural hazard events. Public participation is a central component of this process, providing critical information about the local occurrence of hazards while also serving as a means to build a base of support for hazard mitigation activities. MAPC supports participation by the general public and other plan stakeholders through a Local Hazard Mitigation Planning Teams two public meetings hosted by the local Hazard Mitigation Team, posting of the plan to the Town’s website, and invitations sent to neighboring communities, Town boards and commissions, and other local or regional entities to review the plan and provide comment.

A. PLANNING PROCESS SUMMARY

The six-step planning process outlined below is based on the guidance provided by FEMA in the Local Multi-Hazard Mitigation Planning Guidance. Public participation is a central element of this process, which attempts to focus on local problem areas and identify needed mitigation measures based on where gaps occur in the existing mitigation efforts of the municipality. By working on municipal hazard mitigation plans in groups of neighboring cities and towns, MAPC is able to identify regional opportunities for collaboration and facilitate communication between communities. In plan updates, the process described below allows staff to bring the most recent hazard information into the plan, including new hazard occurrence data, changes to a municipality’s existing mitigation measures, and progress made on actions identified in previous plans.



- Map the Hazards – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred. These maps can be found in Appendix B.
- Assess the Risks & Potential Damages – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community. MAPC drew on the following resources to complete the plan:
 - Town of Wrentham, General Bylaws
 - Town of Wrentham, Zoning Bylaw
 - Town of Wrentham Comprehensive Plan 2005-2015
 - Town of Wrentham Open Space Plan, 2015
 - Town of Wrentham Capital Improvement Program
 - Massachusetts State Hazard Mitigation Plan, 2013
 - FEMA, Local Mitigation Plan Review Guide; October 1, 2011
 - FEMA, Flood Insurance Rate Maps for Norfolk County, MA, 2012
 - Massachusetts State Hazard Mitigation Plan, 2013
 - Metropolitan Area Planning Council, GIS Lab, Regional Plans and Data.
 - New England Seismic Network, Boston College Weston Observatory, <http://aki.bc.edu/index.htm>
 - NOAA National Centers for Environmental Information, <http://www.ncdc.noaa.gov/>
 - Northeast States Emergency Consortium, <http://www.nesec.org/>
 - Resilient MA Climate Change Clearinghouse for the Commonwealth, resilientma.org
 - USGS, National Water Information System, <http://nwis.waterdata.usgs.gov/usa/nwis>
 - US Census, 2010
 - American Community Survey 2016
- Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as most have adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State building code, which has strong provisions related to hazard resistant building requirements. All current municipal mitigation measures must be documented.
- Develop Mitigation Strategies – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community’s existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Chapter VII.
- Plan Approval & Adoption – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan the agency issues a conditional approval (Approval Pending Adoption), with the condition being adoption of

the plan by the municipality. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix D.

- Implement & Update the Plan – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five year basis making preparation for the next plan update an important on-going activity. Chapter IX includes more detailed information on plan implementation.

B. 2010 PLAN IMPLEMENTATION & MAINTENANCE

The 2010 Town of Wrentham Hazard Mitigation Plan contained a risk assessment of identified hazards for the Town and mitigation measures to address the risk and vulnerability from these hazards. Since approval of the plan by FEMA and local adoption, progress has been made on implementation of the measures. The Town has advanced a number of projects for implementation, including maintenance drainage improvements, emergency communication improvements, stormwater management, and adoption of the Community Preservation Act for land protection.

C. THE LOCAL MULTIPLE HAZARD COMMUNITY PLANNING TEAM

MAPC worked with the local community representatives to organize a Local Hazard Mitigation Planning Team for Wrentham. MAPC briefed the local representatives as to the desired composition of that team as well as the need for public participation in the local planning process.

The Local Hazard Mitigation Planning Team is central to the planning process as it is the primary body tasked with developing a mitigation strategy for the community. The local team was tasked with working with MAPC to set plan goals, provide information on the hazards that impact the town, existing mitigation measures, and helping to develop new mitigation measures for this plan update. The Local Hazard Mitigation Planning Team membership can be found listed below.

Membership of the Wrentham Hazard Mitigation Planning Team

Name	Representing
Kevin Sweet	Town Administrator
Darryl Luce	Conservation Commission
Joe Heck	Emergency Management
Jay McMorrow	Chief, Fire Department
Mike Lavin	Public Works
John Charbonneau	Director of Planning and Development
George Labonte	Police Lieutenant
William McGrath	Chief of Police

The Local Hazard Mitigation Planning Team met on the following dates.

November 6, 2017	1 st Meeting of the Wrentham Local Hazard Mitigation Planning Team
March 23, 2018	2 nd Meeting of the Wrentham Local Hazard Mitigation Planning Team
June 19, 2018	3 rd Meeting of the Wrentham Local Hazard Mitigation Planning Team

The purpose of the meetings was to introduce the Hazard Mitigation planning program, review and update hazard mitigation goals, and to gather information on local hazard mitigation issues and sites or areas related to these. Later meetings focused on verifying information gathered by MAPC staff and discussion of existing mitigation practices, the status of mitigation measures identified in the 2010 hazard mitigation plan, and potential new or revised mitigation measures. The meeting agendas are included in Appendix A.

1. PUBLIC MEETINGS

Public participation in the hazard mitigation planning process is important, both for plan development and for later implementation of the plan. Residents, business owners, and other community members are an excellent source for information on the historic and potential impacts of natural hazard events and particular vulnerabilities the community may face from these hazards. Their participation in this planning process also builds understanding of the concept of hazard mitigation, potentially creating support for mitigation actions taken in the future to implement the plan. To gather this information and educate residents on hazard mitigation, the Town hosted two public meetings, one during the planning process and one after a complete draft plan is available for review.

Natural hazard mitigation plans unfortunately rarely attract much public involvement in the Boston region, unless there has been a recent hazard event. One of the best strategies for overcoming this challenge is to include discussion of the hazard mitigation plan on the agenda of an existing board or commission. With this strategy, the meeting receives widespread advertising and a guaranteed audience of the board or commission members plus those members of the public who attend the meeting. These board and commission members represent an engaged audience that is informed and up to date on many of the issues that relate to hazard mitigation planning in the locality and will likely be involved in plan implementation, making them an important audience with which to build support for hazard mitigation measures. In addition, these meetings frequently receive press coverage, expanding the audience that has the opportunity to hear the presentation and provide comment.

The public had an opportunity to provide input to the Wrentham hazard mitigation planning process during two public presentations; the first was before the Planning Board on May 2, 2018 and the second was before the Board of Selectmen on June 19, 2018. The plan was also placed on the Town's website for public review and comment.

D. LOCAL STAKEHOLDER INVOLVEMENT

The local Hazard Mitigation Planning Team was encouraged to reach out to local stakeholders that might have an interest in the Hazard Mitigation Plan including neighboring communities, agencies, businesses, nonprofits, and other interested parties. Notice was sent to the following organizations and neighboring municipalities inviting them to review the Hazard Mitigation Plan and submit comments to the Town:

- United Regional Chamber of Commerce
- Fiske Public Library
- Wrentham Developmental Center
- Maples Rehabilitation and Nursing Center
- Housing Authority
- Charles River Watershed Council
- Taunton River Watershed Alliance
- Ten Mile River Watershed Council
- Blackstone River Watershed Council
- Council on Aging

- Town of Plainville
- Town of Foxborough
- Town of Franklin
- Town of Bellingham
- Town of Norfolk
- Wrentham Conservation Commission
- Wrentham Board of Selectmen
- Wrentham Police
- Wrentham Fire
- Wrentham Department of Public Works

See Appendix C for public meeting notices. The draft Wrentham Hazard Mitigation Plan 2018 Update was posted the following URL for the second public meeting:

<http://www.wrentham.ma.us/files/Wrentham%20Website%20Files/Board%20of%20Selectmen/Agendas/2018%20Agendas/06-19-2018%20BOS%20Agenda.pdf>

Members of the public could access the draft document and submit comments or questions to the Town and MAPC. [\[Summary of public comments here\]](#)

E. CONTINUING PUBLIC PARTICIPATION

Following the adoption of the plan update, the planning team will continue to provide residents, businesses, and other stakeholders the opportunity to learn about the hazard mitigation planning process and to contribute information that will update the town’s understanding of local hazards. As updates and a review of the plan are conducted by the Hazard Mitigation Implementation Team, these will be placed on the Town’s web site, and any meetings of the Hazard Mitigation Implementation Team will be publicly noticed in accordance with town and state open meeting laws.

F. PLANNING TIMELINE

November 6, 2018	First Meeting of the Wrentham Local Hazard Mitigation Planning Team
March 23, 2018	Second Meeting of the Wrentham Local Hazard Mitigation Planning Team
June 19, 2018	Third Meeting of the Wrentham Local Hazard Mitigation Planning Team
May 2, 2018	First Public Meeting with Wrentham Planning Board
June 19, 2018	Second Public Meeting with Wrentham Board of Selectmen
[Date]	Draft Plan Update submitted to MEMA
[Date]	FEMA issued notice of Approvable Pending Adoption

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VI. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the Town of Wrentham as well as the relationship between those hazards and current land uses, potential future development, and critical infrastructure. This section also includes a vulnerability assessment that estimates the potential damages that could result from certain large scale natural hazard events.

A. UPDATE PROCESS

In order to update Wrentham’s risk assessment, MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. MAPC also used FEMA’s damage estimation software, HAZUS (described below).

B. OVERVIEW OF HAZARDS AND IMPACTS

The Massachusetts Hazard Mitigation Plan provides an in-depth overview of natural hazards in Massachusetts. Previous state and federal disaster declarations since 1991 are summarized in Table 2. Table 4 below summarizes the hazard risks for Wrentham. This evaluation takes into account the frequency of the hazard, historical records, and variations in land use. This analysis is based on the vulnerability assessment in the Massachusetts State Hazard Mitigation Plan. The statewide assessment was modified to reflect local conditions in Wrentham using the definitions for hazard frequency and severity listed below. Based on this, the Town set an overall priority for each hazard.

Table 4 Hazard Risks Summary

Hazard	Frequency		Severity	
	Massachusetts	Wrentham	Massachusetts	Wrentham
Flooding	High	High	Serious to extensive	Serious to extensive
Dam failures	Low	Low	Extensive	Extensive
Coastal Hazards	High	N/A	Serious	N/A
Tsunamis	Very Low	N/A	Extensive	N/A
Hurricane/Tropical Storm	Medium	Medium	Serious	Serious
Tornadoes	Medium	Medium	Serious	Serious
Thunderstorms	High	High	Minor	Minor
Nor’easter	High	High	Extensive	Extensive
Winter-Blizzard/Snow	High	High	Minor	Minor
Winter-Ice Storms	Medium	Medium	Minor	Minor
Earthquakes	Very Low	Very Low	Serious	Serious
Landslides	Low	Low	Minor	Minor
Brush fires	Medium	Medium	Minor	Minor
Major Urban Fires		N/A		N/A
Extreme Temperatures	Medium	Medium	Minor	Minor
Drought	Low	Low	Minor	Minor

Ice Jams	High	N/A	Minor	Minor

Source, Massachusetts State Hazard Mitigation Plan, 2013, modified for Wrentham

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

- **Very low frequency:** events that occur less frequently than once in 100 years (less than 1% per year)
- **Low frequency:** events that occur from once in 50 years to once in 100 years (1% to 2% per year);
- **Medium frequency:** events that occur from once in 5 years to once in 50 years (2% to 20% per year);
- **High frequency:** events that occur more frequently than once in 5 years (Greater than 20% per year).

Severity

- **Minor:** Limited and scattered property damage; limited damage to public infrastructure and essential services not interrupted; limited injuries or fatalities.
- **Serious:** Scattered major property damage; some minor infrastructure damage; essential services are briefly interrupted; some injuries and/or fatalities.
- **Extensive:** Widespread major property damage; major public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and/or fatalities.
- **Catastrophic:** Property and public infrastructure destroyed; essential services stopped; numerous injuries and fatalities.

Note: Of the hazards listed in the 2013 Massachusetts State Hazard Mitigation Plan, several hazard categories are not applicable to the Town of Wrentham: (i) coastal hazards and tsunamis, due to the town’s inland location away from the coast; and (ii) major urban fires, due to the lack of significant urban areas in close proximity to wildfire hazards that could pose a significant threat of major urban fires, and (iii) ice jams since Wrentham’s rivers are not typically completely frozen during the winter months and there is no documentation of ice jams occurring since 1913 in Norfolk County.

1. FLOOD RELATED HAZARDS

Flooding was the most frequent serious natural hazard identified by local officials in Wrentham. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Climate change has the potential to exacerbate these issues over time with changing rainfall patterns leading to heavier and more frequent storms.

a. REGIONALLY SIGNIFICANT FLOODS

There have been a number of major storms that have affected the Metro Boston region over the last forty years. Significant historic flood events in the region have included:

- February 1978
- January 1979
- April 1987
- October 1991
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010
- March 2018

Local data for previous flooding occurrences are not collected by the Town of Wrentham. The best available local data is for Norfolk County through the National Center for Environmental Information (see Table 5). Norfolk County, which includes the Town of Wrentham, experienced 45 flood events from 1996 –2016. No deaths or injuries were reported and the total reported property damage in the county was \$26.3 million dollars. Of that total, \$24.9 million is attributed to the two major events of March 2010.

Table 5 Norfolk County Flood Events, 1996-2016

Date	Deaths	Injuries	Property Damage
01/27/1996	0	0	0.00K
09/18/1996	0	0	0.00K
10/21/1996	0	0	0.00K
05/12/1998	0	0	0.00K
06/13/1998	0	0	570.00K
06/15/1998	0	0	0.00K
03/05/2001	0	0	0.00K
03/22/2001	0	0	0.00K
03/22/2001	0	0	0.00K
04/01/2001	0	0	0.00K

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03/28/2005	0	0	0.00K
10/15/2005	0	0	30.00K
10/15/2005	0	0	40.00K
10/15/2005	0	0	200.00K
10/15/2005	0	0	60.00K
10/15/2005	0	0	40.00K
10/15/2005	0	0	140.00K
10/25/2005	0	0	35.00K
05/13/2006	0	0	5.00K
06/07/2006	0	0	20.00K
10/28/2006	0	0	8.00K
11/24/2006	0	0	0.00K
03/02/2007	0	0	5.00K
04/18/2007	0	0	5.00K
02/13/2009	0	0	10.00K
07/02/2009	0	0	5.00K
08/15/2009	0	0	3.00K
05/24/2009	0	0	0.00K
06/27/2009	0	0	15.00K
03/14/2010	0	0	16.640M
03/29/2010	0	0	8.320M
04/01/2010	0	0	0.00K
07/24/2010	0	0	20.00K
08/05/2010	0	0	0.00K
08/25/2010	0	0	8.00K
08/28/2011	0	0	0.00K
08/15/2012	0	0	0.00K
10/29/2012	0	0	0.00K
06/07/2013	0	0	0.00K
07/29/2013	0	0	0.00K
08/09/2013	0	0	15.00K
10/22/2014	0	0	0.00K
10/23/2014	0	0	0.00K
8/15/2015	0	0	0.00K
8/18/2015	0	0	0.00K
6/07/2016	0	0	5.00K
8/14/2016	0	0	5.00K
4/1/2017	0	0	5.00k
7/12/2017	0	0	0
7/18/2017	0	0	1.00k
8/2/2017	0	0	0
9/30/2017	0	0	10.0k

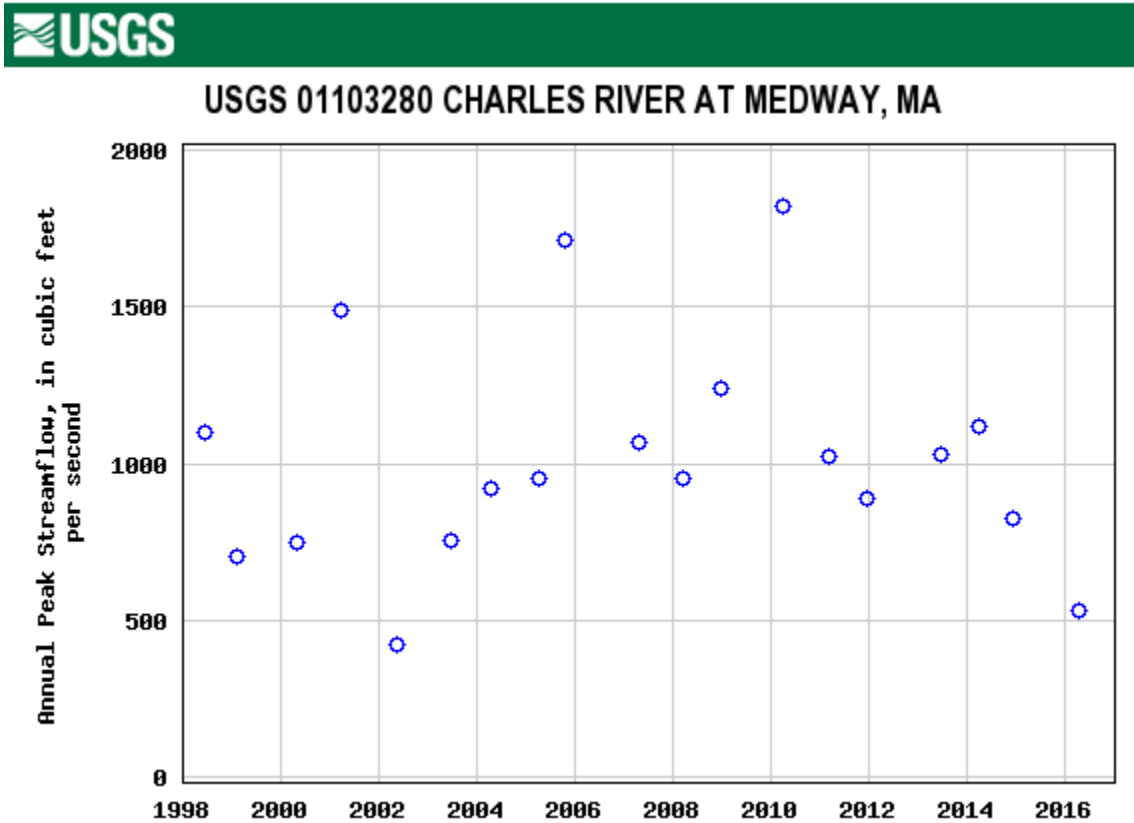


10/25/2017	0	0	0
10/29/2017	0	0	0
Total	0	0	26.3 M

Source: NOAA, National Climatic Data Center

The most severe flooding since the previous plan occurred during March 2010 when a total of 14.83 inches of rainfall accumulation was recorded by the National Weather Service (NWS). The weather pattern that consisted of early springtime prevailing westerly winds that moved three successive storms, combined with tropical moisture from the Gulf of Mexico, across New England. Torrential rainfall caused March 2010 to be the wettest month on record.

Figure 2 USGS Flood Gage Discharge Data for Charles River at Wrentham



Source: United States Geological Survey 2018

One indication of the extent of flooding is the gage discharge at the nearest USGS streamflow gauging station on Charles Street in Medway at the Walker Street Bridge. Figure 2 illustrates that 2010 had the highest streamflow at nearly 2,000 cubic feet per second for the years of 1998-2016. Potential damages from flooding in the Town of Wrentham were estimated using FEMA’s HAZUS-MH program. The results, shown in Table 26, indicate potential damages from a 1% Annual Chance Flood (100-year) at \$2,210,000 and from a 0.2% Annual Chance Flood (500-year) at \$2,830,000.

b. OVERVIEW OF TOWN-WIDE FLOODING

As with most of eastern Massachusetts the natural hazard threat that is most prevalent in the town of Wrentham, and therefore the focus of most of the town's hazard mitigation efforts is flooding. Wrentham is bordered by the town of Bellingham on the west, Franklin and Norfolk to the north, Walpole and Foxborough to the east and Plainville to the south.

Wrentham is fortunate to contain water recourses that contribute to the headwaters of four watersheds, the Charles, Ten-Mile, Taunton, and the Blackstone Rivers. This is matched by only one other community in Massachusetts. Although these headwaters suggest an abundance of water resources, it also means that this water is continually flowing downhill, away from Wrentham, and that many other communities are dependent on these flows and their quality. The aquifers rely on being recharged ultimately from the rain and snow which falls on the town, and the intermediary recharge of waters used in the town as they are released through drainage and septic systems.

Wrentham is considered on the head waters of the Charles River watershed, which is 80 miles in length - the longest river with its entire length in Massachusetts. The Charles River Watershed has a drainage area of approximately 308 square miles and encompasses all or part of 35 municipalities. The watershed drains northward and is divided into three distinct regions, which include the rural, forested upper watershed, the suburban lakes or middle watershed, and the urban lower watershed, which drains through the Boston metropolitan area. In general, the upper and middle watersheds are characterized by forest cover and residential land use, while the lower watershed is characterized by commercial land use. Since 1995, the water quality of the Charles River has improved dramatically, and is now clean enough for boating and swimming for the greater part of each year, according to the Environmental Protection Agency (EPA). The greatest source of pollution to the river is non-point source pollution, especially from stormwater runoff and Combined Sewer Overflows (CSOs). The quantity of water available for residential and commercial use is also threatened by overuse, which has lowered groundwater levels and decreased stream flow.

In the 1960's studies by the Corps of Engineers revealed that the communities above Newton had a history of only minimal flooding. Extensive marshes, swamps and wet meadows scattered around the upper watershed were holding floodwaters and then only slowly letting them go. In 1974 Congress authorized the "Charles River Natural Valley Storage Area," allowing for the acquisition and permanent protection of 17 scattered wetlands in the middle and upper watershed. Final acquisition totaled 8,103 acres, with 3,221 acres of land acquired in fee and 4,882 acres in flood easement, at total project cost of \$8,300,000. It must be noted that within the Charles River Watershed, flooding within the lower watershed (Boston metro area) is controlled with dams and channelization, while the upper and middle watersheds, wetlands and other natural storage areas are relied upon to protect the area from flooding.

The lakes and ponds are also preeminent assets, with Lake Pearl noted as a Great Pond. Attleboro withdraws from the area around Crocker Pond for a portion of its needs. Previously the lakes served as water sources, but now are mainly used for recreational purposes. Their health continues to be crucial to their success, and they are variously threatened by failing septic systems, pollution from overland runoff, and the introduction of alien, invasive species which can upset the delicate ecological balance of the lakes. Over time, the recreational use of the lakes became a primary feature of the town, spreading its renown, and later

leading to residential settlement as the cabins and camps were slowly converted and winterized to be year round dwellings.

Although there are no major rivers or streams in Wrentham, and the ponds are few in number, the town is studded with a surprisingly high number of certified and potential vernal pools. These pools are remarkably productive and fill essential ecological roles, even though they are wet for only a portion of the year. There are also many isolated wetlands abutting open water and throughout the town, granting them a larger role and significance than they may play in other communities.

Virtually all of the 1% and 0.2% Annual Chance Flood zones in town are located near major bodies of water, including those named above. However, in many of those zones the flood frequency is greater than the 1% Annual Chance Flood event. Though the flood zones have not been properly studied as a system, town officials indicated that they believe that many of the town's more frequent flooding problems are related to insufficient or inoperable flood management structures, such as culverts, dams and drain pipes that are not large enough to quickly transport flood waters away from town streets and neighborhoods and toward the nearby wetlands.

As with most of eastern Massachusetts the natural hazard threat that is most prevalent in the town of Wrentham, and therefore the focus of most of the town's hazard mitigation efforts is flooding. According to Public Works, most of the town's flood-related hazards are related to high rain events, such as heavy rainstorms, tropical storms or winter rain and snow storms. In addition, the spring rainy season is a particularly hazardous time, as runoff from winter snowfalls saturates much of the town's wetlands and fills the town's streams and brooks. A heavy or severe rain event at this time of year can often overwhelm the natural flood storage areas of the town and create flood hazards on streets and around residential and business areas in town.

c. POTENTIAL FLOOD HAZARD AREAS

Information on potential flood hazard areas was taken from two sources. The first was the current National Flood Insurance Rate Maps, dated July 17, 2012. The FIRM flood zones are shown on Map 3 in Appendix B and their definitions are listed below.

In addition, information on areas subject to flooding was provided by local officials. The Locally Identified Areas of Flooding described below were identified by Town staff as areas where flooding is known to occur. All of these areas do not necessarily coincide with the flood zones from the FIRM maps. Some may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Local Hazard Areas."

Flood Insurance Rate Map Zone Definitions

Zone A (1% annual chance) - Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone AE and A1-A30 (1% annual chance) - Zones AE and A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zones X500 (.2% annual chance) - Zone X500 is the flood insurance rate zone that correspond to the 500-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone.

Zone VE (1% annual chance) - Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply

d. **LOCALLY IDENTIFIED AREAS OF FLOODING**

The town identified the following local areas of potential flooding. These are summarized in Table 6 and displayed on Map 8, with the corresponding map location numbers in parentheses.

The locally identified areas of flooding described below were identified by the Local Committee as areas where flooding occurs. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas". The numbers do not reflect priority order.

1. *Green Street* (Flooding): Green Street sustains regular flooding due to water runoff from Aggregate Industries. Increased impervious surface and lack of drainage on both sides of the road cause the roadway flooding. Aggregate Industries owns both sides of the road and has attempted to mitigate the flooding problems on multiple occasions, but the problems still remain. Green Street is a secondary bypass for the Wrentham Outlets and an escape route in times of emergency. Potential mitigation measures include roadway redesign, evaluation, and/or improvements to the drainage system.

3. *Franklin Street* (Flooding): The drainage system on Franklin Street is inadequate and exceeds capacity during most large rain storms. In the early 1990's the town attempted to mitigate this problem, but flooding still persists. The flooding is attributed to an outdated and inadequate drainage system. According to town officials, "the water has nowhere to go." Several mitigation measures were offered to alleviate the problem, ranging from enlarging the culvert under Franklin Street, to the installation of a comprehensive drainage, to stream restoration of a small brook located off the road.

4. *Taunton Street (Flooding)*: About six houses on Taunton Street sustain backyard and basement flooding every three to five years, largely due to beaver activity. One single family house, without a basement, has sustained reoccurring flooding. Backyard flooding attracts mosquitoes close to populations, which is a public health hazard. Potential mitigation measures include improvements to drainage system, installation of a retention basin and raising the utilities on flood prone properties.

5. *Burnt Swamp Road (Flooding)*: Overflow from Burnt Swamp Brook causes a single family home on Burnt Swamp Road to flood. The town has replaced the culvert, however some flooding still persists due to beaver activity.

6. *Hancock Street (Flooding)*: The Burnt Swamp Brook backs up at the culvert at Hancock Street and floods the road. Flooding typically occurs during large storm events and has caused road closures and minor damage to several single family houses. Expanding the culvert from 12 inches to 24 inches could potentially mitigate this problem.

7. *Well #4 at Thurston Street (Flooding)*: The area around well #4 is an area of concern to the town. While the area has not sustained any significant flooding, it resides in the floodplain of Meadow Brook. The facility for Well #4 is particularly at risk in the case of a large storm event. The town is concerned that flooding could result in contamination of the water supply.

8. *Franklin Street at Ray's Dry Cleaners (Flooding)*: Franklin Street, in the vicinity of Ray's Dry Cleaners sustains regular flooding. Flooding causes partial road closures and some damage to commercial properties. In the winter, flood waters on Franklin Street tend to freeze. This is particularly a concern at the bend of the road, as it has resulted in car accidents. A potential mitigation measure includes upgrades to the drainage system.

19. *Madison Hill (Flooding)*: Because there is no formal drainage in the area, the roads at the top of Madison Hill flood during periods of heavier rain.

20. *Eagle Dam (Flooding)*: Eagle dam is a low hazard dam, privately owned, with mature vegetation on the embankment. The spillway collapsed recently and local residents rebuilt the spillway without professional consultation. The Town is concerned that high-winds, hurricane, or other storm will pull down the mature trees and cause flooding on State Route 140.

Table 6 Locally Identified Areas of Flooding

Map ID	Site Name	type
1	Green Street	Flooding
3	Franklin Street	Flooding
4	Taunton Street	Flooding
5	Burnt Swamp Road	Flooding
6	Hancock Street	Flooding
7	Well #4 at Thurston Street	Flooding
8	Franklin Street	Flooding
19	Madison Street Hill	Flooding
20	Crocker Pond Dam	Flooding
21	Eagle Dam	Flooding

e. REPETITIVE LOSS STRUCTURES

As defined by the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see https://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt

The state plan indicates that Massachusetts is one of the 10 states that cumulatively account for 76% of all repetitive loss buildings in the United States. However, there are no repetitive loss structures in the town of Wrentham.

f. DAMS AND DAM FAILURE

Dam failure can occur as a result of structural failure, independent of a hazard event, or as the result of the impacts of a hazard event such as flooding associated with storms or an earthquake. In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters. With an anticipated increase in the intensity or amount of precipitation, a primary climate change dam concern is failure and/or overtopping since they were most likely designed based on historic weather patterns.

Dam failure is a highly infrequent occurrence but a severe incident could result in loss of lives and significant property damage. Since 1984, and according to the Association of State Dam Safety Officials, three dams have failed in Massachusetts, one of which resulted in a death. There have been no recorded dam breaches in Wrentham.

According to data provided by the Massachusetts Department of Conservation and Recreation (DCR) and the town, there are three dams located in Wrentham, one that is owned by another municipality. Further there

are two dams in Norfolk whose safety could impact the Town of Wrentham in the event of failure since Norfolk and Wrentham share the water body. These dams are summarized in Table 7. DCR defines dam hazard classifications as follows:

High: Dams located where failure or mis-operation will likely cause loss of life and serious damage to homes(s), industrial or commercial facilities, important public utilities, main highways(s) or railroad(s).

Significant: Dams located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.

Low: Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected.

Table 7 Inventory of Dams in Wrentham

Dam Name	Water Body	Owner	Location	Hazard Potential Classification
Red Dam	Lake Pearl	Town of Wrentham	Wrentham	Significant Hazard
Eagle Dam	Eagle Brook	Town of Wrentham	Wrentham	Low Hazard
Crocker Pond Dam	Crocker Pond	Town of Attleboro	Wrentham	Low Hazard
Mirror Lake Dam	Mirror Lake	Town of Norfolk	Norfolk	Significant Hazard
Mirror Lake Dike	Mirror Lake	MA DCR	Norfolk	Significant Hazard

2. WIND RELATED HAZARDS

Wind-related hazards include hurricanes, tropical storms, and tornadoes, as well as high winds during nor'easters and thunderstorms. As with many communities, falling trees that result in downed power lines and power outages are an issue in Wrentham. Information on wind related hazards can be found on Map 5 in Appendix B.

Tree damage during high winds has the potential to be a significant hazard in Wrentham. Trees can knock out power lines and block major roadways, which hinders emergency response. While Wrentham does experience downed trees that have caused isolated power outages and roadway blockages, the town also takes pride in its tree-lined streets. Therefore, maintaining trees in a proactive fashion has been a trade-off for the tree amenities. The Department of Public Works has effective tree trimming and removal programs.

g. HURRICANES AND TROPICAL STORMS

A hurricane is a violent wind and rainstorm with wind speeds of 74 to 200 miles per hour. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as the storm hits land. Given its location not too distant from the coast, the Town of Wrentham’s entire area is vulnerable to hurricanes, which occur between June and November. A tropical storm has similar characteristics, but wind speeds are below 74 miles per hour. Since 1900, 39 tropical storms have impacted New England (NESEC), nine Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. This equates to a frequency of once every six years Massachusetts hurricanes since 1938 are shown in Table 8.

Table 8: Hurricane Records for Massachusetts, 1938 to 2012

Hurricane Event	Date
Great New England Hurricane	September 21, 1938
Great Atlantic Hurricane	September 14-15, 1944
Hurricane Doug	September 11-12, 1950
Hurricane Carol	August 31, 1954
Hurricane Edna	September 11, 1954
Hurricane Diane	August 17-19, 1955
Hurricane Donna	September 12, 1960
Hurricane Gloria	September 27, 1985
Hurricane Bob	August 19, 1991
Hurricane Earl	September 4, 2010
Tropical Storm Irene	August 28, 2011
Hurricane Sandy	October 29-30, 2012

Source: National Oceanic and Atmospheric Administration

Hurricane intensity is measured according to the Saffir/Simpson scale, which categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. These are combined to estimate potential damage. Table 9 gives an overview of the wind speeds, surges, and range of damage caused by different hurricane categories:

Table 9: Saffir/Simpson Scale

Scale No. (Category)	Winds (mph)	Surge (ft)	Potential Damage
1	74 – 95	4 - 5	Minimal
2	96 – 110	6 - 8	Moderate
3	111 – 130	9 - 12	Extensive
4	131 – 155	13 - 18	Extreme
5	> 155	>18	Catastrophic

Source: National Oceanic and Atmospheric Administration

There have been two major storms tracks through the town of Wrentham. A tropical storm tracked west to east, and a Category 3 hurricane tracked south to north through the town. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. However, the town does experience

the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the town. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour.

h. TORNADOS

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. These events are spawned by thunderstorms and occasionally by hurricanes, and may occur singularly or in multiples. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. Most vortices remain suspended in the atmosphere. Should they touch down, they become a force of destruction. Some ingredients for tornado formation include:

- Very strong winds in the mid and upper levels of the atmosphere.
- Clockwise turning of the wind with height (from southeast at the surface to west aloft).
- Increasing wind speed with altitude in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet.)
- Very warm, moist air near the ground with unusually cooler air aloft.
- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity.

Tornado damage severity is measured by the Fujita Tornado Scale, in which wind speed is not measured directly but rather estimated from the amount of damage. As of February 01, 2007, the National Weather Service began rating tornados using the Enhanced Fujita-scale (EF-scale), which allows surveyors to create more precise assessments of tornado severity. The EF-scale is summarized below:

Enhanced Fujita Scale	
EF-0	65–85 mph winds
EF-1	86–110 mph
EF-2	111–135 mph
EF-3	136–165 mph
EF-4	166–200 mph
EF-5	>200 mph

Source: Tornado Facts

The frequency of tornadoes in eastern Massachusetts is low; on average, there are six tornadoes that touchdown somewhere in the Northeast region every year. The strongest tornado in Massachusetts history

was the Worcester Tornado in 1953, killing 94 people, injuring 1,288 and costing \$52.1 million in damages (worth \$465.3 million today).²

The most recent tornado events in Massachusetts were in Springfield in 2011 and in Revere in 2014. The Springfield tornado caused significant damage and resulted in 4 deaths in June of 2011. The Revere tornado touched down at in Chelsea just south of Route 16 and moved north into Revere's business district along Broadway and ended near the intersection of Routes 1 and 60. The path was approximately two miles long and 3/8 mile wide, with wind speeds up to 120 miles per hour. Approximately 65 homes had substantial damages and 13 homes and businesses were uninhabitable.

Although there have been no recorded tornados within the limits of the Town of Wrentham, since 1956 there have been 9 tornadoes in surrounding Norfolk County recorded by the Tornado History Project. One of these was an F2 tornado, and three were F1. According to the Local Committee, three tornados have traversed Wrentham, in 1936, 1954, and 2004. Representatives on the Local Steering Committee recall moderate to severe damages caused by these storm events. A tornado can cause damage to property and knock down power lines and in some cases, damage infrastructure and destabilize foundations.

The Local Committee identified the following localized wind related hazard. The numbers correspond to the numbers on Map 8, "Hazard Areas".

1) *Tornado 2004 (Wind)*

In 2004 a tornado swept through Wrentham. The tornado tracked west to east through town causing damage to houses, knocking down power lines and trees. The area around Lake Pearl sustain significant damages from this tornado. .

2) *Tornado 1936 (Wind)*

Town officials recall a tornado tracking through town in 1938.

3) *Tornado 1954 (Wind)*

Town officials recall a tornado tracking through town in 1954.

Based on records of previous occurrences, hurricanes in Wrentham are a medium frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard occurs from once in 5 years to once in 50 years, or a 2% to 20% chance per year.

Buildings constructed prior to current building codes may be more vulnerable to damages caused by tornadoes. Evacuation of impacted areas may be required on short notice. Sheltering and mass feeding efforts may be required along with debris clearance, search and rescue, and emergency fire and medical services. Key routes may be blocked by downed trees and other debris, and widespread power outages are also typically associated with tornadoes.

² Morrison, Sara. 2014. Tornadoes of Massachusetts Past. <https://www.boston.com/weather/untagged/2014/07/28/tornadoes-of-massachusetts-past>

Table 10 Tornado Records for Norfolk County

Date	Fujita	Fatalities	Injuries	Width	Length	Damage
11/21/1956	2	0	0	17	0.1	\$500-\$5000
8/9/1972	1	1	6	30	4.9	\$5K-\$50K
9/6/1973	1	0	0	10	1.1	\$5K-\$50K
7/10/1989	0	0	0	23	0.1	\$500-\$5000
5/18/1990	0	0	0	10	0.2	\$500-\$5000
5/18/1990	0	0	0	10	0.2	\$500-\$5000
6/30/2001	0	0	0	80	0.1	-
8/21/2004	1	0	0	40	6	\$1,500,000
5/9/2013	0	0	0	50	0.38	\$20,000
6/23/2015	0	0	0	200	0.48	-
8/22/2016	1	0	0	400	0.85	\$10
TOTAL		1	5			

Source: The Tornado History Project

Although tornadoes are a potential town-wide hazard in Wrentham, tornado impacts are relatively localized compared to severe storms and hurricanes. Damages from any tornado in Wrentham would greatly depend on the track of the tornado. While there are no existing estimates for potential damages from tornadoes in Wrentham, the best available data for Norfolk County (Table 10) shows that 10 recorded tornadoes since 1956 resulted in a range of damages from \$1,532,00 to \$1,640,000 million. One fatality and six injuries were reported.

Based on the record of previous occurrences since 1950, Tornado events in Wrentham are a Medium frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 5 years to once in 50 years, or a 2% to 20% chance per year.

i. SEVERE THUNDERSTORMS

While less severe than the other types of storms discussed, thunderstorms can lead to localized damage and represent a hazard risk for communities. A thunderstorm typically features lightning, strong winds, and rain and/or hail. Thunderstorms sometime give rise to tornados. On average, these storms are only around 15 miles in diameter and last for about 30 minutes. A severe thunderstorm can include winds of close to 60 mph and rain sufficient to produce flooding. The town's entire area is potentially subject to severe thunderstorms.

The best available data on previous occurrences of thunderstorms in Wrentham is for Norfolk County through the National Climatic Data Center (NCDC). While there are no existing estimates for potential damages from thunderstorms in Wrentham, the best available data for Norfolk County (Table 11) shows that from 1995 to 2017 thunderstorms resulted in \$1,062,000 in property damages. There were no injuries or deaths reported.

Table 11 Norfolk County Thunderstorm Events, 1995-2017

Date	Magnitude*	Deaths	Injuries	Damage (\$)
4/4/1995	53	0	0	0
7/15/1995	55	0	0	0
10/28/1995	0	0	0	0
5/21/1996	60	0	0	0
5/31/1998	50	0	0	0
6/26/1998	50	0	0	20000
7/20/1998	50	0	0	0
7/23/1998	50	0	0	0
7/6/1999	70	0	0	0
7/24/1999	50	0	0	0
8/5/1999	50	0	0	0
4/9/2000	61	0	0	0
6/2/2000	50	0	0	0
6/27/2000	50	0	0	0
7/18/2000	55	0	0	0
8/10/2000	50	0	0	0
6/30/2001	50	0	0	0
8/10/2001	50	0	0	20000
6/16/2002	50	0	0	5000
7/15/2002	62	0	0	25000
7/23/2002	50	0	0	7000
8/21/2004	50	0	0	25000
8/5/2005	50	0	0	25000
8/14/2005	50	0	0	20000
5/21/2006	52	0	0	35000
6/1/2006	50	0	0	15000
6/23/2006	50	0	0	15000
7/4/2006	50	0	0	40000
7/21/2006	50	0	0	15000
7/28/2006	50	0	0	20000
8/2/2006	50	0	0	55000
6/28/2007	50	0	0	0
7/28/2007	50	0	0	0
8/17/2007	50	0	0	0
6/24/2008	50	0	0	5000
7/2/2008	54	0	0	20000
8/3/2008	50	0	0	1000
9/9/2008	50	0	0	1000
5/24/2009	50	0	0	1000
6/27/2009	50	0	0	10000
7/7/2009	50	0	0	500

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Date	Magnitude*	Deaths	Injuries	Damage (\$)
7/8/2009	50	0	0	1000
7/31/2009	50	0	0	26000
6/6/2010	53	0	0	10000
6/20/2010	58	0	0	113000
6/24/2010	50	0	0	1000
8/19/2011	50	0	0	7000
6/23/2012	50	0	0	41000
8/10/2012	50	0	0	5000
8/15/2012	40	0	0	500
6/17/2013	50	0	0	11000
7/29/2013	50	0	0	20500
7/3/2014	50	0	0	20000
7/28/2014	60	0	0	50000
6/23/2015	50	0	0	5000
8/4/2015	50	0	0	30000
8/15/2015	50	0	0	35000
2/25/2016	56	0	0	94000
6/7/2016	50	0	0	10000
7/18/2016	50	0	0	90000
7/22/2016	50	0	0	65000
7/23/2016	40	0	0	35000
8/14/2016	50	0	0	5000
6/9/2017	45	0	0	1000
6/13/2017	48	0	0	1000
6/23/2017	50	0	0	1000
8/2/2017	50	0	0	2500
9/6/2017	50	0	0	1000
Total		0	0	1,062,000

Magnitude refers to maximum wind speed

Source: NOAA, National Centers for Environmental Information

Severe thunderstorms are a town-wide hazard for Wrentham. The town's vulnerability to severe thunderstorms is similar to that of Nor'easters. High winds can cause falling trees and power outages, as well as obstruction of key routes and emergency access. Heavy precipitation may also cause localized flooding, both riverine and urban drainage related.

Based on the record of previous occurrences, severe thunderstorms in Wrentham are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

3. WINTER STORMS

Winter storms, including heavy snow, blizzards, and ice storms, are the most common and most familiar of the region's hazards that affect large geographic areas. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large-scale emergency response. Map 6 in Appendix B indicates one snowfall band within Wrentham. The average annual snowfall in Wrentham is 36.1 – 48.0 inches. The Town provides standard snow plowing operations, and clearing snow has not posed any significant challenges. They feel they have sufficient storage space and snow removal equipment.

a. HEAVY SNOW AND BLIZZARDS

A blizzard is a winter snow storm with sustained or frequent wind gusts to 35 mph or more, accompanied by falling or blowing snow reducing visibility to or below $\frac{1}{4}$ mile. These conditions must be the predominant condition over a 3 hour period. Extremely cold temperatures are often associated with blizzard conditions, but are not a formal part of the definition. The hazard created by the combination of snow, wind and low visibility significantly increases, however, with temperatures below 20 degrees.

Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The National Weather Service defines “heavy snow fall” as an event generating at least 4 inches of snowfall within a 12 hour period. Winter Storms are often associated with a Nor’easter event, a large counter-clockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain.

The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service³ characterizes and ranks high impact northeast snowstorms. These storms have large areas of 10 inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. NESIS scores 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 major metropolitan centers. The NESIS categories are summarized below:

³ Kocin, Paul J. and Uccellini, Louis W. 2004. A snowfall impact scale derived from Northeast storm snowfall distributions. American Meteorological Society. October 14, 2003.

TABLE 5. NESIS categories, their corresponding NESIS values, number of 70 total cases within each category, and a descriptive adjective.

Category	NESIS values	No. of cases	Description
1	1–2.499	23	“Notable”
2	2.5–3.99	22	“Significant”
3	4–5.99	16	“Major”
4	6–9.99	7	“Crippling”
5	10.0+	2	“Extreme”

Source: Kocin and Uccellini 2004

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

Table 12 Severe Winter Storm Records for Massachusetts

Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996
Severe Snow Storm	March 2001
Severe Snow Storm	December 2003
Severe Snow Storm	January 2004
Severe Snow Storm	January 2005
Severe Snow Storm	April, 2007
Severe Snow Storm	December 2010
Severe Snow Storm	January 2011
Blizzard of 2013	February 2013
Blizzard of 2015	January 2015

Source: National Oceanic and Atmospheric Administration

The Town of Wrentham does not keep local records of winter storms. Data for Norfolk County, which includes Wrentham, is the best available data to help understand previous occurrences and impacts of heavy snow events. While there are no existing estimates for damages from winter storms in Wrentham, the best available data for Norfolk County from NOAA shows that from 1996 to 2016 there were 77 heavy snowfall events that resulted in \$6.4 million dollars in property damage (Table 13). There were no deaths and one injury reported.

Table 13 Heavy Snow events and Impacts in Norfolk County 1996 –2017

Date	Deaths	Injuries	Property Damage
1/2/1996	0	0	-
1/7/1996	0	0	1,400,000
1/7/1996	0	0	2,000,000
1/10/1996	0	0	-
2/2/1996	0	0	-
2/16/1996	0	0	-
3/2/1996	0	0	-
3/7/1996	0	0	-
4/7/1996	0	0	-
4/9/1996	0	0	-
12/6/1996	0	0	-
1/11/1997	0	0	-
2/16/1997	0	0	-
3/31/1997	0	0	-
4/1/1997	0	0	2,500,000
12/23/1997	0	0	-
1/15/1998	0	0	-
1/15/1998	0	0	-
12/24/1998	0	0	-
1/14/1999	0	0	-
2/25/1999	0	0	-
3/6/1999	0	0	-
3/15/1999	0	0	-
1/13/2000	0	0	-
2/18/2000	0	0	-
12/30/2000	0	0	-
1/20/2001	0	0	-
2/5/2001	0	0	-
3/5/2001	0	0	-
3/9/2001	0	0	-
3/26/2001	0	0	250,000
12/8/2001	0	0	-
12/5/2002	0	0	-
3/16/2004	0	0	-
2/21/2005	0	0	-
2/24/2005	0	0	-
12/13/2007	0	0	-
12/16/2007	0	0	7,500
12/19/2007	0	0	-
1/14/2009	0	0	36,000
1/14/2009	0	0	30,000
1/14/2009	0	0	55,000
1/27/2009	0	0	-
2/22/2009	0	0	-
12/19/2009	0	0	10,000
12/19/2009	0	0	3,000
12/31/2009	0	0	-
1/18/2009	0	0	-
1/19/2009	0	0	-
2/3/2009	0	0	-
3/1/2009	0	0	-

Date	Deaths	Injuries	Property Damage
3/2/2009	0	0	-
12/19/2009	0	0	-
2/16/2010	0	0	-
12/20/2010	0	0	-
1/12/2011	0	0	-
1/26/2011	0	0	-
1/21/2012	0	0	-
12/29/2012	0	0	5,000
2/8/2013	0	0	-
3/7/2013	0	0	-
3/18/2013	0	0	-
12/14/2013	0	0	-
12/17/2013	0	0	-
1/2/2014	0	0	-
1/21/2014	0	0	-
2/5/2014	0	0	-
2/15/2014	0	0	5,000
01/26/2015	0	0	-
02/02/2015	0	0	-
02/08/2015	0	0	-
02/14/2015	0	0	-
01/23/2016	0	0	-
02/05/2016	2	0	100,000
02/08/2016	0	0	-
04/04/2016	0	0	-
3/14/2017	0	0	0
Total	0	1	6,401,500

Source: NOAA, National Climatic Data Center

As expected, a number of public safety issues can arise during snow storms. Impassible streets are a challenge for emergency vehicles and affect residents and employers. Snow-covered sidewalks force people to walk in streets, which are already less safe due to snow, slush, puddles and ice. Large piles of snow can also block sight lines for drivers, particularly at intersections. Not all residents are able to clear their properties, especially the elderly. Refreezing of melting snow can cause dangerous roadway conditions.

b. NOR'EASTERS

A northeast coastal storm, known as a nor'easter, is typically a large counter-clockwise wind circulation around a low-pressure center. Featuring strong northeasterly winds blowing in from the ocean over coastal areas, nor'easters are relatively common in the winter months in New England occurring one to two times a year. The storm radius of a nor'easter can be as much as 1,000 miles and these storms feature sustained winds of 10 to 40 mph with gusts of up to 70 mph. These storms are accompanied by heavy rains or snows, depending on temperatures.

Previous occurrences of Nor'easters include the following:

- February 1978 Blizzard of 1978
- October 1991 Severe Coastal Storm ("Perfect Storm")



December 1992	Great Nor'easter of 1992
January 2005	Blizzard/ oreaster
October 2005	Coastal Storm/Nor'easter
April 2007	Severe Storms, Inland & Coastal Flooding/Nor'easter
January 2011	Winter Storm/Nor'easter
October 2011	Severe Storm/Nor'easter
February 2013	Winter Storm/Nor'easter
January 2015	Winter Storm/Nor'easter
March 2018	Nor'easter(s)

Many of the historic flood events identified in the previous section were precipitated by nor'easters, including the "Perfect Storm" event in 1991. More recently, blizzards in January 2015 and March 2018 were large Nor'easters that caused significant snowfall amounts. Further, 2015 presented recorded breaking annual snowfall for the Commonwealth of Massachusetts where persistent winter storms and heavy snowfall exasperated winter storm challenges with large accumulations of snow on roadways, sidewalks, and snow farms.

Wrentham is vulnerable to both the wind and precipitation that accompanies nor'easters depending on the track and radius of the storm, but due to its inland location the town would not be subject to coastal hazards.. High winds can cause damage to structures, fallen trees, and downed power lines leading to power outages. Intense rainfall can overwhelm drainage systems causing localized flooding of rivers and streams as well as urban stormwater ponding and localized flooding. Fallen tree limbs as well as heavy snow accumulation and intense rainfall can impede local transportation corridors, block access for emergency vehicles, severely damage utilities, and cause injury and death.

Based on the record of previous occurrences, nor'easters in Wrentham are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

Blizzards are considered to be high frequency events based on past occurrences, as defined by the Massachusetts State Hazard Mitigation Plan, 2013. This hazard occurs more than once in five years, with a greater than 20 percent chance of occurring each year.

c. ICE STORMS

The ice storm category covers a range of different weather phenomena that collectively involve rain or snow being converted to ice in the lower atmosphere leading to potentially hazardous conditions on the ground. Hail size typically refers to the diameter of the hailstones. Warnings and reports may report hail size through comparisons with real-world objects that correspond to certain diameters:

While ice pellets and sleet are examples of these, the greatest hazard is created by freezing rain conditions, which is rain that freezes on contact with hard surfaces leading to a layer of ice on roads, walkways, trees, and other surfaces. The conditions created by freezing rain can make driving particularly dangerous and emergency response more difficult. The weight of ice on tree branches can also lead to falling branches damaging electric lines.

Description	Diameter (inches)
Pea	0.25
Marble or Mothball	0.50
Penny or Dime	0.75
Nickel	0.88
Quarter	1.00
Half Dollar	1.25
Walnut or Ping Pong Ball	1.50
Golf ball	1.75
Hen's Egg	2.00
Tennis Ball	2.50
Baseball	2.75
Tea Cup	3.00
Grapefruit	4.00
Softball	4.50

Town-specific data for previous ice storm occurrences are not collected by the Town of Wrentham. The best available local data is for Norfolk County through the National Centers for Environmental Information (Table 14) which experienced eight events from 1969 –2014. Since 1965, Norfolk County experienced eight events, but no damages, deaths, or injuries were recorded for these events.

Table 14 Norfolk County Ice Storm Events, 1965-2014

BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
6/8/1965	Hail	1.5	0	0	0
4/19/1969	Hail	2	0	0	0
9/6/1973	Hail	1.75	0	0	0
6/13/1987	Hail	0.75	0	0	0
7/7/1994	Hail	1.75	0	0	0
7/15/2002	Hail	1	0	0	0
7/2/2009	Hail	0.88	0	0	0
8/7/2014	Hail	1	0	0	0

Source: NOAA, National Centers for Environmental Information. Magnitude refers to diameter of hail stones in inches.

Ice storms are considered to be medium frequency events based on past occurrences, as defined by the Massachusetts State Hazard Mitigation Plan, 2013. This hazard occurs once in 5 years to once in 50 years, with 2% to 20% chance of occurring each year.

The Town’s vulnerability is primarily related to restrictions to travel on roadways, temporary road closures, school closures, and potential restrictions on emergency vehicle access. The Town works to clear roads and carries out general snow removal operations, and bans on-street parking during snow removal to ensure that

streets can be plowed and public safety vehicle access is maximized. Transit operations may also be impacted, as they were in the 2015 blizzard which caused the closure of the MBTA system for one day and limited services on several transit lines for several weeks. Another winter storm vulnerability is power outages due to fallen trees and utility lines.

4. GEOLOGIC HAZARDS

Geologic hazards include earthquakes and landslides. Although new construction under the current building codes generally will be built to seismic standards, there are still many structures which pre-date the most recent building code. Information on geologic hazards in Wrentham can be found on Map 4 in Appendix B.

A. EARTHQUAKES

Damage in an earthquake stems from ground motion, surface faulting, and ground failure in which weak or unstable soils, such as those composed primarily of saturated sand or silts, liquefy. The effects of an earthquake are mitigated by distance and ground materials between the epicenter and a given location. An earthquake in New England affects a much wider area than a similar earthquake in California due to New England’s solid bedrock geology.⁴

Seismologists use a Magnitude scale (Richter Scale) to express the seismic energy released by each earthquake. The typical effects of earthquakes in various ranges are summarized below.

<u>Richter Magnitudes</u>	<u>Earthquake Effects⁵</u>
Less than 3.5	Generally not felt, but recorded
3.5- 5.4	Often felt, but rarely causes damage
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 km. across where people live.
7.0- 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred meters across.

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 2007, 355 earthquakes were recorded in Massachusetts (NESEC). Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, including a magnitude 5.0 earthquake in 1727 and a 6.0 earthquake that struck in 1755 off the coast of Cape Anne. More recently, a pair of damaging earthquakes occurred near Ossipee, NH in 1940, and a 4.0 earthquake centered in Hollis, Maine in October 2012 was felt in the Boston area. Historical records of some of the more significant earthquakes in the region are shown in Table 15.

⁴The Northeast States Emergency Consortium. <http://nsec.org/earthquakes-hazards/>

⁵ Nevada Seismological Library (NSL), 2005

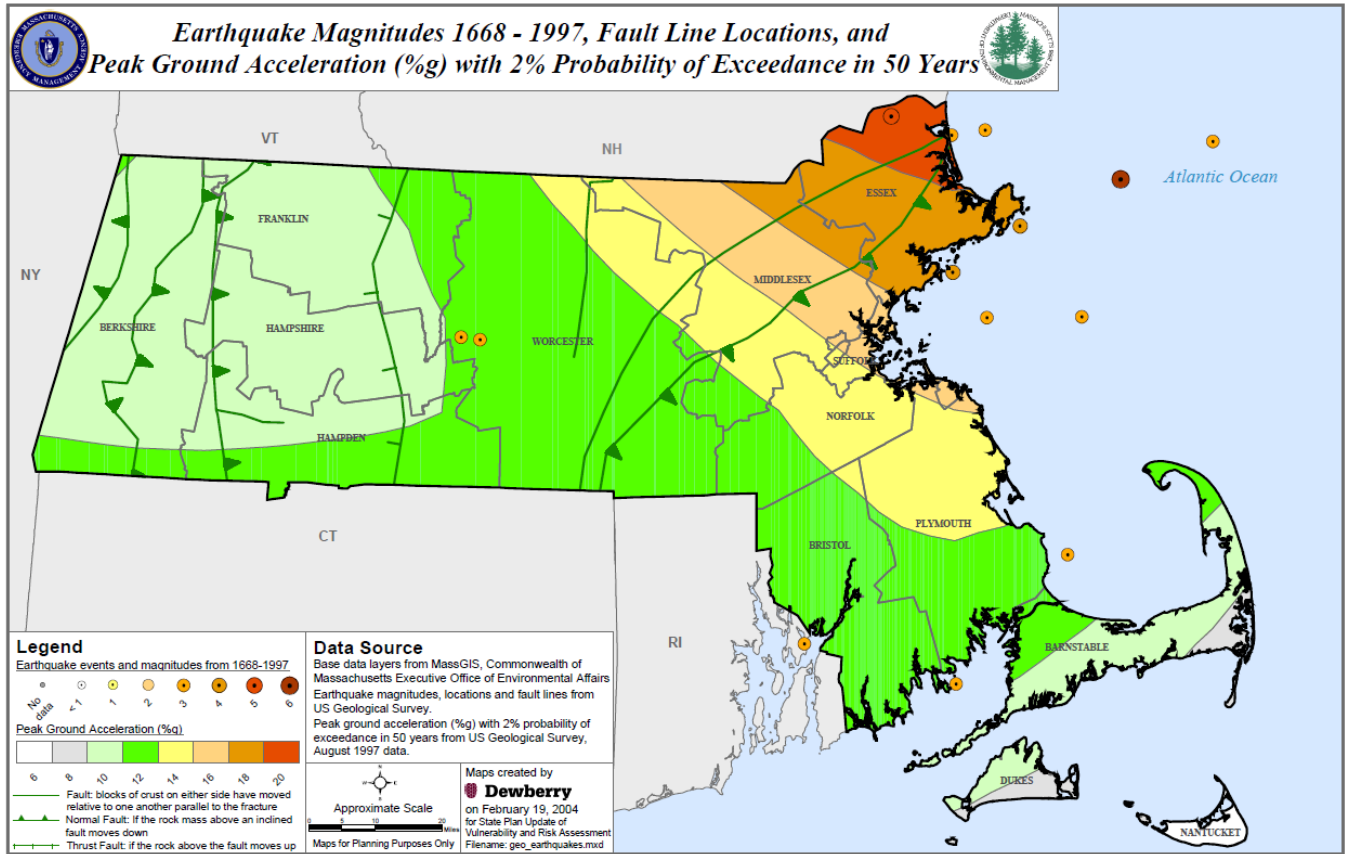
Table 15 Historical Earthquakes in Massachusetts or Surrounding Area

Location	Date	Magnitude
MA - Cape Ann	11/10/1727	5
MA - Cape Ann	12/29/1727	NA
MA - Cape Ann	2/10/1728	NA
MA - Cape Ann	3/30/1729	NA
MA - Cape Ann	12/9/1729	NA
MA - Cape Ann	2/20/1730	NA
MA - Cape Ann	3/9/1730	NA
MA - Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA - Salem	7/1/1744	NA
MA - Off Cape Ann	11/18/1755	6
MA - Off Cape Cod	11/23/1755	NA
MA - Boston	3/12/1761	4.6
MA - Off Cape Cod	2/2/1766	NA
MA - Offshore	1/2/1785	5.4
MA - Wareham/Taunton	12/25/1800	NA
MA - Woburn	10/5/1817	4.3
MA - Marblehead	8/25/1846	4.3
MA - Brewster	8/8/1847	4.2
MA - Boxford	5/12/1880	NA
MA - Newbury	11/7/1907	NA
MA - Wareham	4/25/1924	NA
MA - Cape Ann	1/7/1925	4
MA - Nantucket	10/25/1965	NA
MA - Boston	12/27/74	2.3
VA - Mineral	8/23/11	5.8
MA - Nantucket	4/12/12	4.5
ME - Hollis	10/17/12	4.0
CT-Wauregan	1/12/2015	3.3
CT-Wauregan	1/13/2015	2.6
NH-East Kingston	2/15/2018	2.7

Source: United States Geological Society. <https://earthquake.usgs.gov/earthquakes/>

One measure of earthquake risk is ground motion, which is measured as maximum peak horizontal acceleration, expressed as a percentage of gravity (1 g). The range of peak ground acceleration in Massachusetts is from 10g to 20g, with a 2% probability of exceedance in 50 years. Wrentham is in the middle part of the range for Massachusetts, at 14g to 16g, making it a relatively moderate area of earthquake risk within the state, although the state as a whole is considered to have a low risk of earthquakes compared to the rest of the country. There have been no recorded earthquake epicenters within Wrentham.

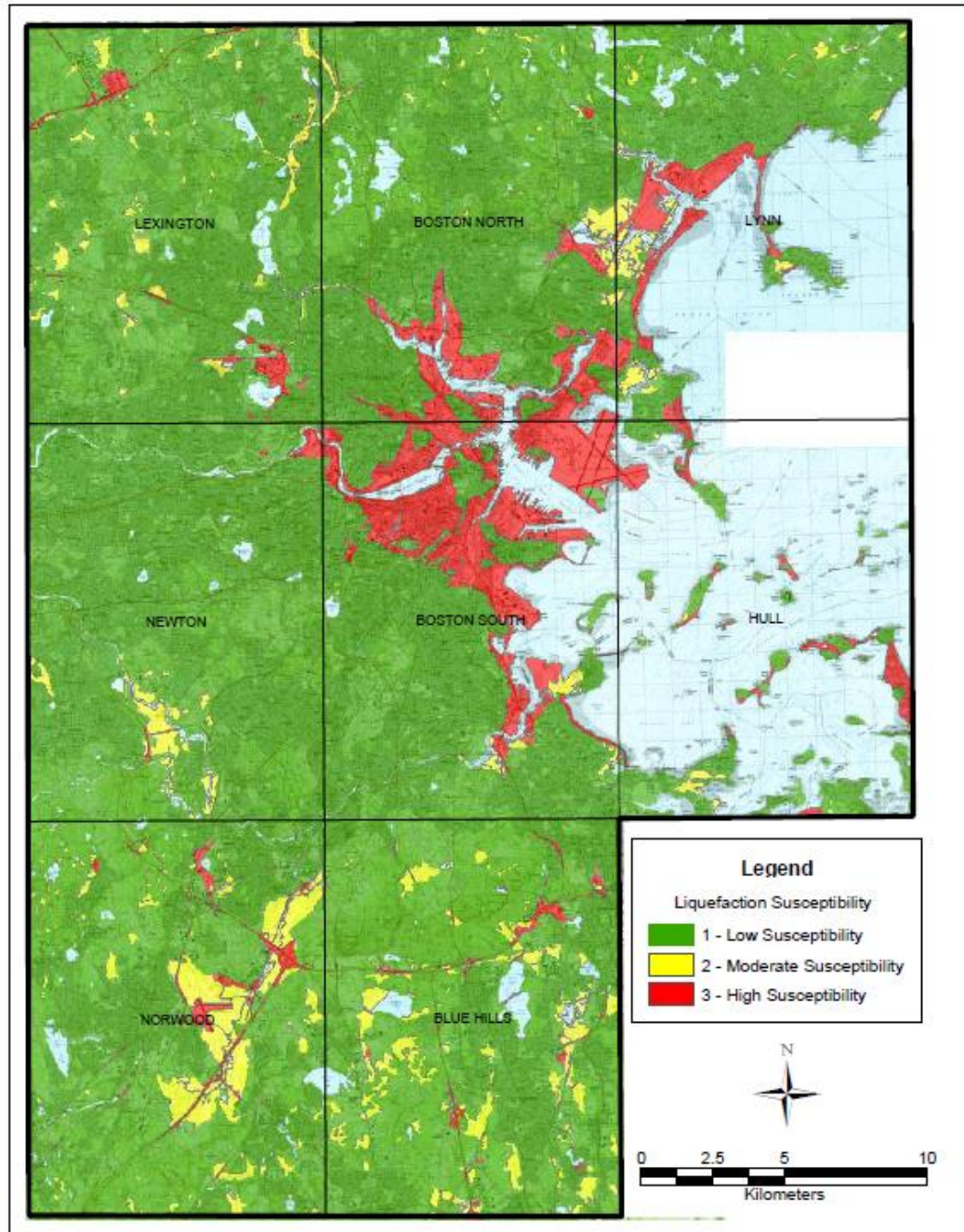
Figure 3 State of Massachusetts Earthquake Probability Map



Source: Massachusetts Emergency Management Agency

One additional potential concern in the Boston metropolitan area is liquefaction. This is a risk in areas with a prevalence of filled land. Liquefaction means that loosely packed, water-logged sediments lose strength and therefore move in large masses or lose bearing strength. Soil units susceptible to liquefaction include: non-engineered artificial fill, alluvial deposits, fluvial deposits, and flood plain deposits. Non-engineered artificial fill is what is typically known locally as filled land. An earthquake with a magnitude of 5.5 or greater can trigger liquefaction. However, as shown in Figure 4, Wrentham is located in an area of low susceptibility to liquefaction.

Figure 4 Liquefaction Susceptibility of the Boston Metropolitan Area



Source: Baise, Laurie G.; and Charles M. Brankman, Tufts University

Although New England has not experienced a damaging earthquake since 1755, seismologists state that a serious earthquake occurrence is possible. There are five seismological faults in Massachusetts, but there is no discernible pattern of previous earthquakes along these fault lines. Earthquakes occur without warning and may be followed by aftershocks. Most older buildings and infrastructure were constructed without specific earthquake resistant design features.

Earthquakes are a hazard with multiple impacts beyond the obvious building collapse. Buildings may suffer structural damage which may or may not be readily apparent. Earthquakes can cause major damage to

roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Another potential vulnerability is equipment within structures. For example, a hospital may be structurally engineered to withstand an earthquake, but if the equipment inside the building is not properly secured, the operations at the hospital could be severely impacted during an earthquake. Earthquakes can also trigger landslides.

Earthquakes are a potential town-wide hazard in Wrentham. The Town has many older buildings that pre-date current building code which could be vulnerable in the event of a severe earthquake. Potential earthquake damages to Wrentham have been estimated using HAZUS-MH. Total building damages are estimated at \$1,156,000,000 for a 5.0 magnitude earthquake and \$1,156,000,000 for a 7.0 magnitude earthquake. Other potential impacts are detailed in Table 26.

According to the Boston College Weston Observatory, in most parts of New England, there is a one in ten chance that a potentially damaging earthquake will occur in a 50 year time period. The Massachusetts State Hazard Mitigation Plan classifies earthquakes as "very low" frequency events that occur less frequently than once in 100 years, or a less than 1% per year. The Steering Committee states earthquakes are not a major concern for the Town.

d. LANDSLIDES

According to the United States Geological Society (USGS), a landslide describes a process that results in movement of rock, soil, fill, or combination downward and outward by falling, toppling, sliding, spreading or flowing.⁶ Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors. Among the contributing factors are: erosion by rivers or ocean waves over steepened slopes; rock and soil slopes weakened through saturation by snowmelt or heavy rains; earthquakes create stresses that make weak slopes fail; and excess weight from accumulation of rain or snow, and stockpiling of rock or ore, from waste piles, or from man-made structures.

Landslides can result from human activities that destabilize an area or can occur as a secondary impact from another natural hazard such as flooding. In addition to structural damage to buildings and the blockage of transportation corridors, landslides can lead to sedimentation of water bodies. Typically, a landslide occurs when the condition of a slope changes from stable to unstable. Natural precipitation such as heavy snow accumulation, torrential rain and run-off may saturate soil creating instability enough to contribute to a landslide. The lack of vegetation and root structure that stabilizes soil can destabilize hilly terrain.

There is no universally accepted measure of landslide extent but it has been represented as a measure of the destructiveness. The table below summarizes the estimated intensity for a range of landslides. For a given landslide volume, fast moving rock falls have the highest intensity while slow moving landslides have the lowest intensity.

⁶ U.S. Dept. of Interior U.S. Geological Society. Landslide Types and Processes. Fact Sheet 2003-3072

Estimated Volume (m ³)	Expected Landslide Velocity		
	Fast moving landslide (Rock fall)	Rapid moving landslide (Debris flow)	Slow moving landslide (Slide)
<0.001	Slight intensity		
<0.5	Medium intensity		
>0.5	High intensity		
<500	High intensity	Slight intensity	
500-10,000	High intensity	Medium intensity	Slight intensity
10,000 – 50,000	Very high intensity	High intensity	Medium intensity
>500,000		Very high intensity	High intensity
>>500,000			Very high intensity

Source: *A Geomorphological Approach to the Estimation of Landslide Hazards and Risks in Umbria, Central Italy*, M. Cardinali et al, 2002

Most of Wrentham has been classified as having a low risk for landslides (see Map 4, Appendix B), and the Steering Committee stated that they were unaware of any areas of geologic instability. There are not many steep slopes in the town and the Steering Committee concurs that landslides are not a major threat or occurrence in Wrentham. Rather, there may be localized issues of erosion during construction, as a result of development, or as a result of clearing vegetation.

Should a landslide occur in the future, the type and degree of impacts would be highly localized, and the town’s vulnerabilities could include damage to structures, damage to infrastructure, and localized road closures. The value of potential damages would depend on how many properties were affected. Given the assessed value of property in Wrentham, damages affecting a single residence could exceed \$440,000, and damages affecting several homes or business properties could theoretically extend from \$1 million to several million. However, there are no data available on landslide damages in Wrentham, as there are no records of any damages caused by landslides in the town. Injuries and casualties, while possible, would be unlikely given the low extent and impact of landslides in Wrentham.

Based on past occurrences and the Massachusetts Hazard Mitigation Plan, landslides are of Low frequency, events that can occur once in 50 to 100 years (a 1% to 2% chance of occurring each year).

5. FIRE RELATED HAZARDS

A brush fire is an uncontrolled fire occurring in a forested or grassland area. In the Boston Metro region these fires rarely grow to the size of a wildfire as seen more typically in the western U.S. As their name implies, these fires typically burn no more than the underbrush of a forested area. There are three different classes of wild fires:

- Surface fires are the most common type and burn along the floor of a forest, moving slowly and killing or damaging trees;
- Ground fires are usually started by lightning and burn on or below the forest floor;
- Crown fires spread rapidly by wind, jumping along the tops of trees.

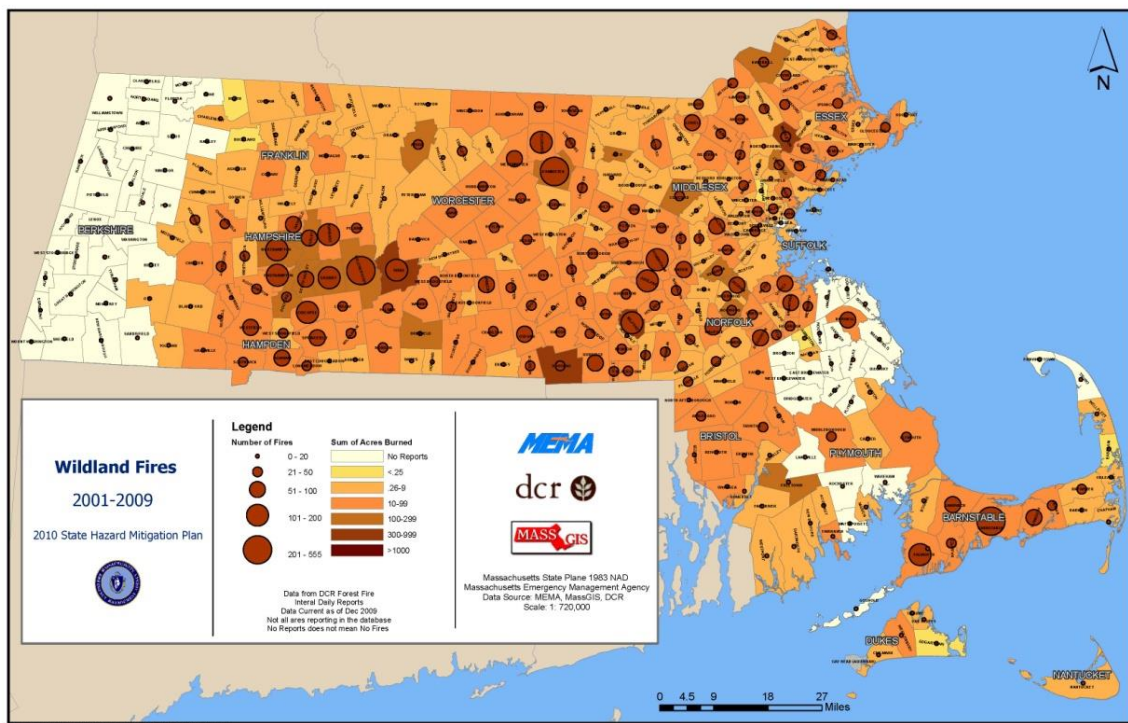
Wildfire season can begin in March and usually ends in late November. The majority of wildfires typically occur in April and May, when most vegetation is void of any appreciable moisture, making them highly

flammable. Once "green-up" takes place in late May to early June, the fire danger usually is reduced somewhat.

A wildfire differs greatly from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to unexpectedly change direction, and its ability to jump gaps such as roads, rivers and fire breaks. These fires can present a hazard where there is the potential for them to spread into developed or inhabited areas, particularly residential areas where sufficient fuel materials might exist to allow the fire the spread into homes. Protecting structures from fire poses special problems, and can stretch firefighting resources to the limit. If heavy rains follow a fire, other natural disasters can occur, including landslides, mudflows, and floods. If the wild fire destroys the ground cover, then erosion becomes one of several potential problems.

Wildfires in Massachusetts are measured by the number of fires and the sum of acres burned. The most recent data available for wildfires in Massachusetts, shown in Figure 5 below, indicates that the wildfire extent in Wrentham consists of 9 to 26 acres burned, with 21 to 50 recordable fires from 2001 to 2009.

Figure 5 Massachusetts Wildfires 2001-2009



Source: Massachusetts State Hazard Mitigation Plan

According to the Wrentham Fire Chief, there are up to 150 brush fires annually. The majority of brush fires occur in areas of public open space or by disregarded cigarettes near major roadways and weather conditions such as lack of rainfall, winds and lightning. These fires typically result in minimal property damage and there have been no deaths as. Most of these fires are small, but some are larger

The Steering Committee identified the seven following fire hazard areas, though the Town does not feel that fires present a significant hazard to the community.

Map ID	Area	Hazard Type
9	I-495 Corridor	Brush Fire
10	Joe's Rock	Brush Fire
11	Green Street	Brush Fire
12	Wrentham State Forest	Brush Fire
13	High Rock	Brush Fire
14	Well #4	Brush Fire
15	Anglers Club	Brush Fire

The Map ID in the table corresponds to the numbers on Map 8, “Hazard Areas” and do not reflect any priority order. Less than 1% result in any significant property damage and there have been no deaths as a result of brush fires. The area with the highest incidence of brush fires is around the Interstate 495 corridor, mostly from cigarette littering as shown on Map 8 in Appendix B. Potential damages from wildfires in Wrentham would depend on the extent and type of land affected. There could be the need for post-fire revegetation to restore a burned property, which could cost from a few thousand dollars to tens of thousands for an extensive area. However, there are no data on actual wildfire damages in the town.

Based on past occurrences and the Massachusetts Hazard Mitigation Plan 2013, brushfires are of Medium frequency, events that occur from once in 5 years to once in 50 years (2% to 20% probability per year).

6. EXTREME TEMPERATURES

Extreme temperatures occur when either high temperature or low temperatures relative to average local temperatures occur. These can occur for brief periods of time and be acute, or they can occur over long periods of time where there is prolonged period of excessively hot or cold weather.

Wrentham has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those, which are far outside of the normal seasonal ranges for Massachusetts. The average temperatures for Massachusetts are: winter (Dec-Feb) Average = 31.8°F and summer (Jun-Aug) Average = 71°F. Extreme temperatures are a town-wide hazard.

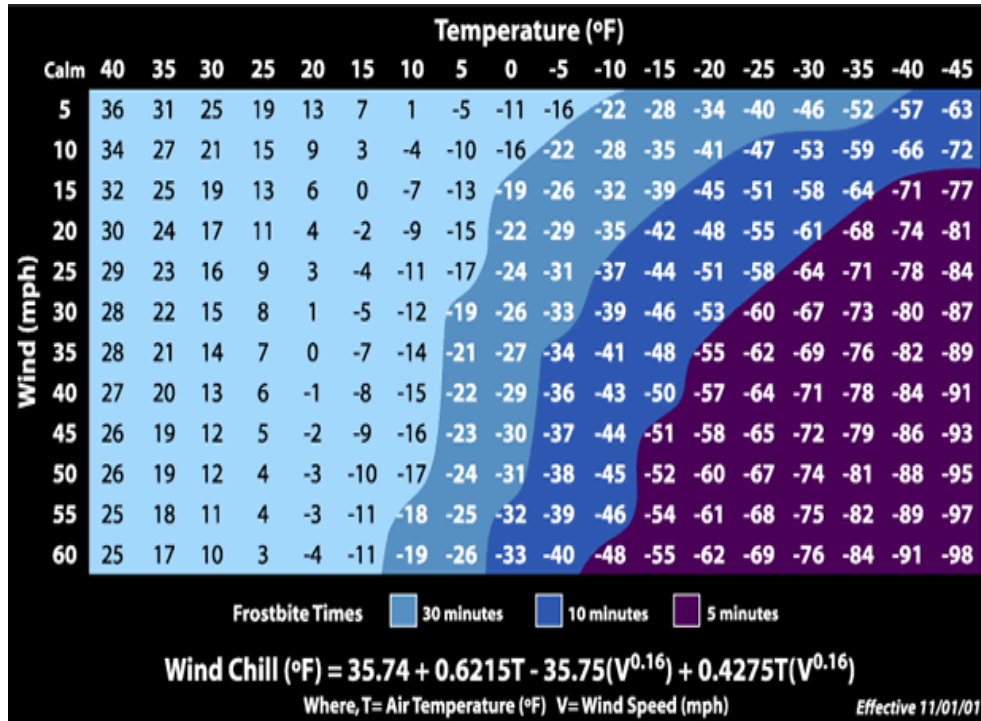
A. EXTREME COLD

For extreme cold, temperature is typically measured using Wind Chill Temperature Index, which is provided by the National Weather Service (NWS). The latest version of the index was implemented in 2001 and it meant to show how cold conditions feel on unexposed skin. The index is provided in Figure 6 below.

Extreme cold is relative to the normal climatic lows in a region. Temperatures that drop decidedly below normal and wind speeds that increase can cause harmful wind-chill factors. The wind chill is the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed. The National

Weather Service (NWS) issues a Wind Chill Advisory if the Wind Chills of -5F to -19F are expected. A Wind Chill Warning issued when wind chills of -20F or lower are expected.⁷

Figure 6 Wind Chill Temperature Index and Frostbit Risk



Source: NOAA and National Weather Service.

Extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat. The elderly and people with disabilities are often most vulnerable. In Wrentham, 10.4% of the population people are over 65 years old, and 3.5% of the population have a disability.

The Town of Wrentham does not collect data for previous occurrences of extreme cold. The best available local data are for Norfolk County, through the National Centers for Environmental Information. There was one extreme cold event in February 2007 which caused one death and no injuries or property damage (Table 16). Three other occurrences in February 2016 did not lead to any reported deaths or damages.

Table 16 Norfolk County Extreme Cold and Wind Chill Occurrences

Date	Deaths	Injuries	Property Damage
02/03/2007	1	0	0
2/16/2015	0	0	0
2/13/2016	0	0	0
2/14/2016	0	0	0

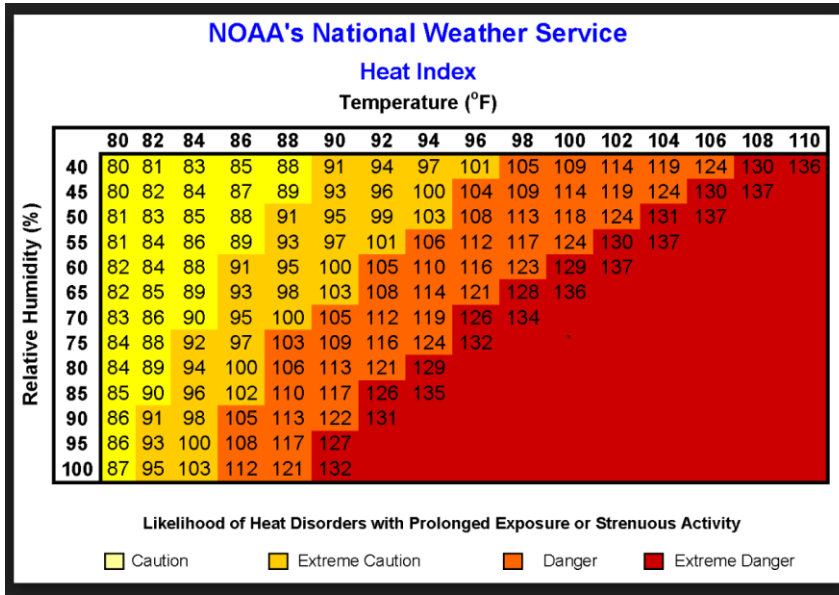
Source: NOAA, National Centers for Environmental Information

⁷ National Weather Service. <https://www.weather.gov/lwx/WarningsDefined#Wind%20Chill%20Advisory>

B. EXTREME HEAT

While a heat wave for Massachusetts is defined as three or more consecutive days above 90°F, another measure used for identifying extreme heat events is through a Heat Advisory from the NWS. These advisories are issued when the heat index (Figure 7) is forecast to exceed 100 degree Fahrenheit (F) for 2 or more hours; an excessive heat advisory is issued if forecast predicts the temperature to rise above 105 degree F.

Figure 7 Heat Index Chart



Source: National Weather Service

Extreme heat poses many health risks. Prolonged exposure to high temperatures can cause heat-related illnesses, such as heat cramps, heat exhaustion, heat stroke, and in severe cases, death. Heat exhaustion is the most common heat-related illness and if untreated, it may progress to heat stroke. Prolonged heat exposure can also exacerbate pre-existing conditions, including respiratory illnesses, cardiovascular disease, and mental illnesses.

Senior adults are at particularly high risk to heat for several reasons. They may not adjust to sudden changes in temperature as quickly as younger people, they are more likely to have a chronic medical condition whose symptoms may be exacerbated by heat, and they are more likely to be taking prescription medications that affect their ability to control body temperature.^{8,9}

Power failures can occur during heat waves, where intense heat spikes electricity demand and aging infrastructure. This occurred in June 2017 in the Town of Belmont, MA where intense heat cause a spike in electricity demand. With its aging infrastructure, the combination of these factors led to equipment failure.¹⁰ Loss of electricity not only impair a resident’s ability to cool, but can cause significant medical emergency for

⁸ Gamble, J. L., Hurley, B. J., Schultz, P. A., Jaglom, W. S., Krishnan, N., & Harris, M. (2013). Climate Change and Older Americans: State of the Science. Environmental Health Perspectives, 121(1), 15–22. <http://doi.org/10.1289/ehp.1205223>

⁹ Center for Disease Control and Prevention. Natural Disasters and Severe Weather. <https://www.cdc.gov/disasters/extremeheat/older-adults-heat.html>

¹⁰ Wicked Local Belmont “Power Outage in Belmont Affects 2,000 Customers” June 14, 2017.

<http://belmont.wickedlocal.com/news/20170612/power-outage-in-belmont-affects-2000-customers>.

those who require electronic medical equipment or from food-borne illnesses from contaminated food, ingested after loss of refrigeration.

Table 17 Norfolk County Extreme Heat Occurrences

DATE	DEATHS	INJURIES	DAMAGE
6/7/1999	0	0	0
7/5/1999	2	0	0
7/16/1999	0	0	0
7/17/1999	0	0	0
7/18/1999	0	0	0
9/7/1999	0	0	0
9/8/1999	0	0	0
7/6/2010	0	0	0
7/22/2011	0	0	0
TOTAL	2	0	0

Source: NOAA, National Centers for Environmental Information

The Town of Wrentham does not collect data on excessive heat occurrences, however an analysis of land surface temperatures using LANDSAT ground surface temperatures during the warmest months in 2016 indicate that Wrentham has areas that are significantly hotter than the remaining Town, known as the urban heat island effect (UHI). UHI is typically caused by lack of tree cover and extensive impervious surface. The area in Town most vulnerable to UHI is the Wrentham Village Premium Outlets as illustrated in Appendix B Map 9.

The best data for frequency of heat waves is through the National Centers for Environmental Information for Norfolk County. From 1999 - 2017, there have been a total of 16 excessive heat events, with two reported deaths, no injuries, and no property damage resulting from excessive heat (see Table 17). Further, scientists project that extreme heat events are likely to occur more frequently with climate change. According to the Northeast Climate Science Center, Wrentham in the Charles River Basin could experience 10-35 more days over 90° by 2050 and 15-76 more days over 90° by the end of the century.¹¹

Today, extreme temperatures are a medium frequency event based on past occurrences, as defined by the Massachusetts State Hazard Mitigation Plan, 2013. Both extreme cold and hot weather events occur between once in five years to once in 50 years, or a 2 percent to 20 percent chance of occurring each year.

7. DROUGHT

Drought is a temporary irregularity in precipitation and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate. Drought is a period characterized by long durations of below normal precipitation. Drought conditions occur in virtually all climatic zones yet its characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

¹¹ Northeast Climate Science Center. UMass Amherst. Massachusetts Climate Change Projections. December 2017

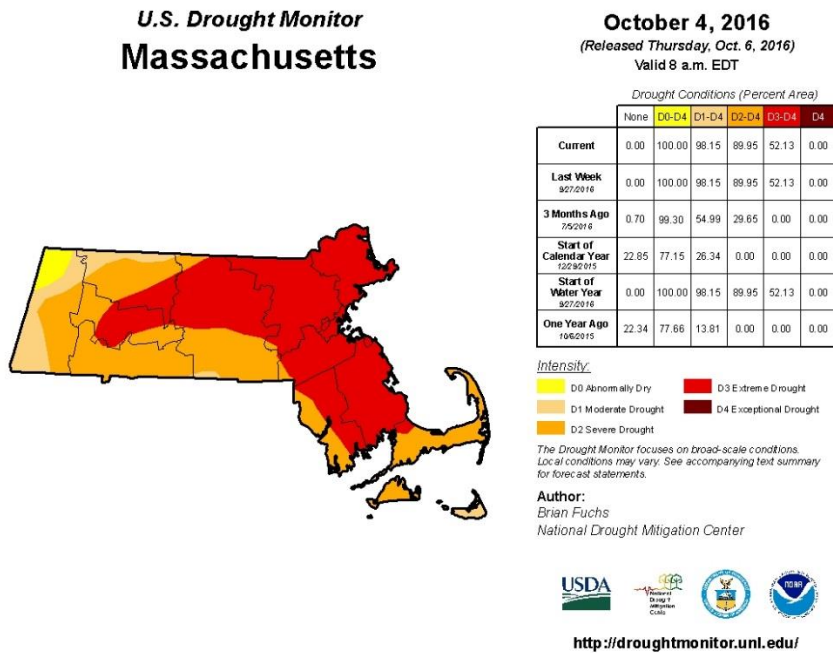
Five levels of drought have been developed to characterize drought severity: Normal, Advisory, Watch, Warning, and Emergency. These drought levels are based on the conditions of natural resources and are intended to provide information on the current status of water resources. The levels provide a basic framework from which to take actions to assess, communicate, and respond to drought conditions. They begin with a normal situation where data are routinely collected and distributed, move to heightened vigilance with increased data collection during an advisory, to increased assessment and proactive education during a watch. Water restrictions might be appropriate at the watch or warning stage, depending on the capacity of each individual water supply system. A warning level indicates a severe situation and the possibility that a drought emergency may be necessary. A drought emergency is one in which mandatory water restrictions or use of emergency supplies is necessary. Drought levels are used to coordinate both state agency and local response to drought situations.

In Massachusetts, droughts are caused by the prevalence of dry northern continental air and a decrease in coastal- and tropical-cyclone activity. During the 1960's, a cool drought occurred because dry air from the north caused lower temperatures in the spring and summer of 1962-65. Average annual precipitation in Massachusetts is 44 inches per year, and during the 1965 drought, the statewide precipitation total of 30 inches was 68 percent of average. The drought was so severe, the Quabbin Reservoir was 20 feet below its current level today.¹² In 2016, nearly half of Massachusetts was in extreme drought conditions with 15 inches of deficit rainfall (Figure 8), the worst drought since 1965. The drought geographically affected 6.5 million people, forced some communities to buy drinking water from the Massachusetts Water Resources Authority,¹³ and prompting State aid to farmers for crop losses.

¹² Lathrop, Janet. Putting New England's Drought into Perspective. <https://www.umass.edu/newsoffice/article/putting-new-england%E2%80%99s-drought-perspective>

¹³ <https://www.boston.com/weather/local-news/2016/09/15/more-than-half-of-massachusetts-now-experiencing-an-extreme-drought>

Figure 8 Extreme Drought Conditions in Massachusetts 2016.



Although Massachusetts is relatively small, it has a number of distinct regions that experience significantly different weather patterns and react differently to the amounts of precipitation they receive. The DCR precipitation index divides the state into six regions: Western, Central, Connecticut River Valley, Northeast, Southeast, and Cape and Islands. Wrentham is located in the Northeast Region. In Wrentham drought is a potential town-wide hazard.

As dry conditions can have a range of different impacts, a number of drought indices are available to assess these various impacts. Massachusetts uses a multi-index system that takes advantage of several of these indices to determine the severity of a given drought or extended period of dry conditions. Drought level is determined monthly based on the number of indices which have reached a given drought level. Drought levels are declared on a regional basis for each of six regions in Massachusetts. County by county or watershed-specific determinations may also be made.

A determination of drought level is based on seven indices:

- Standardized Precipitation Index (SPI) reflects soil moisture and precipitation.
- Crop Moisture Index: (CMI) reflects soil moisture conditions for agriculture.
- Keetch Byram Drought Index (KBDI) is designed for fire potential assessment.
- Precipitation Index is a comparison of measured precipitation amounts to historic normal precipitation.
- The Groundwater Level Index is based on the number of consecutive month's groundwater levels are below normal (lowest 25% of period of record).
- The Stream flow Index is based on the number of consecutive months that stream flow levels are below normal (lowest 25% of period of record).

- The Reservoir Index is based on the water levels of small, medium and large index reservoirs across the state, relative to normal conditions for each month.

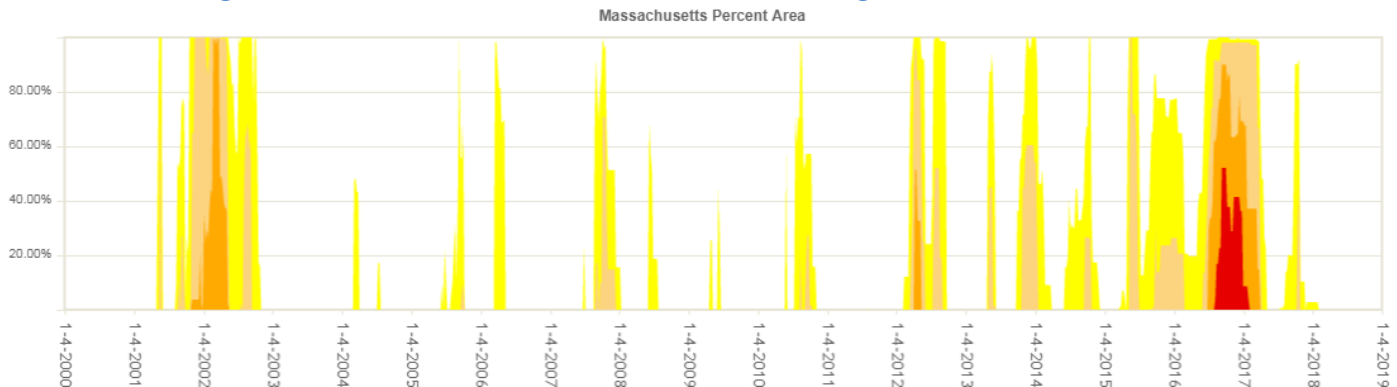
Determinations regarding the end of a drought or reduction of the drought level focus on two key drought indicators: precipitation and groundwater levels. These two factors have the greatest long-term impact on stream flow, water supply, reservoir levels, soil moisture and potential for forest fires.

Previous Occurrences

Wrentham does not collect data relative to drought events. Because drought tends to be a regional natural hazard, this plan references state data as the best available data for drought. The statewide scale is a composite of six regions of the state. Regional composite precipitation values are based on monthly values from six stations, and three stations in the smaller regions (Cape Cod/Islands and West).

Figure 9 depicts the incidents and percent area of drought levels' occurrence in Massachusetts from 1850 to 2018 using the Standardized Precipitation Index (SPI) parameter alone. On a monthly basis, the state would have been in a Drought Watch to Emergency condition 11 percent of the time between 1850 and 2012. Table 18 summarizes the chronology of major droughts since the 1920's.

Figure 9 Percent Area in Massachusetts with Drought Conditions 2000-2018



Source: US Drought Monitor

Drought Emergency

Drought emergencies have been reached infrequently, with six events occurring in the period between 1850 and 2018: in 1883, 1911, 1941, 1957, and 1965-1966. The 1965-1966 drought period is viewed as the most severe drought to have occurred in modern times in Massachusetts because of its long duration. On a monthly basis over the 162-year period of record, there is a one percent chance of being in a drought Emergency.

Drought Warning

Drought Warning levels not associated with drought Emergencies have occurred five times, in 1894, 1915, 1930, and 1985, and 2016. On a monthly basis over the 162-year period of record, there is a two percent chance of being in a drought Warning level. From July –December 2016, a Drought Warning was declared for the Northeast region, which includes the Town of Wrentham. December, 2016 marked the ninth

consecutive month of below average rainfall (see Figure 10). In response to the drought, surface drinking water supply was severely and the Wrentham Water Department imposed a Level V Watering Restriction.

Drought Watch

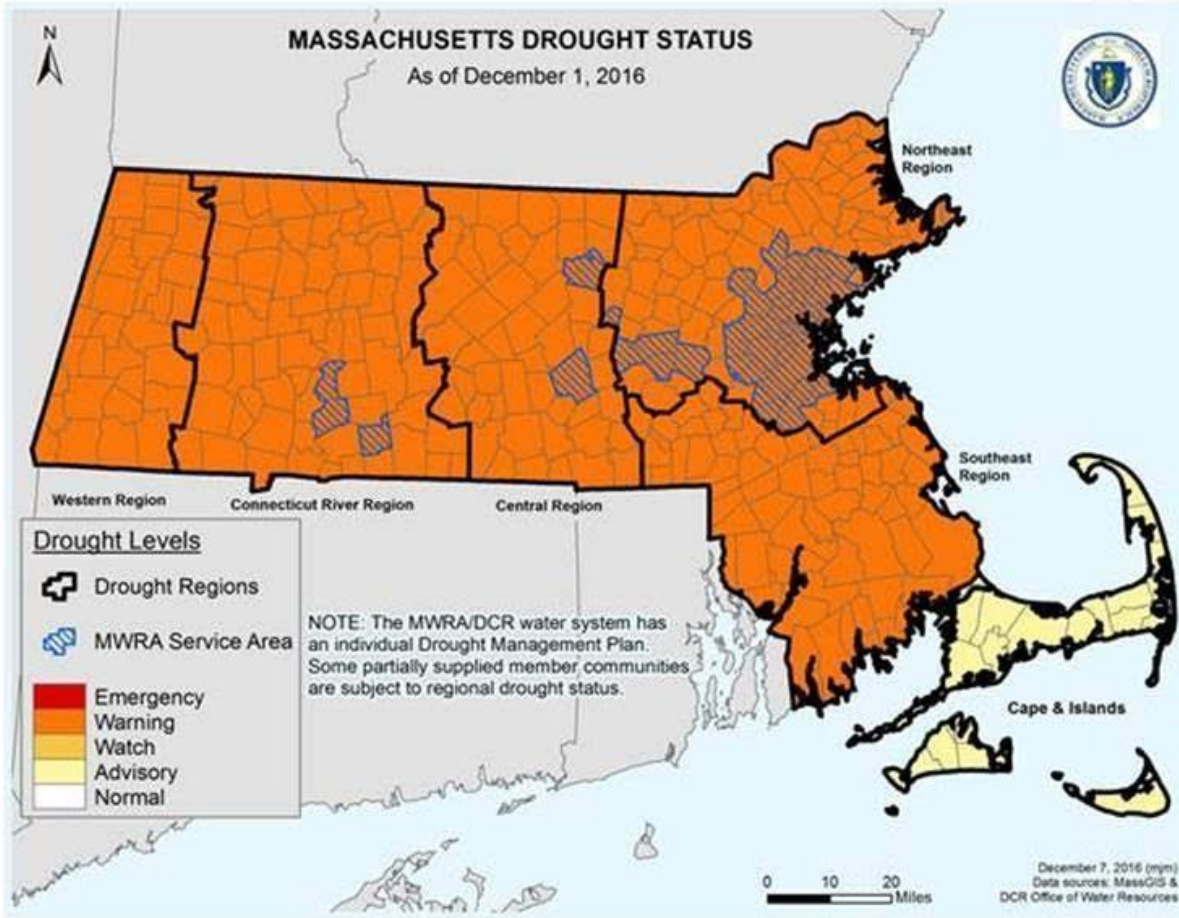
Drought Watches not associated with higher levels of drought generally have occurred in three to four years per decade between 1850 and 1950. In the 1980s, there was a lengthy drought Watch level of precipitation between 1980 and 1981, followed by a drought Warning in 1985. A frequency of drought Watches at a rate of three years per decade resumed in the 1990s (1995, 1998, 1999). In the 2000s, Drought Watches occurred in 2001 and 2002. The overall frequency of being in a drought Watch is 8% on a monthly basis over the 162-year period of record.

Under a severe long term drought the Town of Wrentham could be vulnerable to restrictions on water supply. Potential damages of a severe drought could include losses of landscaped areas if outdoor watering is restricted and potential loss of business revenues if water supplies were severely restricted for a prolonged period. As this hazard has never occurred to such a severe degree in Wrentham, there are no data or estimates of potential damages, but under a severe long term drought scenario it would be reasonable to expect a range of potential damages from several million to tens of millions of dollars.

Table 18 Chronology of major droughts in Massachusetts

Date	Area affected	Recurrence interval (years)	Remarks
1929-32	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.
	Statewide	15 to >50	More severe in eastern and extreme western Massachusetts. Multistate.
1957-59	Statewide	5 to 25	Record low water levels in observation wells, northeastern Massachusetts.
1961-69	Statewide	35 to >50	Water-supply shortages common. Record drought. Multistate.
1980-83	Statewide	10 to 30	Most severe in Ipswich and Taunton River basins; minimal effect in Nashua River basin. Multistate.
1985-88	Housatonic River basin	25	Duration and severity unknown. Streamflow showed mixed trends elsewhere.
2016-17	Statewide	NA	Drought declaration began in July 2016 with a Drought Watch, which was upgraded to a Drought Warning in August 2016. The Central and Northeast regions were initially affected, then the declaration was extended statewide except the Cape and Islands.

Figure 8 Massachusetts Drought Status in December 2016



Source: MA Department of Conservation and Recreation, Office of Water Resources

Probability of Future Occurrences

The state has experienced Emergency Droughts five times between 1850 and 2012. Even given that regional drought conditions may occur at a different interval than state data indicates, droughts remain primarily regional and state phenomena in Massachusetts. Emergency Drought conditions over the 162 period of record in Massachusetts are a Low Frequency natural hazard event that can occur from once in 50 years to once in 100 years (1% to 2% chance per year), as defined by the Massachusetts State Hazard Mitigation Plan, 2013. However, with accelerated global warming as a result of greenhouse gas emissions causing climate change, scientists’ temperature projection models indicate that drought could become more frequent and intense. The Northeast Climate Science Center at UMass Amherst indicates that consecutive dry days, typically 17 annually today, could increase over 18 by the end of the century.¹⁴

¹⁴ Resilientma.org

C. LAND USE AND DEVELOPMENT TRENDS

1. EXISTING LAND USE

The most recent land use statistics available from the state are from aerial photography done in 2005. Table 19 shows the acreage and percentage of land in 25 categories. The majority of the Town is comprised of forest at 55% with low density residential use being the second most significant land use at 9.4%. Commercial and industrial combined make up 2.1% of the town, or 305 acres.

Table 19 Town of Wrentham, MA 2005 Land Use

Land Use	Acres	Percentage
Waste Disposal	2.7	0.0
Water-Based Recreation	3.3	0.0
Brushland/Successional	13.7	0.1
Nursery	15.7	0.1
Cemetery	17.2	0.1
Junkyard	24.6	0.2
Cranberry Bog	24.6	0.2
Golf Course	29.8	0.2
Transitional	41.1	0.3
High Density Residential	41.9	0.3
Cropland	65.9	0.5
Multi-Family Residential	66.2	0.5
Participation Recreation	96.4	0.7
Powerline/Utility	101.5	0.7
Industrial	108.0	0.7
Orchard	110.8	0.8
Transportation	143.8	1.0
Urban Public/Institutional	146.2	1.0
Commercial	197.4	1.4
Mining	245.5	1.7
Open Land	362.9	2.5
Pasture	378.9	2.6
Medium Density Residential	386.7	2.7
Very Low Density Residential	420.9	2.9
Water	502.1	3.5
Non-Forested Wetland	728.2	5.0
Forested Wetland	806.6	5.6
Low Density Residential	1367.1	9.5
Forest	8015.3	55.4

For more information on how the land use statistics were developed and the definitions of the categories, please go to <http://www.mass.gov/mgis/lus.htm>.

2. NATURAL, CULTURAL, AND HISTORIC RESOURCE AREAS

Wrentham experienced significant growth from 1990 to 2000 where it began to experience a steady decline in building permits, in part due to the economic conditions and anecdotal comments that building lots are difficult to find.¹⁵ Though the Town has seen increased growth and development in recent years, Wrentham's rural character remains an important community value and draw for residents. Further, the Town adopted the Community Preservation Act in 2016 providing a dedicated source of funding for acquiring land for open space, historic preservation, and affordable housing.

Wrentham contains significant open space with over 2,300 acres of protected land, constituting 16% of the total land area. Of its total area, 1,376 acres are considered BioMap2 Core Habitat of which 32.5% is protection and 752 acres of BioMap2 Critical Natural Landscape of which 28.5% is protected. BioMap2 is a program created in partnership with the MA Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program and The Nature Conservancy to identify exemplary natural ecosystems that are able to withstand stressors related to climate change while protecting the nature and biodiversity of Massachusetts. Wrentham's Forest Core, Aquatic Core and Wetland Core support 10 Species of Conservation Concern, such as the Oak Hairstreak Butterfly and the Bridle Shiner and one Threatened species, the Marbled Salamander. Further, 61% of Wrentham is covered by tree canopy totaling over 8,500 acres. The tree canopy serves as a great resource for community health, beauty and livability. The Tree canopy mitigates 665,176 pounds of air pollutants per year, intercepts 712 million gallons of stormwater a year and sequesters 719,872 tons of carbon a year.¹⁶

Wrentham's community characters is also shaped by three large lakes in town, Lake Pearl (218 acres), Lake Archer (79 acres) and Mirror Lake (55), all within the Charles River Watershed. These lakes are important recreational assets to the Town and surrounding area and most lake shorelines are developed with single-family homes. Water quality and weed control has been an ongoing challenge, exacerbated by non-point source pollution from stormwater runoff. The Steering Committee as well as Wrentham participants in the Municipal Vulnerability Preparedness workshop indicate that multi-departmental re-evaluation and regulation on stormwater management and bylaw review is critical to support these lake and other important assets in Town. Other water resources in Wrentham include Eagle Brook, Stop River, and Safe Meadow Brook, all within the Charles River watershed. Crocker Pond in Wrentham provides surface drinking water supply for the Town of Attleboro. Finally, Wrentham is serves the upper watershed for four major Rivers-the Charles, the Blackstone, the Ten Mile, and the Taunton. Land use decisions-such as stormwater management, development, and land protection, will have far-reaching impacts and benefits to communities downriver from Wrentham.¹³

Wrentham has approximately 360 historic structures registered with the Massachusetts Historic Inventory. Some of Wrentham's most prominent historic assets include Wompam House, the oldest structure in Wrentham and Old Fiske Library Museum now home to the Wrentham Historical Commission and Arts and Culture Commission. Wrentham's Town Center containing the Town Common is another important historic and cultural

¹⁵ Wrentham Conservation Commission. 2015. *Wrentham Open Space and Recreation Plan*.

¹⁶ iTreeLandscape.v.3.1.Modeled June 7, 2018

asset, representative of New England. Of Wrentham’s 360 historic structures, only one is within a flood zone. This is the Franklin Street Bridge of Eagle Brook within a 1% Annual Chance Flood.

3. DEVELOPMENT TRENDS

Wrentham experienced significant growth and development from the 1990s to the early 2000s when development trends began to diminish. This is attributed to the decline in economic conditions nationally and lack of space to build residential development.¹⁷ AS of 2014, 35% of the Town areas was residential development, 3.9% was commercial, industrial and institutional, and 10.5% were roads or quarries. Wrentham has experienced new development and growth in recent years however. Its population has grown from 10, 812 from the 2010 to a projected 11,483 as of 2016. ¹⁸ An analysis on population and housing demand in Wrentham, performed by the Metropolitan Area Planning Council indicates that Wrentham households and housing units will both likely increase by approximately 10% by 2030 from 2010 data (Figure 9).

Figure 9 Housing Projections for Wrentham¹⁹

WRENTHAM					
Households and Housing Demand, 2000-2030					
		2000	2010	2020	2030
MAPC projected the number of households using age-specific headship rates and municipal-specific housing occupancy patterns and vacancy rates. Total household change and housing unit demand are shown in the table on the right.	Households	3,402	3,703	3,914	4,087
	Housing Units	3,507	3,869	4,096	4,273

Recently instituted Open Space Residential Development zoning has created more open space opportunities preserving Wrentham’s character while increasing density. However, the smaller lots associated with this zoning have been met with mixed response.¹⁷ Commercial and industrial development in Town is largely centered at major transportation corridors such as Route 1, Route 140, and Route 1A as well as the Town Center.

Development trends throughout the metropolitan region are tracked by MAPC’s Development Database, which provides an inventory of new development from 2006-2016. The database tracks both completed developments and those currently under construction. The database includes 18 new developments in the Town of Wrentham. The database also includes several attributes of the new development, including site acreage, housing units, and commercial space. They are a mix of commercial and residential projects. The 18 developments in Wrentham include a total of 396 housing units, 361,073 square feet of commercial/industrial space, and are sited on a total of 396 acres (see Table 20).

¹⁷ Wrentham Conservation Commission. 2015. *Wrentham Open Space and Recreation Plan*.

¹⁸ American Community Survey Demographic and Housing Estimates 2012-2016.

¹⁹ Metropolitan Area Planning Council http://www.mapc.org/wp-content/uploads/2017/08/MetroBoston-Projections-Final-Report_1_16_2014_0.pdf

Table 20 Summary of Wrentham New Developments

Development	Completion Year	Project Acres	Residential (ct)	Commercial/Industrial (SF)
Toils End/Fox Run subdivision	2015	85	70	0
Thurston Acres	2020	6	12	0.25
Kenworth	2020	4	0	53,552
The Proctor Mansion Inn	2007	1	0	14.5
Reverend Williams Estates	2020	4	8	0.25
Dana Estates	2020	2	4	0
Toils End Farm Open Space Subdivision	2023	30	166	0
Lovers Lane	2020	2	4	0
Deer Brook	2015	6	12	0
Badus Brook Subdivision	2015	11	16	0
Amberfields Subdivision	2015	66	60	0
Meadowview Estates Subdivision	2015	8	10	0
Safe Meadow Estates	2015	7.5	12	0
Ridge Estates	2015	7	14	0
Wyllie Estates Subdivision	2018	7	8	0
Wrentham Crossing	2015	23	0	130,001
30 Cushing Drive	2020	10	0	45,001
225 Industrial Road	2015	3.34	0	24,001
Wrentham Business Center	2020	52	0	162,001

Source: MAPC Development Database

In order to characterize any change in the town’s vulnerability associated with new developments, a GIS mapping analysis was conducted which overlaid the development sites with the FEMA Flood Insurance Rate Map with data from the development database. The analysis shows that one development, Toils End Farm Open Space Subdivision is within a 1% Annual Chance Flood Zone. With respect to average annual snowfall, all of the development sites are within the zone of 36 to 48 inches average annual snowfall. With respect to wind, there is no variation across the town of Wrentham; the entire town is in the same category, which has a 100-year wind maximum speed of 110 miles per hour. Overall, Wrentham’s new development does not significantly increase the town’s vulnerability to natural hazards.

4. POTENTIAL FUTURE DEVELOPMENT

MAPC consulted with Steering Committee and planning staff to determine areas that may be developed in the future, based on the Town’s comprehensive planning efforts and current trends and projects. These areas are listed below in Table 21 and shown on Map 8 in Appendix B.

Table 21 Potential Future Development Sites

Map ID	Name	Type	Comments
C	Simeone Industrial Development	Development	Future Development
E	Kenworth Truck Dealership	Development	Future Development
F	Fairfield 40B	Development	Future Development
I	Franklin Street at Town Line	Development	Future Development 40b Under construction. Future Commercial/Industrial Development
K	Franklin Street	Development	Potential Development
M	Commercial Drive	Development	Future Development
N	Daniels Property	Development	Potential Development
O	Wrentham Business Park	Development	Potential Development
P	Lurroso	Development	Potential Development
Q	Simeone 40B	Development	Future Development
S	Farmer Street Sportsplex	Development	Potential Development
T	Industrial Road	Development	Potential Development
U	South Street Development	Development	Potential Development 100 acres rezoned commercial/industrial.
V	Route 1 Dickens	Development	Potential Development
W	Park Place	Development	Future Development
X	Thurston Street Columbia Gas	Development	Future Development
Y	650 South Street	Development	Future Development
Z	Depot and Kendrick Streets	Development	Potential Development

* “Future Development” indicates a project in or completed the permitting process, “Development” indicates a project currently under construction and “Potential Development” indicates prospective development opportunities.

a. FUTURE DEVELOPMENT IN HAZARD AREAS

Table 22 shows the relationship of these 18 potential development parcels to two of the mapped hazards, flood zones and landslides. This information is provided so that planners can ensure that development proposals comply with flood plain zoning and that careful attention is paid to drainage issues and other natural hazards.

The table shows that none of development sites are entirely or partially within a flood hazard area. With respect to other natural hazards, all of the development sites are located in the area designated as “Low Incidence” for landslides. Besides flooding and landslides, the only other hazard that varies with location within the town is snowfall. For average annual snowfall, all of the 18 development sites are located in the area of 36 to 48 inches average annual snowfall. With respect to wind, there is no variation across different sites in Wrentham; the hazard map depicts the entire town in the same category, which is a 100-year wind maximum speed of 110 miles per hour (Appendix B). Overall, Wrentham’s potential future development would not significantly increasing the town’s vulnerability.

Table 22 Future Development Sites in Hazard Areas

Map ID	Name	Comments	FEMA Flood Zone	Landslides Incidence	Snowfall	100 Year Wind
C	Simeone Industrial Development	Future Development	—	Low	36-48 in	110 mph
E	Kenworth Truck Dealership	Future Development	—	Low	36-48 in	110 mph
F	Fairfield 40B	Future Development	—	Low	36-48 in	110 mph
I	Franklin Street at Town Line	Future Development 40b Under construction. Commercial/Industrial Development	—		36-48 in	110 mph
K	Franklin Street	Potential Development	—	Low	36-48 in	110 mph
M	Commercial Drive	Future Development	—	Low	36-48 in	110 mph
N	Daniels Property	Potential Development	—	Low	36-48 in	110 mph
O	Wrentham Business Park	Potential Development	—	Low	36-48 in	110 mph
P	Lurroso	Potential Development	—	Low	36-48 in	110 mph
Q	Simeone 40B	Future Development	—	Low	36-48 in	110 mph
S	Farmer Street Sportsplex	Potential Development	—	Low	36-48 in	110 mph
T	Industrial Road	Potential Development	—	Low	36-48 in	110 mph
U	South Street Development	Potential Development 100 acres rezoned commercial/industrial.	—	Low	36-48 in	110 mph
V	Route 1 Dickens	Potential Development	—	Low	36-48 in	110 mph
W	Park Place	Future Development	—	Low	36-48 in	110 mph
X	Thurston Street Columbia Gas	Future Development	—	Low	36-48 in	110 mph
Y	650 South Street	Future Development	—	Low	36-48 in	110 mph
Z	Depot and Kendrick Streets	Potential Development	—	Low	36-48 in	110 mph

5. CRITICAL FACILITIES & INFRASTRUCTURE IN HAZARD AREAS

Critical facilities and infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, water pump stations, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). There are 72 facilities identified in Wrentham. These are listed in Table 23 and are shown on the maps in Appendix B. There are several critical facilities located within a flood zone, these include some wells and two water pump stations, and all the dams. Seventeen critical facilities are located in a locally identify hazard area known for Tornados.

Explanation of Columns in Table 23

- **Column 1: ID #:** The first column in Table 21 is an ID number which appears on the maps that are part of this plan. See Appendix B.
- **Column 2: Name:** The second column is the name of the site. If no name appears in this column, this information was not provided to MAPC by the community.
- **Column 3: Type:** The third column indicates what type of site it is.
- **Column 4: Landslide Risk:** The fourth column indicates the degree of landslide risk for that site. This information came from NESEC. The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>.
- **Column 5: FEMA Flood Zone:** The fifth column addresses the risk of flooding. A “No” entry in this column means that the site is not within any of the mapped risk zones on the Flood Insurance Rate Maps (FIRM maps). If there is an entry in this column, it indicates the type of flood zone.
- **Column 6: Snowfall.** Areas designated "low" receive an annual average of 36.1 to 48.0 inches of snow. Areas designated "high" receive an annual average of 48.1 to 72 inches of snow, as shown on Map 6 in Appendix B.

Table 23 Critical Facilities and Relationship to Hazard Areas

Map ID	NAME	TYPE	FEMA Flood	Locally Identified Hazard	Landslide	Snow	Wind 100 Year
1	Taunton Street @ 495 Bridge North	Bridge	No	Brush Fire	Low	36-48 in	110 mph
2	Exit #15 Bridge South @ South Street	Bridge	No	Brush Fire	Low	36-48 in	110 mph
3	Taunton Street @ 495 Bridge South	Bridge	No	Brush Fire	Low	36-48 in	110 mph
4	West Street Bridge@I495	Bridge	No	Brush Fire	Low	36-48 in	110 mph
5	Dedham Street Bridge	Bridge	No	No	Low	36-48 in	110 mph
6	Exit #15 Bridge North @ South Street	Bridge	No	Brush Fire	Low	36-48 in	110 mph
7	Town Hall	Municipal	No	Other-Tornado	Low	36-48 in	110 mph
8	Industrial Road Cell Tower	Communication Tower	No	No	Low	36-48 in	110 mph
9	Green Street Cell Tower	Communication Tower	No	No	Low	36-48 in	110 mph
10	Knuckup Hill Fire/DPW Comm Antenna	Communication Tower	No	No	Low	36-48 in	110 mph
11	Washington Street Police Comm Tower	Communication Tower	No	No	Low	36-48 in	110 mph
12	Wrentham District Court	Court House	No	Other-Tornado	Low	36-48 in	110 mph
13	Trout Pond Dam	Dam	No	No	Low	36-48 in	110 mph
14	Crocker Pond Dam	Dam	A: 1% Annual Chance of Flooding, no BFE	Flooding	Low	36-48 in	110 mph
16	Red Dam	Dam	A: 1% Annual Chance of Flooding, no BFE	No	Low	36-48 in	110 mph
17	Jenks Street Dam	Dam	A: 1% Annual Chance of Flooding, no BFE	No	Low	36-48 in	110 mph
18	Eagle Dam	Dam	A: 1% Annual Chance of Flooding, no BFE	Flooding	Low	36-48 in	110 mph
19	Stars of Tomorrow Day Care	Child Care	No	Other-Tornado	Low	36-48 in	110 mph
21	Bearly Beginning Day Care	Child Care	No	No	Low	36-48 in	110 mph
22	Hockomock YMCA Before and After School Care	Child Care	No	No	Low	36-48 in	110 mph
23	Little Red School House	Child Care	No	No	Low	36-48 in	110 mph
25	Maples Little Angels	Child Care	No	Other-Tornado	Low	36-48 in	110 mph
26	Department of Public Works	Municipal	No	No	Low	36-48 in	110 mph
27	Wrentham Emergency Operations Center	Emergency Operations Center	No	Other-Tornado	Low	36-48 in	110 mph
28	Fire Station #2	Fire Station	No	No	Low	36-48 in	110 mph
29	Fire HQ	Fire Station	No	Other-Tornado	Low	36-48 in	110 mph
30	South Street Distribution Hub	Emergency Distribution Site	No	No	Low	36-48 in	110 mph
31	Fiske Library	Municipal	No	No	Low	36-48 in	110 mph
32	Pond Home	Nursing Home	No	No	Low	36-48 in	110 mph
33	Maples Nursing and Retirement Center	Nursing Home	No	Other-Tornado	Low	36-48 in	110 mph
34	Serenity Hill Nursing Home	Nursing Home	No	No	Low	36-48 in	110 mph
35	Sheldonville Baptist Church	Church	No	No	Low	36-48 in	110 mph
36	Trinity Church	Church	No	Other-Tornado	Low	36-48 in	110 mph
37	Original Congregational Church	Church	No	Other-Tornado	Low	36-48 in	110 mph
38	Saint Mary's Church	Church	No	Other-Tornado	Low	36-48 in	110 mph
39	Police HQ	Police Station	No	Other-Tornado	Low	36-48 in	110 mph
40	Vogel Elem School	School	No	Other-Tornado	Low	36-48 in	110 mph
41	Roderick Elem School	School	No	No	Low	36-48 in	110 mph
42	King Philip Regional High School	School	No	Wind	Low	36-48 in	110 mph
43	Delaney Elem School	School	No	No	Low	36-48 in	110 mph

Map ID	NAME	TYPE	FEMA Flood	Locally Identified Hazard	Landslide	Snow	Wind 100 Year
44	Wrentham Senior Center	Senior Center	No	No	Low	36-48 in	110 mph
45	Roderick School Waste Water Treatment	Sewer Pump Station	No	No	Low	36-48 in	110 mph
46	South Street Sub Station	Power Substation	No	No	Low	36-48 in	110 mph
47	Washington Street Sub Station	Power Substation	No	No	Low	36-48 in	110 mph
48	Franklin Street Sub Station	Power Substation	No	Other-Tornado	Low	36-48 in	110 mph
49	Waste Water Treatment Plant	Waste Water Treatment	No	No	Low	36-48 in	110 mph
50	Water Pump Station #3	Water Pump Station	No	No	Low	36-48 in	110 mph
51	Water Pump Station #4	Water Pump Station	AE: 1% Annual Chance of Flooding, with BFE	Flooding	Low	36-48 in	110 mph
53	Bucks Hill Grant Water Storage Tank (750KG)	Water Storage Tank	No	No	Low	36-48 in	110 mph
54	Knuckup Hill Water Storage Tank (250KG)	Water Storage Tank	No	No	Low	36-48 in	110 mph
55	Knuckup Hill Water Storage Tank (1.1MG)	Water Storage Tank	No	No	Low	36-48 in	110 mph
56	Water Storage Tank (100KG)	Water Storage Tank	No	No	Low	36-48 in	110 mph
57	Water Storage Tank (.5 MG)	Water Storage Tank	No	No	Low	36-48 in	110 mph
58	Water Pump Station #5	Well	A: 1% Annual Chance of Flooding, no BFE	No	Low	36-48 in	110 mph
59	Well #5	Well	A: 1% Annual Chance of Flooding, no BFE	No	Low	36-48 in	110 mph
60	Well #4	Well	AE: 1% Annual Chance of Flooding, with BFE	Flooding	Low	36-48 in	110 mph
61	Well #6	Well	No	No	Low	36-48 in	110 mph
62	Well #3	Well	No	No	Low	36-48 in	110 mph
63	Well #2	Well	No	Flooding	Low	36-48 in	110 mph
64	Private Cell Tower	Communication Tower	No	Brush Fire	Low	36-48 in	110 mph
65	Fire Police Receiver	Communication Tower	No	No	Low	36-48 in	110 mph
66	Police and Fire Cell Tower	Communications Tower	No	Other-Tornado	Low	36-48 in	110 mph
67	Wrentham Developmental Center	State-Owned Facility	No	No	Low	36-48 in	110 mph
68	Maples Nursing Home WWTP	Waste Water Treatment	No	Other-Tornado	Low	36-48 in	110 mph
69	Hemingway WWTP	Waste Water Treatment Plant	No	No	Low	36-48 in	110 mph
70	Oak Hill WWTP	Waste Water Treatment Plant	No	No	Low	36-48 in	110 mph
71	Wrentham Outlets WWTP	Waste Water Treatment Plant	No	No	Low	36-48 in	110 mph
72	State School WWTP	Waste Water Treatment Plant	No	No	Low	36-48 in	110 mph
73	Wrentham Housing Authority	Senior Housing	No	Other-Tornado	Low	36-48 in	110 mph
74	Liberty Pines	Assisted Living	No	No	Low	36-48 in	110 mph
76	Original Congregation UCC	Communications Tower	No	Other-Tornado	Low	36-48 in	110 mph
77	Verizon Hub	Communications Hub	No	Other-Tornado	Low	36-48 in	110 mph

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D. VULNERABILITY ASSESSMENT

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities. A vulnerability assessment and estimation of damages was performed for hurricanes, earthquakes, and flooding. The methodology used for hurricanes and earthquakes was the HAZUS-MH software. The methodology for flooding was developed specifically to address the issue in many of the communities where flooding was not solely related to location within a floodplain.

Introduction to HAZUS-MH

HAZUS- MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The following overview of HAZUS-MH is taken from the FEMA website.

“HAZUS-MH is a nationally applicable standardized methodology and software program that contains models for estimating potential losses from earthquakes, floods, and hurricane winds. HAZUS-MH was developed by the Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences (NIBS). Loss estimates produced by HAZUS-MH are based on current scientific and engineering knowledge of the effects of hurricane winds, floods and earthquakes. Estimating losses is essential to decision-making at all levels of government, providing a basis for developing and evaluating mitigation plans and policies as well as emergency preparedness, response and recovery planning.

HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of hurricane winds, floods and earthquakes on populations.”²⁰

There are three modules included with the HAZUS-MH software: hurricane wind, flooding, and earthquakes. There are also three levels at which HAZUS-MH can be run. Level 1 uses national baseline data and is the quickest way to begin the risk assessment process. The analysis that follows was completed using Level 1 data. Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. While the databases include a wealth of information on the Town of Wrentham, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is “subject to a great deal of uncertainty.”

However, for the purposes of this plan, the analysis is useful. This plan is attempting to generally indicate the possible extent of damages due to certain types of natural disasters and to allow for a comparison between different types of disasters. Therefore, this analysis should be considered to be a starting point for understanding potential damages from the hazards.

²⁰ <http://www.fema.gov/plan/prevent/hazus/index.shtm>

1. ESTIMATED DAMAGES FROM HURRICANES

The HAZUS software was used to model potential damages to the community from a 100 year and 500 year hurricane event; storms that are 1% and 0.2% likely to happen in a given year, and roughly equivalent to a Category 2 and Category 4 hurricane. The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the Town, bringing the strongest winds and greatest damage potential.

Though there are no recorded instances of a hurricane equivalent to a 500 year storm passing through Massachusetts, this model was included in order to present a reasonable “worst case scenario” that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms.

Table 24 Estimated Damages from Hurricanes

	Category 2	Category 4
Building Characteristics		
Estimated total number of buildings	3,952	
Estimated total building replacement value (2010 \$)	\$1,576,000,000	
Building Damages		
# of buildings sustaining minor damage	200	813
# of buildings sustaining moderate damage	15	150
# of buildings sustaining severe damage	0	11
# of buildings destroyed	0	6
Population Needs		
# of households displaced	0	3
# of people seeking public shelter	0	0
Debris		
Building debris generated (tons)	8,471	21,749
Tree debris generated (tons)	1,599	3,760
# of truckloads to clear building debris (25 ton trucks)	23	104
Value of Damages		
Total property damage (buildings and content)	\$9,942,360	\$34,990,620
Total losses due to business interruption	\$ 279,370	\$1,857,810

2. ESTIMATED DAMAGES FROM EARTHQUAKES

The HAZUS earthquake module allows users to define an earthquake magnitude and model the potential damages caused by that earthquake as if its epicenter had been at the geographic center of the study area. For the purposes of this plan, two earthquakes were selected: magnitude 5.0 and a magnitude 7.0. Historically, major earthquakes are rare in New England, though a magnitude 5 event occurred in 1963.

Table 25 Estimated Damages from Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	3,000	
Estimated total building replacement value (2010 \$)	\$1,576,000,000	
Building Damages		
# of buildings sustaining slight damage	1,151	182
# of buildings sustaining moderate damage	594	989
# of buildings sustaining extensive damage	155	1,177
# of buildings completely damaged	38	1,588
Population Needs		
# of households displaced	71	1,524
# of people seeking public shelter	40	851
Utility Damages		
# Pipeline Breaks Potable Water	16	492
# Pipeline Breaks Waste Water	11	353
# Pipeline Breaks Natural Gas	13	101
Debris		
Building debris generated (tons)	400,000	300,000
# of truckloads to clear debris (@ 25 tons/truck)	1,520	12,000
Value of Damages (Millions of dollars)		
Total property damage	\$210,540,000	\$1,513,460,000
Total Building-Related Economic Losses	\$210,540,000	\$1,513,460,000

3. ESTIMATED DAMAGES FROM FLOODING

The HAZUS flooding module allows users model the potential damages caused by a 100 Year Flood event and a 500 Year Flood event.

Table 26 Estimated Damages from Flooding

	100 Year Flood	500 Year Flood
Building Characteristics		
Estimated total number of buildings	3,952	
Estimated total building replacement value (2010 \$)	\$1,576,000	
Building Damages		
# of buildings sustaining moderate damage	1	2
# of buildings sustaining extensive damage	5	4
# of buildings substantially damaged	0	0
Population Needs		
# of households displaced	22	27
# of people seeking public shelter	16	23
Value of Damages		
Total property damage	\$2,210,000	\$2,830,000
Total losses due to business interruption	\$2,210,000	\$2,840,000

VII. HAZARD MITIGATION GOALS

The Wrentham Local Hazard Mitigation Planning Team reviewed and discussed the goals from the 2010 Hazard Mitigation Plan for the Town of Wrentham. All of the goals are considered critical for the Town and they are not listed in order of importance.

- GOAL 1:** Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.
- GOAL 2:** Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
- GOAL 3:** Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
- GOAL 4:** Prevent and reduce the damage to public infrastructure resulting from all hazards.
- GOAL 5:** Encourage the business community, major institutions and non-profits to work with the Town to develop, review and implement the hazard mitigation plan.
- GOAL 6:** Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.
- GOAL 7:** Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.
- GOAL 8:** Take maximum advantage of resources from FEMA and MEMA to educate Town staff and the public about hazard mitigation.
- GOAL 9:** Consider the impacts of climate change, both adaptation and mitigation. Incorporate the Municipal Vulnerability Preparedness workshop results in hazard mitigation and all municipal planning.

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VIII. EXISTING MITIGATION MEASURES

The existing protections in the Town of Wrentham are a combination of zoning, land use, and environmental regulations, infrastructure maintenance and drainage infrastructure improvement projects. Infrastructure maintenance generally addresses localized drainage clogging problems, while large scale capacity problems may require pipe replacement or invert elevation modifications. These more expensive projects are subject to the capital budget process and lack of funding is one of the biggest obstacles to completion of some of these.

The Town's existing mitigation measures are listed by hazard type here and are summarized in Table 27 below.

A. FLOOD-RELATED HAZARDS EXISTING MITIGATION

Wrentham employs a number of practices to help minimize potential flooding and impacts from flooding, and to maintain existing drainage infrastructure. Existing town-wide mitigation measures include the following:

- Participation in the National Flood Insurance Program (NFIP) – Wrentham participates in the NFIP with 20 policies in force as of the June 19, 2018, 2016. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at <http://www.fema.gov/business/nfip/statistics/pcstat.shtm>

The following information is provided for the Town of Wrentham:

Flood insurance policies in force	20
Coverage amount of flood insurance policies	\$5,603,000
Written Premium in Force	\$312,678
Total losses (all losses submitted regardless of the status)	3
Closed losses (Losses that have been paid)	1
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	2
Total payments (Total amount paid on losses)	\$ 7,000,000

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

- *Street Sweeping* – The Wrentham Department of Public Works conducts seasonal street sweeping. All streets are swept at least once per year or as needed in select areas of town. Street sweeping begins as soon as possible each spring.
- *Catch Basin Cleaning* – All catch basins are cleaned out once a year. Problem areas are cleaned more frequently.

- *Roadway Treatments* – The town uses a mixture of salt and liquid calcium. Roads are treated when needed for winter storms.
- *Enforcement of the State Building Code* – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing and snow loads.
- *Infrastructure Improvements* – Within the past 5-10 years, the town upgraded much of the town’s infrastructure such as culverts, bridges, roads, and drainage systems.
- *Regulations and By-Laws* – The town has adopted many regulations and bylaws that serve to reduce flooding, preserve open space, and protect the community from natural hazards. Copies of all of pertinent regulations are included in Appendix F at the back of this plan.
- *NPDES Plan*: It continues to implement its NPDES Phase II stormwater program which includes public education programs. One example is a public service announcement created by the Town that now runs on the Town cable access channel and on the Charles River Watershed Association's website (<http://www.crwa.org/education/wrentham-swmi>). The Wrentham Recycling Committee subsidizes rain barrels for interested citizens to reduce stormwater. Further, the Town also belongs to a regional stormwater coalition to improve not only its education and outreach programs and collaborate with other municipalities on MS4 compliance related to all size minimum control measures.
- *Stormwater* –Wrentham has stormwater regulations enforced by the Board of Health, and the Massachusetts Stormwater Policy is applied to developments within the jurisdiction of the Conservation Commission.

B. DAM FAILURE EXISTING MITIGATION

- *DCR dam safety regulations* – All dams are subject to the Division of Conservation and Recreation’s dam safety regulations.
- *Permits required for construction* – State law requires a permit for the construction of any dam.
- *The Comprehensive Emergency Management Plan (CEMP)* – The current CEMP addresses dam safety. However, The Steering Committee and priority actions related to Wrentham’s MVP workshop indicate that the Town requires and updated Comprehensive Emergency Management Plan and a Local Emergency Planning Committee comprised of a diverse set of departments.

C. WIND-RELATED HAZARDS EXISTING MITIGATION

- *Massachusetts State Building Code* – The town enforces the Massachusetts State Building Code whose provisions are generally adequate enough to mitigate most wind damage. The code’s provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence. If a tornado were to occur, the potential for severe damages would be extremely high.
- *Tree Trimming* – The Wrentham Tree Warden and local electric companies, NStar and National Grid, conduct regular tree trimming. The town responds to downed tree limbs caused by winds, lightning strike reports and other weather related incidents. The town owns and utilizes a chipper in this service.

D. WINTER-RELATED HAZARDS EXISTING MITIGATION

- *Roadway Treatments* – The town uses a mixture salt and liquid calcium to manage roadways during storms.
- *Snow Removal & Disposal* – The town Highway Department performs regular snow plow operations during winter storms. The town does not do any snow disposal except for removing snow at municipal building.

E. FIRE-RELATED HAZARDS EXISTING MITIGATION

- *Permits Required for Outdoor Burning* - The Fire Department requires a written permit for outdoor burning. The property-owner must come into the Fire Station and fill out a form.
- *Fire Hydrant Regulations* - The Wrentham DPW Water regulates that fire hydrants be installed at all new developments at the expense of the developer.
- *Subdivision Review* - The Fire Department is involved in reviewing subdivision plans from conceptual design through occupancy to ensure that there is adequate access for fire trucks and an adequate water supply.
- *Portable Water Pumps* - Rivers and ponds in town are available to be tapped into for water supply if necessary.
- *All-Terrain Vehicles* - The town maintains three all-terrain vehicles for fighting forest fires. These vehicles provide access to remote areas that otherwise would not be reachable.

F. EARTHQUAKE HAZARDS EXISTING MITIGATION

- *Massachusetts State Building Code* – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is “to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake”. This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be “prudent and economically justified” for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.
- *Comprehensive Emergency Management Plan* –The town has an evacuation plan as specified in its Comprehensive Emergency Management Plan (CEMP).

G. LANDSLIDE HAZARDS EXISTING MITIGATION FOR

- The subdivision regulations have maximum slope requirements for new roads to minimize landslide risk.

H. MULTI-HAZARD EXISTING MITIGATION

- Massachusetts State Building Code – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is “to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake”. This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be “prudent and economically justified” for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.
- Section 1612.2.5 sets up seismic hazard exposure groups and assigns all buildings to one of these groups according to a Table 1612.2.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.
- Multi-Department Review of Developments – Multiple departments, such as the Town Administrator, Planning, Zoning, Health, Highway, Fire, Police, and Conservation, review all subdivision and site plans prior to approval.
- Comprehensive Emergency Management Plan (CEMP) – Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, dam failures and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to many of the hazards discussed in this plan. The CEMP is available online through secure access for town personnel.

I. COMPILATION OF EXISTING MITIGATION

The following table summarizes the many existing natural hazard mitigation measures already in place in Wrentham. Because of the number of entities, public and private, involved in natural hazard mitigation, it is likely that this list is a starting point for a more comprehensive inventory of all measures.

Table 27 Existing Natural Hazard Mitigation Measures in Wrentham.

Type of Existing Protection	Description	Effectiveness /Enforcement	Changes Needed
MULTIPLE HAZARD MITIGATION			
Comprehensive Emergency Management Plan (CEMP)	Addresses mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies.	Emphasis is on emergency response.	None.
Massachusetts State Building Code	Regulates wind loads, earthquake resistant design, flood-proofing and snow loads.	Most effective for new construction.	None.
Multi-Department Review of Developments	Multiple department within town review site plans before development.	Most effective for new construction.	None.
Portable Water Pumps	Rivers and ponds in town are available to be tapped into for water supply if necessary.	Effective.	None.
FEMA Tankers	FEMA has 8-12 tankers that can be deployed anywhere in the US within 72 hours.	Effective for most situations.	None.
FLOOD RELATED HAZARDS			
Participation in the National Flood Insurance Program (NFIP)	The town participates in the National Flood Insurance Program and has adopted the effective FIRM maps. The town actively enforces the floodplain regulations.	There are 7 policies in force.	Encourage all eligible homeowners to obtain insurance.
Street Sweeping	Every street gets swept once a year or as needed. High traffic areas are swept more regularly.	Effective.	None.
Catch Basin Cleaning	All catch basins are cleaned out once a year.	Effective.	None.
Enforcement of the State Building Code	Regulates for wind loads, earthquake resistant design, flood-proofing and snow loads.	Most effective for new construction.	None.

Type of Existing Protection	Description	Effectiveness /Enforcement	Changes Needed
Massachusetts Stormwater Regulations	This policy is applied to developments within the jurisdiction of the Conservation Commission.	Effective.	None.
Infrastructure Improvements	Infrastructure improvements include culverts, bridges, roads, and drainage systems.	Partially Effective	Funding, Equipment, Resources
Regulations, By-Laws, and Plans	Includes: Stormwater Management and Erosion Control Handbook, Subdivision controls, Floodplain Requirements, Water Resource Districts, NPDES	Effective.	None.
DCR Dam Safety Regulations	The state has enacted dam safety regulations mandating inspections and emergency action plans.	Enforcement is an issue.	None.
State permits required for dam construction	State law requires a permit for the construction of any dam.	Most effective for new construction.	Improvements needed to the statewide.
Comprehensive Emergency Management Plan (CEMP)	The CEMP addresses dam safety issues.	Emphasis is on emergency response.	Plan needs to be updated.
BRUSH FIRE RELATED HAZARDS			
Permits required for outdoor burning.	The Fire Department requires a written permit for outdoor burning. The permit must be obtained from the Fire Dept.	Effective.	None.
Fire Hydrant Regulations	The Wrentham Water Department regulates that fire hydrants be installed at all new developments at the expense of the developer.	Effective.	None.
Subdivision Review	The Fire Department is involved in reviewing all subdivision plans.	Effective.	None.
Comprehensive Emergency Management Plan (CEMP)	Addresses mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies.	Emphasis is on emergency response.	None.

Type of Existing Protection	Description	Effectiveness /Enforcement	Changes Needed
Portable Water Pumps	Rivers and ponds in town are available to be tapped into for water supply if necessary.	Effective.	None.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	The Town enforces the Massachusetts State Building Code.	Effective for most situations.	None.
Comprehensive Emergency Management Plan (CEMP)	Addresses mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies.	Emphasis is on emergency response.	None.
WIND HAZARDS			
Massachusetts State Building Code	The town enforces the Massachusetts State Building Code.	Most effective for new construction.	None.
Tree-Trimming	The Tree Warden and local electric company conduct regular tree trimming.	Effective for most situations.	None.
WINTER-RELATED HAZARDS			
Roadway Treatments	The Highway Department conducts salting and plowing services throughout the town during winter storms.	Effective for most situations.	None.
Snow Removal & Disposal	The town conducts regular winter storm operations.	Effective for most situations.	None.

J. MITIGATION CAPABILITIES AND LOCAL CAPACITY FOR IMPLEMENTATION

Under the Massachusetts system of “Home Rule,” the Town of Wrentham is authorized to adopt and from time to time amend a number of local bylaws and regulations that support the town’s capabilities to mitigate natural hazards. These include Zoning Bylaws, Subdivision and Site Plan Review Regulations, Wetlands Bylaws, Health Regulations, Public Works regulations, Stormwater Bylaws and local enforcement of the State Building Code. Local Bylaws may be amended each year at the annual Town Meeting to improve the town’s capabilities, and changes to most regulations simply require a public hearing and a vote of the authorized board or commission, such as the Planning Board or Conservation Commission

The Town of Wrentham has recognized several existing mitigation measures that require implementation or improvements, and has the capacity within its local boards and departments to address these. The Wrentham Department of Public Works will address the needs for catch basin cleaning, repairs and upgrades to drainage infrastructure. The town’s Planning Board will address the updates to the Master Plan and implementation of the Zoning Ordinance, Floodplain District, and Subdivision Rules and Regulations. The Conservation Commission will oversee implementation of the Wetlands Bylaw and the Open Space Plan. The Steering Committee seeks to have multiple departments such as Department of Public Works, Planning Board, Board of Health and Conservation Commission coordinate implementation and enforcement of the Stormwater Bylaw.

IX. MITIGATION MEASURES FROM THE 2010 PLAN

A. IMPLEMENTATION PROGRESS ON THE PREVIOUS PLAN

At a meeting of the Wrentham Hazard Mitigation Steering Committee, Town staff reviewed the mitigation measures identified in the 2010 Wrentham Hazard Mitigation Plan and determined whether each measure had been implemented or deferred. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into this Hazard Mitigation Plan 2018 Update. The decision on whether to delete or retain a particular measure was based on the committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the Town to take action on the measure. Table 28 summarizes the status of mitigation measures from the 2010 plan and whether the Local Steering Committee suggested continuing these measures as part of the 2018 update.

Wrentham has made considerable progress on implementing mitigation measures identified in the 2010 Hazard Mitigation Plan. Some examples include upgrading and replacing the stormwater catch basin at David Brown Way to mitigate flooding, drainage upgrades and reconstruction, culvert enlargement and stream restoration at Franklin Street to mitigate flooding, advanced their GIS program for multiple hazards, and passed the Community Preservation Act which enables funding for land protection. Moving forward into the next five year plan implementation period there will be many more opportunities to incorporate hazard mitigation into the Town's decision making processes.

The challenges the Town faces in implementing these measures are primarily due to limited funding and available staff time. This plan should help the Town prioritize the best use of its limited resources for enhanced mitigation of natural hazards.

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Table 28 Hazard Mitigation Measures from the 2010 Natural Hazard Mitigation Plan

Mitigation Measure	Description	Priority in 2010 Plan	Current Status	Include in 2018 Plan?
FLOODING				
Green Street-Roadway Redesign/Elevation		High	Still a problem, not completed	Yes
Green Street- Hydro Analysis/ Drainage Study		High	Still a problem, not completed	Yes
Green Street- Drainage Reconstruction		High	Still a problem, not completed	Yes
Taunton Street-Drainage Reconstruction		High	Transportation funding did not go through, not completed	Yes
Taunton Street-Retention Basin		High	Transportation funding did not go through, not completed	Yes
Taunton Street- Elevate Utilities		High	Transportation funding did not go through, not completed	Yes
Protection of Open Space	Pass the Community Preservation Act permitted by Massachusetts General Law Chapter 44B, Sections 3 to 7, to fund the acquisition of open space, especially in the greenway.	NFIP	Completed	No
	Acquire additional conservation land to develop conservation areas centered around the Town's natural resource areas	NFIP	Ongoing	Yes
	Continue open space purchases and negotiate conservation restrictions and easements	NFIP	Ongoing	Yes
	Prioritize land acquisition or protection based on groundwater recharge standards.	NFIP	Updated Open Space and Recreation Plan 2015	
	Designate clearly significant parcels as permanently protected open space.	NFIP	Completed	Yes
	Continue to develop criteria to prioritize lands for protection and find ways to acquire those lands or the development rights.	NFIP	Updated Open Space and Recreation Plan 2015	No

Mitigation Measure	Description	Priority in 2010 Plan	Current Status	Include in 2018 Plan?
Open Space Protection	Develop partnerships with private landowners or pursue easements to protect sensitive open space or recreation lands where land acquisition is not an option.	NFIP	Ongoing	Yes
	Promote compact development to reduce sprawl.	NFIP	Ongoing	Yes
	Encourage/promote the incorporation of open space into new development plans (especially by the use of the open space residential subdivision (OSRD) and the Adult Retirement Community Planned Unit Development (ARCPUD), and use these tools to establish “eco-corridors” or greenbelts where appropriate	NFIP	OSRD implemented	Yes
	Encourage donations of open space by landowners.	NFIP	Ongoing	Yes
	Establish an Open Space and Recreation Plan Implementation Committee to coordinate among Town Boards and Commissions, and contact land owners	NFIP	Open Space Committee established.	No
	Increase public awareness of the value of open space, and encourage citizen input.	NFIP	Completed with Open Space and Recreation Plan. Ongoing	Yes
	Preserve historically significant buildings and sites.	NFIP	Not Completed	Yes
Revisions to Development Regulations	Increase the current Stormwater Management Regulations for pipe size to accommodate more frequent larger storms (current regulations twenty five (25) year storm). The State recognizes that larger storm events have been occurring more frequently and subsequent building standards should reflect the higher frequency of larger storms.	Medium	Stormwater managed by Board of Health, only for site design. Need a stormwater bylaw.	Yes
	Modify the Water Resource Protection District to include all Zone II areas within the town, including those areas that contribute to the water supply of surrounding communities.	Medium	Not Completed	Yes
	Develop a bylaw that protects a 35-foot “no disturbance” buffer around all wetlands that prohibits grading, building and all other construction activities. Consider exempting repairs to existing structures to ensure that this action is not cost-prohibitive to owners (current limits are 25-foot).	Medium	Not Completed	Yes
	Amend zoning bylaws to exclude wetlands from the density calculations.	Medium	Not Completed	Yes
	Expand the Water Resource Protection District to protect water flowing into surrounding communities.	Medium	Not Completed	Yes

Mitigation Measure	Description	Priority in 2010 Plan	Current Status	Include in 2018 Plan?
Revisions to Development Regulations	Continue to address the on-going issue of non-point source pollution to protect the drinking water supply.	Medium	Ongoing	Yes
	Require aggressive and legally-binding operation and maintenance plans and reporting, with enforcement mechanisms, for private drainage facilities.	Medium	Not Completed	Yes
	Include construction and post-construction slope stabilization requirements in the site plan and subdivision regulations.	Medium	Not Completed	Yes
	Require the use of the new LID guidance manual for all developments in town, and not just those within the Aquifer Protection District.	Medium	Not Completed	Yes
	Expand the requirements of the state stormwater policy to not just locations within Conservation Commission jurisdiction, but to all developments in the town.	Medium	Not Completed	Yes
David Brown Way	Upgrade/Replace Stormwater Catch Basin. Adjust Roadway Grade	Medium	Completed	No
Franklin Street	Stream Restoration, Enlarge Culvert, Drainage Reconstruction	Medium	No longer an issue.	No
Franklin St./Ray's Dry Cleaners	Drainage Upgrades	Low	No longer an issue.	No
Burnt Swamp Road	Hydro Analysis	Low	Emergency repairs completed only.	Yes
Hancock Street	Culvert Enlargement	Low	Not Completed, change to high priority.	Yes
BRUSH FIRE				
Backyard Setback Requirements for Fire Protection		Medium	Ongoing	Yes
Public Education on Brush Fire Prevention		Medium	Ongoing	Yes
MULTIPLE HAZARDS				
Acquire GIS & Mapping Technology		High	In Progress. Need to include stormwater and drinking water utilities and emergency management. Change to high priority.	Yes

Mitigation Measure	Description	Priority in 2010 Plan	Current Status	Include in 2018 Plan?
Inter-municipal Communication		Medium	In Progress. Add intra-municipal communications.	Yes
Water-Related Public Education		Medium	Ongoing	Yes
Water Main & Hydrant Improvements,	Installations and Extensions	Medium	Not Completed.	Yes
Communications for Emergency Operations-	Upgrade to Wireless	Medium	Completed, but additional measures needed. Change to high priority.	Yes
Thurston Street Well #4 Aquifer Protection		Low	No longer an issue.	No
Municipal Facilities Upgrades-	Renovate/Construct New DPW	Low	Not Complete. Change to high priority.	Yes
Municipal Facilities Upgrades-	Renovate Fire Station #2	Low	Not Complete.	Yes

X. HAZARD MITIGATION STRATEGY

A. WHAT IS HAZARD MITIGATION?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, education programs, infrastructure projects and other activities. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The three links below provide additional information on these programs.

<http://www.fema.gov/government/grant/hmgp/index.shtm>

<http://www.fema.gov/government/grant/pdm/index.shtm>

<http://www.fema.gov/government/grant/fma/index.shtm>

Hazard Mitigation Measures can generally be sorted into the following groups:

- **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
 - **Property Protection:** Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.
 - **Public Education & Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
 - **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
 - **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.
 - **Emergency Services Protection:** Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, and protection of emergency response infrastructure.
- (Source: FEMA Local Multi-Hazard Mitigation Planning Guidance)

B. IDENTIFICATION OF POTENTIAL MITIGATION MEASURES

During the local hazard team meetings, officials in Wrentham determined possible mitigation measures for the various natural hazards that have impacted or could impact the town. In addition, MAPC solicited suggestions for mitigation measures when it collected hazard information from town officials and from other town plans and studies. MAPC compiled all suggested potential mitigation measures in matrix below. The summary table is then followed by series of considerations that were factored into determining mitigation measures. These include: regional and inter-community issues, regional partners and facilities, and new development and infrastructure. Following those considerations, the Hazard Mitigation Strategy chapter of the plan then provides an explanation of the prioritization process of the potential mitigation measures to be included in the updated mitigation plan, as well as a prioritized matrix of the measures.

1. INTRODUCTION TO POTENTIAL MITIGATION MEASURES

Table 30 lists the mitigation actions that the Local Steering Committee identified as priorities to complete in the next five years. Below is a description of the categories in Table 29.

Description of the Mitigation Measure – The description of each mitigation measure is brief and cost information is given only if cost data were already available from the community. The cost data represent a point in time and would need to be adjusted for inflation and for any changes or refinements in the design of a particular mitigation measure.

Priority – As described above and summarized in Table 29, the designation of high, medium, or low priority was done considering potential benefits and estimated project costs, as well as other factors in the STAPLEE analysis.

Implementation Responsibility – The designation of implementation responsibility was done based on a general knowledge of what each municipal department is responsible for. It is likely that most mitigation measures will require that several departments work together and assigning staff is the sole responsibility of the governing body of each community.

Time Frame – The time frame was based on a combination of the priority for that measure, the complexity of the measure and whether or not the measure is conceptual, in design, or already designed and awaiting funding. Because the time frame for this plan is five years, the timing for all mitigation measures has been kept within this framework. The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

Potential Funding Sources – This column attempts to identify the most likely sources of funding for a specific measure. The information on potential funding sources in this table is preliminary and varies depending on a number of factors. These factors include whether or not a mitigation measure has been studied, evaluated or designed, or if it is still in the conceptual stages. MEMA and DCR assisted MAPC in reviewing the potential eligibility for hazard mitigation funding. Each grant program and agency has specific eligibility requirements that would need to be taken into consideration. In most instances, the measure will require a number of different funding sources. Identification of a potential funding source in this table does not guarantee that a

project will be eligible for, or selected for funding. Upon adoption of this plan, the local team responsible for its implementation should begin to explore the funding sources in more detail.

Additional information on funding sources – The best way to determine eligibility for a particular funding source is to review the project with a staff person at the funding agency. The following websites provide an overview of programs and funding sources.

Army Corps of Engineers (ACOE) – The website for the North Atlantic district office is <http://www.nae.usace.army.mil/>. The ACOE provides assistance in a number of types of projects including shoreline/streambank protection, flood damage reduction, flood plain management services and planning services.

Massachusetts Emergency Management Agency (MEMA) – The grants page <http://www.mass.gov/dem/programs/mitigate/grants.htm> has a useful table that compares eligible projects for the Hazard Mitigation Grant Program and the Flood Mitigation Assistance Program.

Abbreviations Used in Table 29

FEMA Mitigation Grants includes:

FMA = Flood Mitigation Assistance Program.

HMGP = Hazard Mitigation Grant Program.

PDM = Pre-Disaster Mitigation Program

TOW= Town of Wrentham

ACOE = Army Corps of Engineers.

DHS/EOPS = Department of Homeland Security/Emergency Operations

DEP (SRF) = Department of Environmental Protection (State Revolving Fund)

USDA = United States Department of Agriculture

Mass DOT = Massachusetts Department of Transportation

DCR = MA Department of Conservation and Recreation

DOER=MA Division of Ecological Restoration

EEA= MA Executive Office of Energy and Environmental Affairs

MVP=Municipal Vulnerability Preparedness Program Action Grant

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Table 29 Potential Mitigation Measures for a Hazard Mitigation Strategy

Hazard Area	Mitigation Measure	Priority 2018	Priority 2010	Lead Implementation	Time Frame	Estimated Cost Range	Potential Funding Sources
Brush Fire Mitigation Measures							
Backyard Setback Requirements for Fire Protection		Low	Medium	TOW, Fire Department			TOW, MAPC, USDA
Public Education on Brush Fire Prevention		Low	Medium	TOW, Fire Department			TOW
Drought Hazard Mitigation Measures							
Evaluate water rate tiers. Investigate seasonal rates to discourage outdoor watering.		Medium	N/A	Town Administrator and Water and Sewer Commissioners	2019-2020	<\$10,000	TOW
Earthquakes/Geologic Hazard Mitigation Measures							
Conduct feasibility study on how to make town buildings and elementary school earthquake resistant.		Low	N/A	Building Department	2022	\$40,000-\$50,000	
EXTREME TEMPERATURES							
Evaluate landscape site design standards for parking lots to increase tree canopy.		Medium	N/A	Planning Department	2020	<\$10,000	TOW
Evaluate cooling and warming centers locations and opportunities for back-up electricity generation.		High	N/A	Emergency Management	2018-2020	\$35,000	TOW, EEA
WIND-RELATED HAZARDS (TORNADOS, HURRICANES, THUNDERSTORMS)							
Become Tree City USA.		High	N/A	Planning Department	2019-2020	<\$10,000	TOW
Explore underground utilities regulations for new development and subdivision regulations.		Medium	N/A	Planning Department	2019	<\$10,000	TOW
WINTER STORMS							
Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.		Medium	N/A	Building Department	2019	\$30,000-\$40,000	TOW
FLOODING AND DAM RELATED HAZARDS							
Complete a feasibility study to upgrade, renovate, or move New DPW. Needs assessment first then site assessment.		High	Low	DPW	2018-2021	\$100,000-\$200,000	TOW
Create and implement a stormwater bylaw.		High	N/A	DPW, Planning Board, Conservation, Board of Health	2018-2019	<\$10,000	MAPC, TOW
Eagle Dam restoration or removal.		High	N/A	DPW		>\$400-\$500k	DOER, TOW

Hazard Area	Mitigation Measure	Priority 2018	Priority 2010	Lead Implementation	Time Frame	Estimated Cost Range	Potential Funding Sources
Burnt Swamp Road-Drainage Improvements, upgrade to clear span. Hancock Street Culvert Enlargement.		Low	Low	DPW	2021	>\$100,000	PDM, ACOE, CMRP, DCR, DEP, TOW
Taunton Street-Drainage Improvements.	Drainage reconstruction, retention basin, and utility elevation.	Low	High	DPW	2022	\$4 million	PDM, ACOE, CMRP, DCR, DEP, TOW
Implement the updated Open Space and Recreation Plan.	Protect open space with flood management as a priority.	High	NFIP	Conservation Commission, Community Preservation Committee	2018-2023	>\$100,000	ACOE, DCR, DEP, EEA, TOW
Revisions to Development Regulations	Modify the Water Resource Protection District to include all Zone II areas within the town, including those areas that contribute to the water supply of surrounding communities.	High	NFIP	Planning Department, MAPC, Consultant	2018-2023	<\$10k	MAPC, TOW
	Develop a bylaw that protects a 35-foot “no disturbance” buffer around all wetlands that prohibits grading, building and all other construction activities. Consider exempting repairs to existing structures to ensure that this action is not cost-prohibitive to owners (current limits are 25-foot).	High	NFIP	Planning, Conservation, MAPC, Consultant	2018-2023	<\$10k	MAPC, TOW
	Amend zoning bylaws to exclude wetlands from the density calculations.	High	NFIP	Planning, Conservation	2018-2023	<\$10k	MAPC, TOW
	Expand the Water Resource Protection District to protect water flowing into surrounding communities.	High	NFIP	Planning, DPW, Conservation, Consultant	2018-2023	<\$10k	MAPC, TOW
	Continue to address the on-going issue of non-point source pollution to protect the drinking water supply.	High	NFIP	TOW, MAPC, Consultant	2018-2023	<\$10k	MAPC, TOW
	Require the use of the new LID guidance manual for all developments in town, and not just those within the Aquifer Protection District.	High	NFIP	Planning Department, Conservation Commission	2018-2023	<\$10k	MAPC, TOW
	Expand the requirements of the state stormwater policy to not just locations within Conservation Commission jurisdiction, but to all developments in the town.	High	NFIP	Planning Department, Conservation Commission, DPW	2018-2023	<\$10k	MAPC, TOW
Promote compact development to reduce sprawl.	Review land use controls to determine features that encourage sprawl.	Medium	NFIP	Planning Department, MAPC, Consultant	2018-2023	NA	MAPC, TOW
	Formulate and adopt revisions that encourage compact development	Medium	NFIP	Planning Department, MAPC, Consultant	2018-2023		
	Target infrastructure improvements to promote compact development.	Medium	NFIP	Planning Department, MAPC, Consultant	2018-2023		

Hazard Area	Mitigation Measure	Priority 2018	Priority 2010	Lead Implementation	Time Frame	Estimated Cost Range	Potential Funding Sources
Promote compact development to reduce sprawl.	Identify key parcels of land which are most important for protecting natural resources and wildlife corridors.	Medium	NFIP	Conservation Commission, Community Preservation Committee	2018-2023	<\$10,000	TOW
	Identify key parcels of land which are most important for protecting historic landscapes and/or community character.	Medium	NFIP	Community Preservation Committee	2018-2023	<\$10,000	TOW
	Develop/implement a system of prioritizing parcels for potential acquisition.	Medium	NFIP	Conservation Commission, Community Preservation Committee	2018-2023	<\$10,000	TOW
	Encourage/promote the incorporation of open space into new development plans (especially by the use of the open space residential subdivision (OSRD) and the Adult Retirement Community Planned Unit Development (ARCPUD), and use these tools to establish "eco-corridors" or greenbelts where appropriate.	Medium	NFIP	Planning Department, Conservation Commission	2018-2023	<\$10,000	TOW
	Encourage donations of open space by landowners.	Medium	NFIP	Conservation Commission, Community Preservation Committee	2018-2023	<\$10,000	TOW
	Establish an Open Space and Recreation Plan Implementation Committee to coordinate among Town Boards and Commissions, and contact land owners.	Medium	NFIP	Town Administrator	2018-2023	<\$10,000	TOW
	Increase public awareness of the value of open space, and encourage citizen input.	Medium	NFIP	Conservation Commission, Community Preservation Committee	2018-2023	<\$10,000	TOW
MULTIPLE HAZARDS							
Upgrade GIS & Mapping Technology.	Incorporate urban-based stormwater systems into GIS. Need to map rest of community for stormwater infrastructure (i.e., not just the minimum requirement for MS4), water utility infrastructure, and emergency management.	High	High	DPW, Assessor, Emergency Management	2018-2020	\$50,000	TOW
Inter-municipal and Intra-municipal Communication.		Medium	Medium	Town Administrator, Fire Department, Police Department, Emergency Management	2018-2023	<\$10,000	TOW, MAPC
Water-Related Public Education.		Medium	Medium	DPW	2018-2023	<\$10,000	TOW
Water Main & Hydrant Improvements, Installations and Extensions.		Low	Medium	Fire Department, DPW	2022-2023	\$20,000-\$500,00	PDM, MHD, EOT, TOW

Hazard Area	Mitigation Measure	Priority 2018	Priority 2010	Lead Implementation	Time Frame	Estimated Cost Range	Potential Funding Sources
Upgrade communications for Emergency Operations.		Medium	Medium	Police and Fire Departments, Emergency Management	2019	>\$100,000	HMS, TOW
Municipal Facilities Upgrades- Renovate Fire Station #2 so it is a police/fire.		Medium	Low	Town Administrator, Fire Department	2022-2023	>\$100,000	TOW
CLIMATE CHANGE HAZARDS							
Implement Municipal Vulnerability Preparedness Plan		High	N/A	Emergency Management	2018-2023	>\$100,000	EEA

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C. PROCESS FOR SETTING PRIORITIES FOR MITIGATION MEASURES

The last step in developing the Town’s mitigation strategy is to assign a level of priority to each mitigation measure so as to guide the focus of the Town’s limited resources towards those actions with the greatest potential benefit. At this stage in the process, the Local Hazard Mitigation Planning Team had limited access to detailed analyses of the cost and benefits of any given mitigation measure, so prioritization is based on the local team members’ understanding of existing and potential hazard impacts and an approximate sense of the costs associated with pursuing any given mitigation measure.

Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events, the extent of the area impacted, and the relation of a given mitigation measure to the Town’s goals. In addition, the local Hazard Mitigation Planning Team also took into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether any environmental constraints existed, and whether the Town would be able to justify the costs relative to the anticipated benefits.

Table 30 demonstrates the prioritization of the Town’s City’s potential hazard mitigation measures. For each mitigation measure, the geographic extent of the potential benefiting area is identified as is an estimate of the overall benefit and cost of the measures. The benefits, costs, and overall priority were evaluated in terms of the following parameters:

Estimated Benefits

High	Action will result in a significant reduction of hazard risk to people and/or property from a hazard event
Medium	Action will likely result in a moderate reduction of hazard risk to people and/or property from a hazard event
Low	Action will result in a low reduction of hazard risk to people and/or property from a hazard event

Estimated Costs

High	Estimated costs greater than \$100,000
Medium	Estimated costs between \$10,000 to \$100,000
Low	Estimated costs less than \$10,000 and/or staff time

Priority

High	Action very likely to have political and public support and necessary maintenance can occur following the project, and the costs seem reasonable considering likely benefits from the measure
Medium	Action may have political and public support and necessary maintenance has potential to occur following the project
Low	Not clear if action has political and public support and not certain that necessary maintenance can occur following the project

Table 30 Prioritization of 2018 Hazard Mitigation Measures.

Hazard Area	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
Brush Fire Mitigation Measures				
Backyard Setback Requirements for Fire Protection	Town wide	Low	Low	Low
Public Education on Brush Fire Prevention	Town wide	Low	Low	Low
Drought Hazard Mitigation Measures				
Evaluate water rate tiers. Investigate seasonal rates to discourage outdoor watering.	Town wide	Medium	Low	Medium
Earthquakes/Geologic Hazard Mitigation Measures				
Conduct feasibility study on how to make town buildings and elementary school earthquake resistant.	Town wide	Medium	Medium	Medium
EXTREME TEMPERATURES				
Evaluate landscape site design standards for parking lots to increase tree canopy.	Commercial and Industrial Areas	High	Low	Medium
Evaluate cooling and warming centers locations and opportunities for back-up electricity generation.	Town wide	High	Medium	High
WIND-RELATED HAZARDS (TORNADOS, HURRICANES, THUNDERSTORMS)				
Become Tree City USA.	Town wide	Low	Low	Medium
Explore underground utilities regulations for new development and subdivision regulations.	Town wide	Medium	Low	Medium
WINTER STORMS				
Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.	Town wide	Low	Medium	Medium
FLOODING AND DAM RELATED HAZARDS				
Complete a feasibility study to upgrade, renovate, or move New DPW.	Public Works Complex	Medium	High	High
Create and implement a stormwater bylaw.	Town wide	High	Low	Medium
Eagle Dam restoration or removal.	Eagle Brook	High	High	High
Burnt Swamp Road-Drainage Improvements, upgrade to clear span. Hancock Street Culvert Enlargement.	Burnt Swamp	High	High	Medium
Taunton Street-Drainage Improvements.	Taunton Street	High	High	Medium

WRENTHAM HAZARD MITIGATION PLAN 2018 UPDATE

Hazard Area	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
Implement the updated Open Space and Recreation Plan.	Town wide	High	High	High
Revisions to Development Regulations	Town wide	Medium	Low	Medium
Promote compact development to reduce sprawl.	Town wide	Medium	Low	Medium/Low
MULTIPLE HAZARDS				
Upgrade GIS & Mapping Technology.	Town wide	Low	Medium	Medium
Inter-municipal and Intra-municipal Communication.	Regional	Medium	Low	Medium
Water-Related Public Education.	Town wide	Low	Low	Low
Water Main & Hydrant Improvements, Installations and Extensions.	Town wide	Low	Medium/High	Medium
Upgrade communications for Emergency Operations.	Town wide	Medium	High	Medium
Municipal Facilities Upgrades- Renovate Fire Station #2 so it is a police/fire.	west Wrentham	Medium	High	Medium
CLIMATE CHANGE HAZARDS				
Implement Municipal Vulnerability Preparedness Plan	Town wide	High	High	High

D. NEW DEVELOPMENT AND INFRASTRUCTURE

As part of the process of developing recommendations for new mitigation measures for this plan update, the Town considered the issues related to new development, redevelopment, and infrastructure needs in order to limit future risks. Taking into consideration the town's stormwater requirements town-wide, the Wetlands Bylaw enforced by the Conservation Commission, the Master Plan, the Municipal Vulnerability Preparedness Community Resilience Building Summary of Findings, and the Open Space Plan, the town determined that existing regulatory measures are taking good advantage of local Home Rule land use regulatory authority to minimize natural hazard impacts of development. Priorities for the future include further regulatory changes and public education efforts toward ensuring that future development occurs in a sustainable manner. Open Space purchases, drainage upgrades are also priorities in this plan.

E. REGIONAL AND INTER-COMMUNITY CONSIDERATIONS

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level. Other issues are inter-community and require cooperation between two or more municipalities. There is a third level of mitigation which is regional and may involve a state, regional or federal agency or three or more municipalities.

REGIONAL PARTNERS

In densely developed urban communities such as the metropolitan Boston area, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are complex systems of storm drains, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including the Town, the Massachusetts Department of Conservation and Recreation (DCR), Massachusetts Department of Developmental Services and the Massachusetts Department of Transportation (MassDOT). The planning, construction, operation and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities' regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do including budgetary and staffing constraints and they must make decisions about numerous competing priorities.

Following, is a brief overview of regional facilities found in Wrentham and a discussion of inter-municipal issues.

OVERVIEW OF REGIONAL FACILITIES WITHIN WRENTHAM

Major facilities owned, operated and maintained by state or regional entities include:

- Interstate I-495 (Mass Highways)
- State roads Routes 1, 1A, 121 (Mass Highways)
- Crocker Pond Dam (Town of Attleboro)
- Mirror Lake Dams (Town of Norfolk and MA DCR)
- Wrentham Development Center (Massachusetts Department of Developmental Services)

INTER-COMMUNITY CONSIDERATIONS

Mitigation measures for the following regional issues should be taken into account as Wrentham develops its own local plan:

A) Coordinate and Review Developments on a Regional Basis

As Wrentham and the surrounding communities are undergoing development, it is vital that these communities communicate and provide input during the review processes. When addressing housing, transportation, and economic development projects, the impacts to neighbors must be addressed. The Plainridge Park Casino in Plainville is a prime example of how one development has the potential to create impacts in Wrentham, Plainville, and Foxborough.

B) Long-Term Regional Management Plan To Control Beaver Activity

One regional issue of significance is the widespread effects of beaver dams in the area. Most streams, wetland areas, and ponds in the region have had some degree of beaver activity in the past several years. Much of the localized flooding that occurs is due to beaver activity. The towns will mitigate the problem temporarily by hiring trappers, removing dams, or installing pipes, but a long-term comprehensive approach should be considered.

C) Dam Conditions and Emergency Plans Upstream of the Town of Wrentham

Dams in upstream communities are frequently of concern to downstream communities. In the case of Wrentham, the Crocker Pond dam, located on Crocker Pond in Wrentham, is owned by the Town of Attleboro. Failure of that dam would have an impact on Wrentham rather than Attleboro, so coordination and communication on repairs and maintenance are critical. In addition, the Town of Wrentham shares Mirror Lake with the Town of Norfolk. There are two dams located in Norfolk owned by the town of Norfolk and the Commonwealth of Massachusetts, Department of Conservation and Recreation. The communities and state agencies should continue to coordinate with each other to address concerns of dam conditions and emergency response plans in the event of a hazardous storm event.

XI. PLAN ADOPTION & MAINTENANCE

A. PLAN ADOPTION

The Wrentham Hazard Mitigation Plan 2018 Update was adopted by the Board of Selectmen on [ADD DATE]. See Appendix D for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

B. PLAN MAINTENANCE

Although several of the mitigation measures from the Town's previous Hazard Mitigation Plan have been implemented, since that plan was adopted there has not been an ongoing local process to guide implementation of the plan. Such a process is needed over the next five years for the implementation of this plan update, and will be structured as described below.

MAPC worked with the Wrentham Hazard Mitigation Planning Team to prepare this plan. After approval of the plan by FEMA, this group will meet to function as the Hazard Mitigation Implementation Team, with the Commissioner of Public Works designated as the coordinator. Additional members could be added to the local implementation team from businesses, non-profits and institutions. The Town will encourage public participation during the next 5-year planning cycle. As updates and a review of the plan are conducted by the Hazard Mitigation Implementation Team, these will be placed on the Town's web site, and any meetings of the Hazard Mitigation Implementation Team will be publicly noticed in accordance with town and state open meeting laws.

C. IMPLEMENTATION AND EVALUATION SCHEDULE

Mid-Term Survey on Progress– The coordinator of the Hazard Mitigation Implementation Team will prepare and distribute a survey in year three of the plan. The survey will be distributed to all of the local implementation group members and other interested local stakeholders. The survey will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.

This information will be used to prepare a report or addendum to the local hazard mitigation plan in order to evaluate its effectiveness in meeting the plan's goals and identify areas that need to be updated in the next plan. The Hazard Mitigation Implementation Team, coordinated by the Town Engineer, will have primary responsibility for tracking progress, evaluating, and updating the plan.

Begin to Prepare for the next Plan Update -- FEMA's approval of this plan is valid for five years, by which time an updated plan must be approved by FEMA in order to maintain the town's approved plan status and its eligibility for FEMA mitigation grants. Given the lead time needed to secure funding and conduct the planning process, the Hazard Mitigation Implementation Team will begin to prepare for an update of the plan in year three. This will help the Town avoid a lapse in its approved plan status and grant eligibility when the current plan expires.

The Hazard Mitigation Implementation Team will use the information from the Mid-Term progress review to identify the needs and priorities for the plan update and seek funding for the plan update process. Potential sources of funding may include FEMA Pre-Disaster Mitigation grants and the Hazard Mitigation Grant Program. Both grant programs can pay for 75% of a planning project, with a 25% local cost share required.

Prepare and Adopt an Updated Local Hazard Mitigation Plan –Once the resources have been secured to update the plan, the Hazard Mitigation Implementation Team may decide to undertake the update themselves, contract with the Metropolitan Area Planning Council to update the plan or to hire another consultant. However the Hazard Mitigation Implementation Team decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The Wrentham Hazard Mitigation Plan Update will be forwarded to MEMA and DCR for review and to FEMA for approval.

D. INTEGRATION OF THE PLANS WITH OTHER PLANNING INITIATIVES

Upon approval of the Wrentham Hazard Mitigation Plan 2017 Update by FEMA, the Local Hazard Mitigation Team will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department’s ongoing work. The plan will be reviewed and discussed with the following departments. During updates of any Town department’s plans or policies, the relevant portions of this mitigation strategy will be incorporated.

- Fire Department
- Emergency Management
- Police Department
- Public Works Department
- Engineering
- Planning and Community Development
- Conservation Commission
- Parks and Recreation
- Public Health
- Building
- Land use

Other groups that will be coordinated with include large institutions, businesses, land conservation organizations and watershed groups. The plans will also be posted on a community’s website with the caveat that local team coordinator will review the plan for sensitive information that would be inappropriate for public posting. The posting of the plan on a web site will include a mechanism for citizen feedback such as an e-mail address to send comments.

The Hazard Mitigation Plan will be integrated into other town plans and policies as they are updated and renewed, including the Wrentham Comprehensive Plan, Open Space Plan, Comprehensive Emergency Management Plan, and Capital Investment Program.

XII. LIST OF REFERENCES

Town of Wrentham, Massachusetts. *Personal Communication with Local Multiple Hazard Community Planning Team.* 2017-2018

Town of Wrentham, Massachusetts. *Subdivision Rules and Regulations.*

Town of Wrentham, Massachusetts. Website <https://www.townofWrentham.org/> Accessed through June 2018.

Town of Wrentham, Massachusetts. *Zoning Bylaw.*

Town of Wrentham Open Space and Recreation Plan, 2015

FEMA, Flood Insurance Rate Maps for Norfolk County, MA, 2012

FEMA, Local Mitigation Plan Review Guide; October 1, 2011.

MA Emergency Management Agency, *State Hazard Mitigation Plan*, 2013

MA Geographic Information System, *McConnell Land Use Statistics*, 2005

MA Office of Dam Safety, *Inventory of Massachusetts Dams*

Metropolitan Area Planning Council, *Geographic Information Systems Lab*

New England Seismic Network, Weston Observatory, <http://aki.bc.edu/index.htm>

Resilient MA Climate Change Clearinghouse for the Commonwealth, <http://resilientma.org/>

Northeast States Emergency Consortium, website <http://www.nesec.org/>

NOAA, National Centers for Environmental Information, <https://www.ncei.noaa.gov/>

U. S. Census, 2010, and American Community Survey, 2016

USGS, National Water Information Center, website

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APPENDIX A: LOCAL TEAM MEETINGS



AGENDA

**Wrentham Hazard Mitigation Plan Update
Local Hazard Mitigation Planning Team**

**Meeting #1
November 6, 2017
10:00AM**

**Wrentham Public Safety Building
99 South Street
Wrentham, MA 02093**

1. Review Project Scope of Work and Schedule

2. Update Critical Facilities Inventory and Mapping

3. Identify/update local hazards:

- a) Flood Hazard Areas
- b) Fire Hazard Areas (brushfires/wildfires)
- c) Dams
- d) Other hazards

4. Identify/Update New and Potential Development Sites

5. Discuss Public Involvement and Outreach

- a) Identify local stakeholders
- b) Schedule first public meeting

APPENDIX – WRENTHAM HAZARD MITIGATION PLAN 2018 UPDATE

WRENTHAM LOCAL HAZARD MITIGATION TEAM MEETING #1
November 6, 2017 – 9:30 AM – Wrentham Public Safety Building

Name	Department	Email	Phone
JOE HECK	EMERGENCY MANAGEMENT	WEMA@WRENTHAM.MA.US	508-471-0490
Douglas Valocin	Public Works	DVALOCIN@WRENTHAM.MA.US	508-384-5477
Jay McNeese	Fire	jimmera@fire.wrentham.ma.us	508-384-3131 ext 1100
Darryl Luce	Conservation Comm	dluce@wrentham.ma.us	508-314-4743
Bill McGoath	Wrentham Police Dept	mcgoath@wrenthampolice.com	508-384-6915
Chuck DiPirro	I.T.	cdipirro@wrentham.ma.us	508-384-5418
George Labate	Wrentham Police	labate@police.wrentham.ma.us	508-384-2121 (107)
Mrs. Lavin	Public Works	MLAVIN@WRENTHAM.MA.US	508-384-5477



Town of Wrentham
Natural Hazard Mitigation Plan 2018 Update

Friday, March 23, 2018

10:00 -12:00

Team Meeting #2

AGENDA

1. Introductions
2. Review Map and Data from Last Meeting
3. Review original existing mitigation measures from 2010 plan
 - confirm effectiveness
 - note any needed changes
4. Review recommended mitigation measures from 2010 plan
 - current status
 - decide which to carry forward into 2018 plan
5. Review Hazard Mitigation Goals and update as needed
6. Next Steps
 - Schedule a public meeting (Planning Board, Board of Selectmen, or Conservation Commission)
 - Create Stakeholder List for Comment (includes business, institutions, public agencies, watershed organizations)

Wrentham Haz. Mit

3/23/18

Name	Dept.
Martin Pillsbury	MAPC
Darryl Luce	Conservation Commission
JOE HECK	EMERGENCY MGMT Agcy
Dixy McMorrew	FD
MIKE LAVIN	Public Works
John Charbonneau	Director of Planning & Development
Kent Sweet	Town Administrator
GEORGE LABUTE	Police Lieutenant
William McGrath	Chief of Police



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AGENDA

Wrentham Local Hazard Mitigation Planning Team Meeting #3

Wednesday, June 13, 2018
2:00-3:30 PM

1. HAZARD MITIGATION PLAN TIMELINE AND STATUS UPDATE

2. PROPOSE NEW MITIGATION MEASURES FOR THE 2018 PLAN

Mitigation categories:

- Flood
- Brushfire
- Drought
- Earthquakes
- Extreme Temperatures
- Wind
- Winter Storms
- Climate Resilience/Adaptation (optional)

3. PRIORITIZE NEW MITIGATION STRATEGIES/COST ESTIMATE

4. MVP SUMMARY OF FINDINGS DISCUSSION

Final public meeting before the Board of Selectmen – June 19, 2018



APPENDIX – WRENTHAM HAZARD MITIGATION PLAN 2018 UPDATE

MAPC Sign-In Sheet – Wrentham LOCAL HAZARD MITIGATION TEAM MEETING – 2018 Plan Update
 June 19, 2018 – 2:00 PM – Wrentham Town Hall

Name	Department	Email
JOE HECK	EMA	JEHECK@WRENTHAM.MA.US
John Charbonneau	Planning Director	jcharbonneau@wrentham.ma.us
GEORGE LABENTÉ	Police	labente@police.wrentham.ma.us
MIKE LAVIN	Public Works	MLAVIN@WRENTHAM.MA.US
Kevin Sweet	Town Admin	KSweet@wrentham.ma.us
William McGrath	Police Chief	megrath@wrenthampolice.com

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APPENDIX B: HAZARD MAPPING

The MAPC GIS (Geographic Information Systems) Lab produced a series of maps for each community. Some of the data came from the Northeast States Emergency Consortium (NESEC). More information on NESEC can be found at <http://www.serve.com/NESEC/>. Due to the various sources for the data and varying levels of accuracy, the identification of an area as being in one of the hazard categories must be considered as a general classification that should always be supplemented with more local knowledge.

The map series consists of eight maps as described below. The maps in this appendix are necessarily reduced scale versions for general reference. Full sized higher resolution PDF's of the maps can be downloaded from the MAPC File Transfer Protocol (FTP) website at: ftp://ftp.mapc.org/Hazard_Mitigation_Plans/maps/Wrentham/

Map 1.	Population Density
Map 2.	Potential Development
Map 3.	Flood Zones
Map 4.	Earthquakes and Landslides
Map 5.	Hurricanes and Tornadoes
Map 6.	Average Snowfall
Map 7.	Composite Natural Hazards
Map 8.	Hazard Areas
Map 9.	Extreme Heat

Map 1: Population Density – This map uses the US Census block data for 2010 and shows population density as the number of people per acre in seven categories with 60 or more people per acre representing the highest density areas.

Map 2: Land Use – This map depicts existing land use, based on the MacConnell Land Use map series from University of Massachusetts, available from MassGIS . The map displays 33 categories of land use based on interpretation of aerial photos. For more information on how the land use statistics were developed and the definitions of the categories, please go to <http://www.mass.gov/mgis/lus.htm>

Map 3: Flood Zones – The map of flood zones used the FEMA NFIP Flood Zones as depicted on the FIRMs (Federal Insurance Rate Maps) for Norfolk County dated July 17, 2012 as its source. This map is not intended for use in determining whether or not a specific property is located within a FEMA NFIP flood zone. The currently adopted FIRMS for Wrentham are kept by the Town. For more information, refer to the FEMA Map Service Center website <http://www.msc.fema.gov>. The definitions of the flood zones are described in detail on this site as well. The flood zone map for each community also shows critical infrastructure and repetitive loss areas.

Map 4: Earthquakes and Landslides – This information came from NESEC. For most communities, there was no data for earthquakes because only the epicenters of an earthquake are mapped.

The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>.

Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms, if any occurred in this community. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind and rain from these storms were felt in other communities even if the track was not within that community.

This map also shows the location of tornadoes with a classification as to the level of damages. What appears on the map varies by community since not all communities experience the same wind-related events. These maps also show the 100 year wind speed.

Map 6: Average Snowfall - - This map shows the average snowfall. It also shows storm tracks for nor'easters, if any storms tracked through the community.

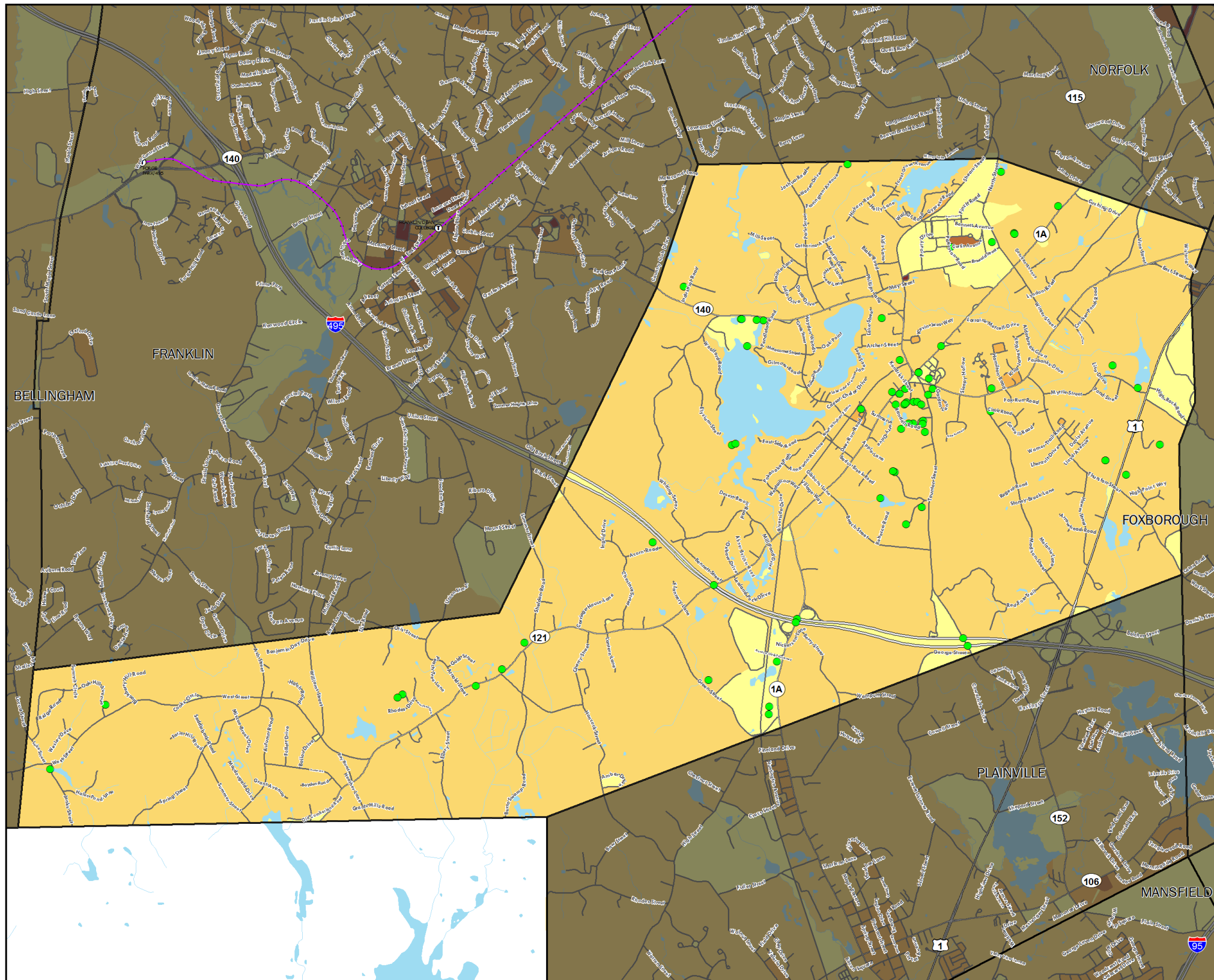
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane surge inundation areas. Areas with only one hazard were considered to be low hazard areas. Moderate areas have two of the hazards present. High hazard areas have three hazards present and severe hazard areas have four hazards present.

Map 8: Hazard Areas – For each community, locally identified hazard areas are overlaid on an aerial photograph dated April, 2009. The source of the aerial photograph is Mass GIS. This map also shows potential future developments, and critical infrastructure sites. MAPC consulted with town staff to determine areas that were likely to be developed or redeveloped in the future.

Map 9: Extreme Heat Areas. MAPC performs an urban heat island analysis using land surface temperature from LANDSAT then calculates the top 5% hottest areas in the Metropolitan Boston region to indicate areas of extreme heat and urban heat island. This analysis uses data from July and August 2016.

Table 31 Wrentham Locally Identified Hazards

Map ID	Name	Type
1	Green Street	Flooding
3	Franklin Street	Flooding
4	Taunton Street	Flooding
5	Burnt Swamp Road	Flooding
6	Hancock Street	Flooding
7	Well #4 at Thurston Street	Flooding
8	Franklin Street	Flooding
9	I-495 Corridor	Brush Fire
10	Joe's Rock	Brush Fire
11	Green Street	Brush Fire
12	Wrentham State Forest	Brush Fire
13	High Rock	Brush Fire
14	Well #4	Brush Fire
15	Anglers Club	Brush Fire
16	Tornado 2004	Other
17	Tornado 1939	Other
18	Tornado 1954	Other
19	Madison Street Hill	Flooding
20	Crocker Pond Dam	Flooding
21	Eagle Dam	Flooding
22	Wollomonopoag	Brush Fire
23	Wrentham Center	Other
25	Birchwold Farm	Brush Fire

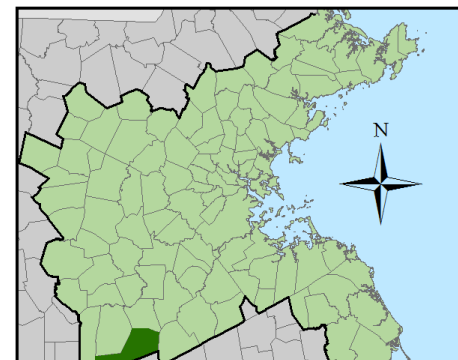


FEMA Hazard Mitigation Planning Grant
WRENTHAM, MA

Map 1: Population Density

- Sites**
- Critical Infrastructure Sites*
 - Ⓣ Train Stations
 - Commuter Rail Lines
 - Trains
- * See details in separate table
- Water Bodies**
- Population Density 2010 Census Blocks People Per Acre**
- 0 or No Data
 - 0.1 - 5.0
 - 5.1 - 15.0
 - 15.1 - 30.0
 - More than 30
- All Roads**
- Interstate
 - U.S. Highway
 - State Route
 - Street

0 0.25 0.5 Miles

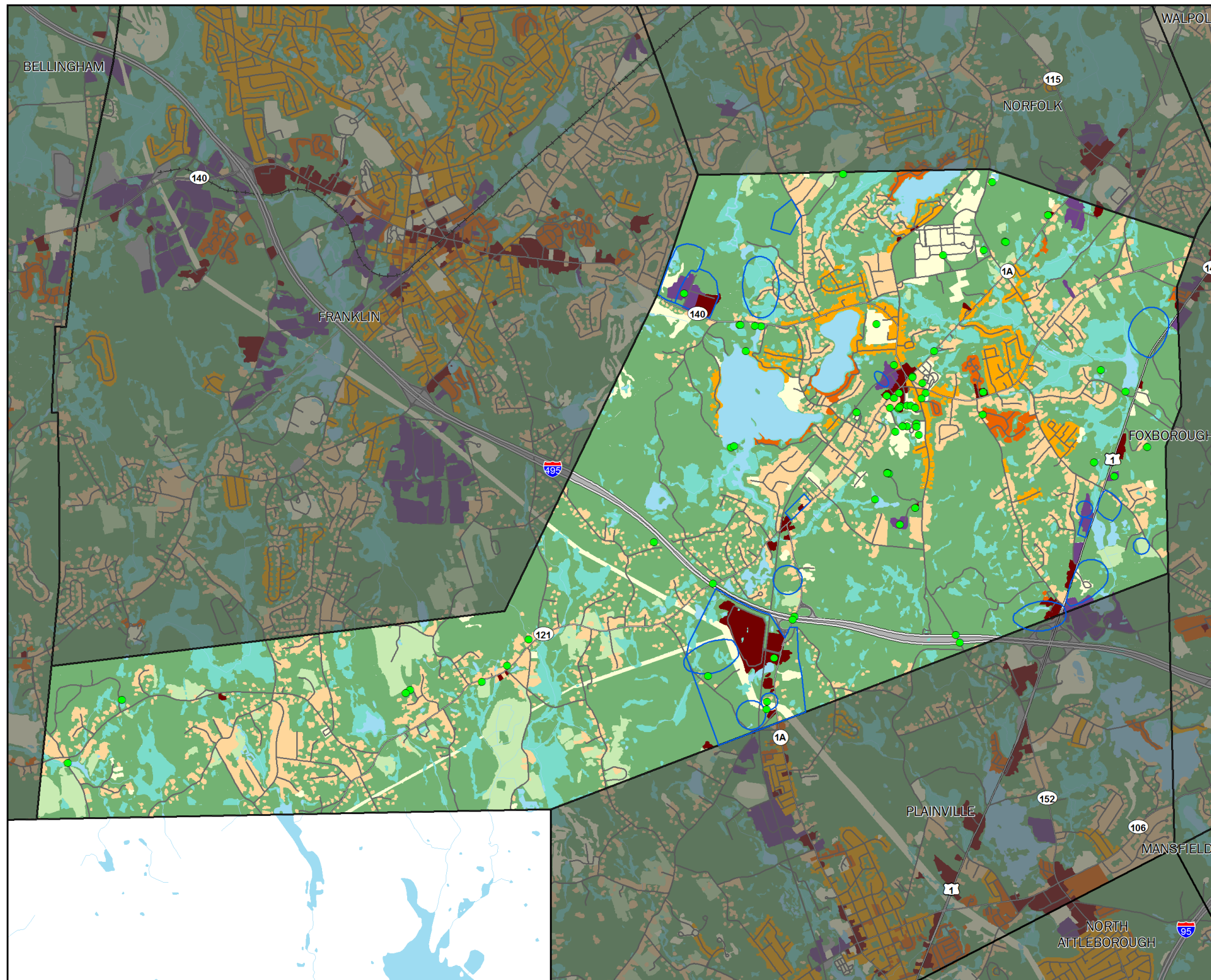


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
WRENTHAM, MA

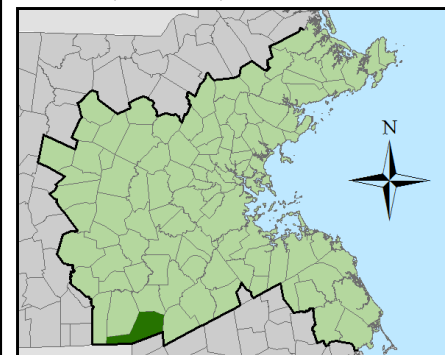
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FEMA Hazard Mitigation Planning Grant
WRENTHAM, MA
 Map 2: Land Use

- Sites**
- Critical Infrastructure Sites*
 - Repetitive Loss Sites
 - * See details in separate table
- Land Use (2005)**
- High Density Residential
 - Medium Density Residential
 - Low Density Residential
 - Non-Residential Developed
 - Commercial
 - Industrial
 - Transportation
 - Agriculture
 - Undeveloped
 - Undeveloped Wetlands
- Development Areas**
- Development Areas
 - * See details in separate table
- All Roads**
- Interstate
 - U.S. Highway
 - State Route
 - Street
- Other Features**
- Ⓜ Train Stations
 - Commuter Rail Lines
 - Trains
 - Water Bodies

0 0.25 0.5 Miles

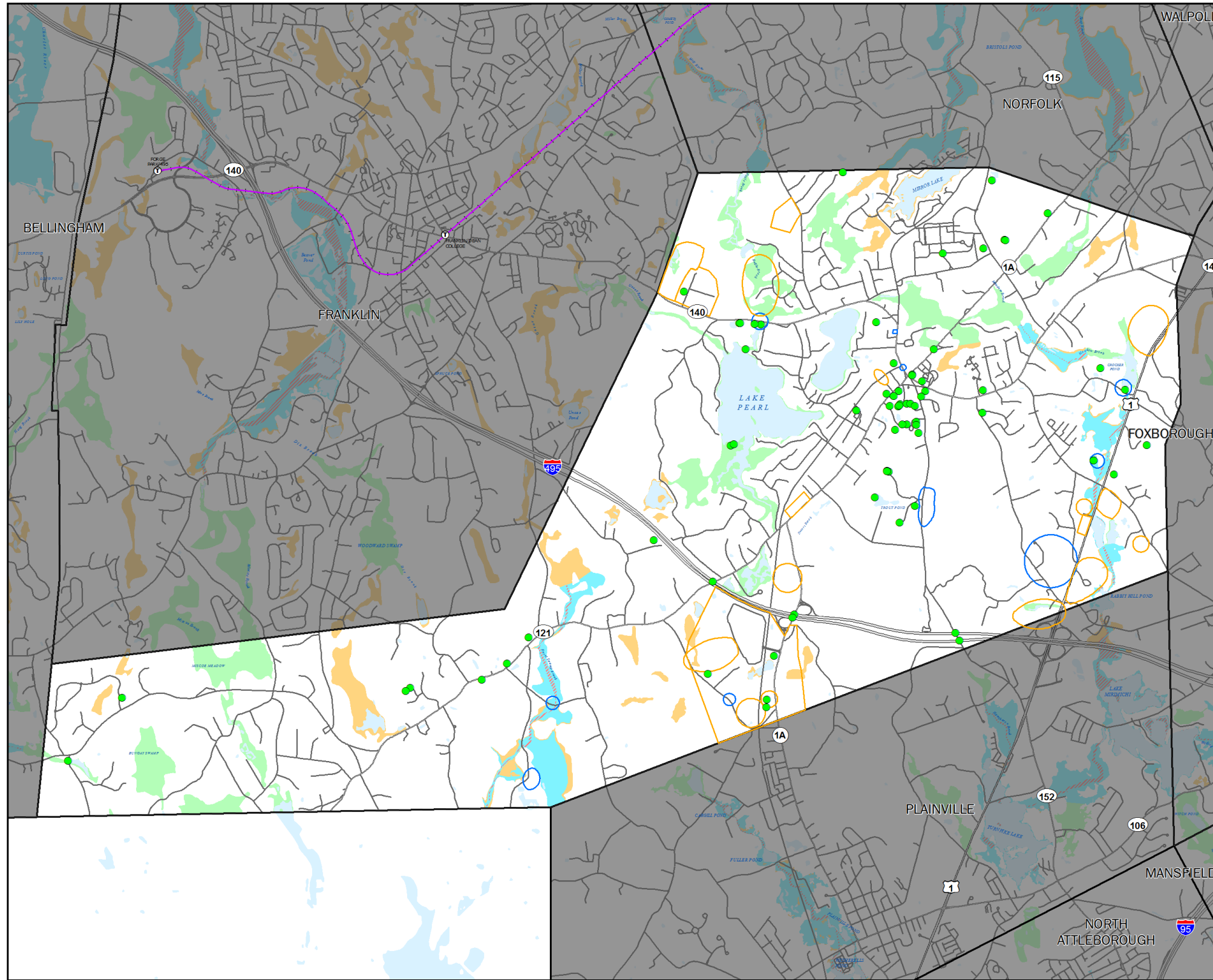


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Data Sources:
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 Northeast States Emergency Consortium (NESEC)
 Massachusetts Emergency Management Agency (MEMA)
 Federal Emergency Management Agency (FEMA)
 WRENTHAM, MA

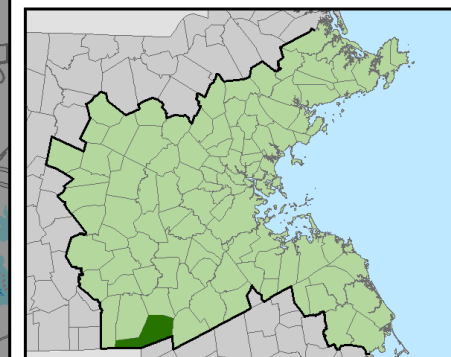
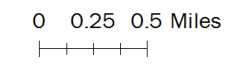
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FEMA Hazard Mitigation Planning Grant
WRENTHAM, MA

Map 3: Flood Zones

- Sites**
 - Critical Infrastructure Sites*
 - Repetitive Loss Sites
 - * See details in separate table
 - Water Bodies
 - Locally Identified Hazard Areas***
 - Flooding
 - Development Areas*
 - * See details in separate table
-
- Flood Zones, 2017 (Annual Chance)**
 - A: 1% Annual Chance of Flooding, no BFE
 - AE: 1% Annual Chance of Flooding, with BFE
 - AE: Regulatory Floodway
 - X: 0.2% Annual Chance of Flooding
-
- Ⓣ Train Stations
 - Commuter Rail Lines
 - Trains
 - All Roads**
 - Interstate
 - U.S. Highway
 - State Route
 - Street



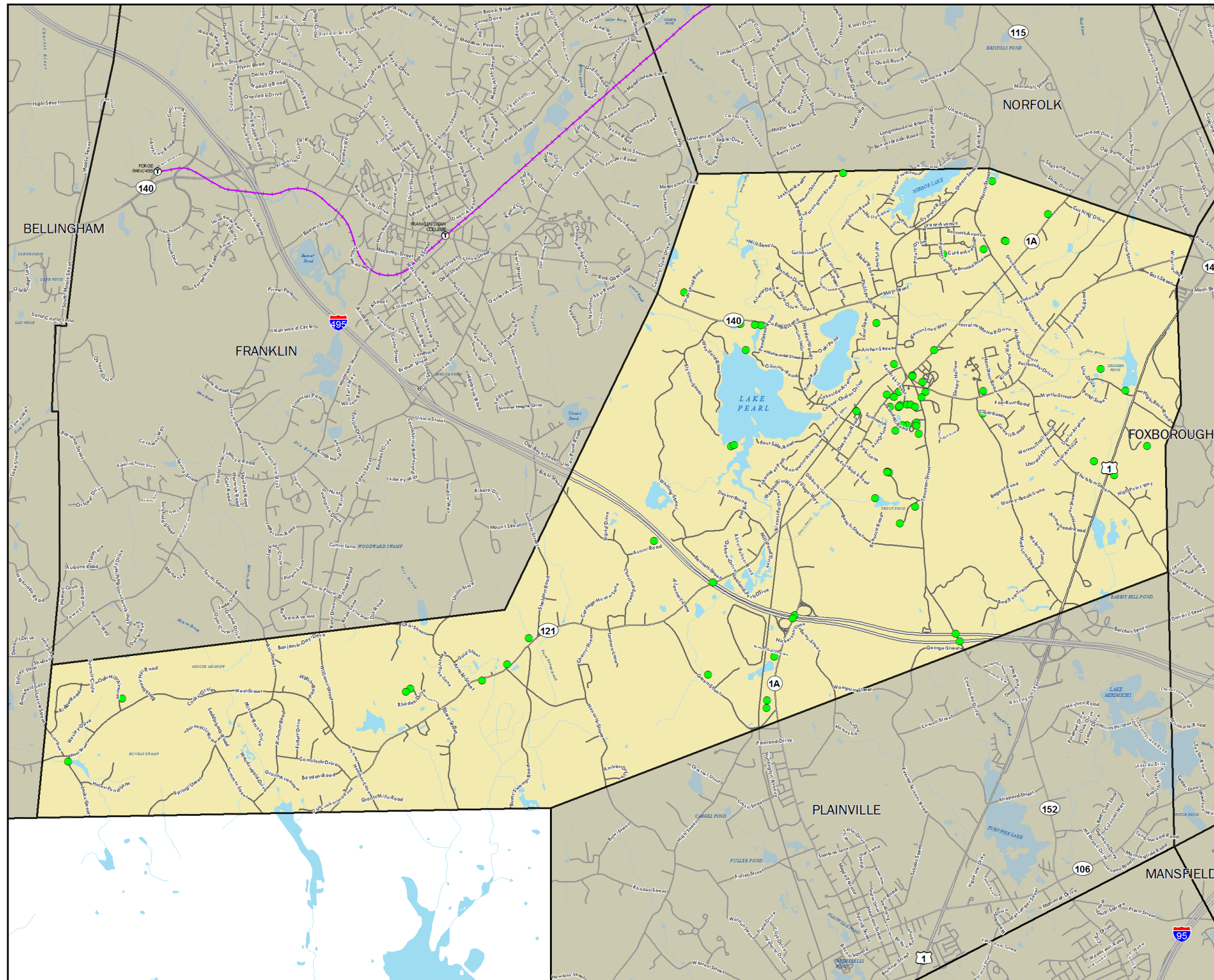
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)

Flood Zones datalayer updated by MassGIS October 2013 from finalized data provided by Federal Emergency Management Agency (FEMA)

WRENTHAM, MA
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Date: 6/7/2018

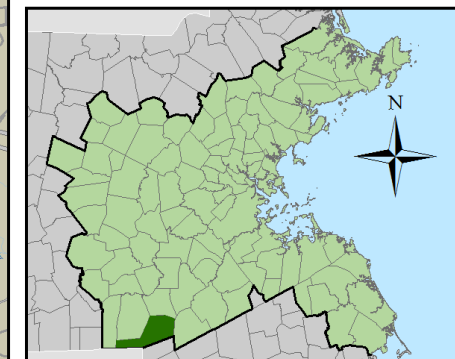


FEMA Hazard Mitigation Planning Grant
WRENTHAM, MA

Map 4: Earthquakes / Landslides

- Sites**
- Critical Infrastructure Sites*
 - Water Bodies
- * See details in separate table
- Earthquakes**
- Epicenters
 - Train Stations
 - Commuter Rail Lines
 - Trains
- All Roads**
- Interstate
 - U.S. Highway
 - State Route
 - Street
- Landslides**
- High landslide incidence (greater than 15% of the area is involved in landsliding)
 - High susceptibility to landsliding and moderate incidence
 - High susceptibility to landsliding and low incidence
 - Moderate susceptibility to landsliding and low incidence
 - Low landslide incidence (less than 1.5 % of the area is involved in landsliding)

0 0.25 0.5 Miles

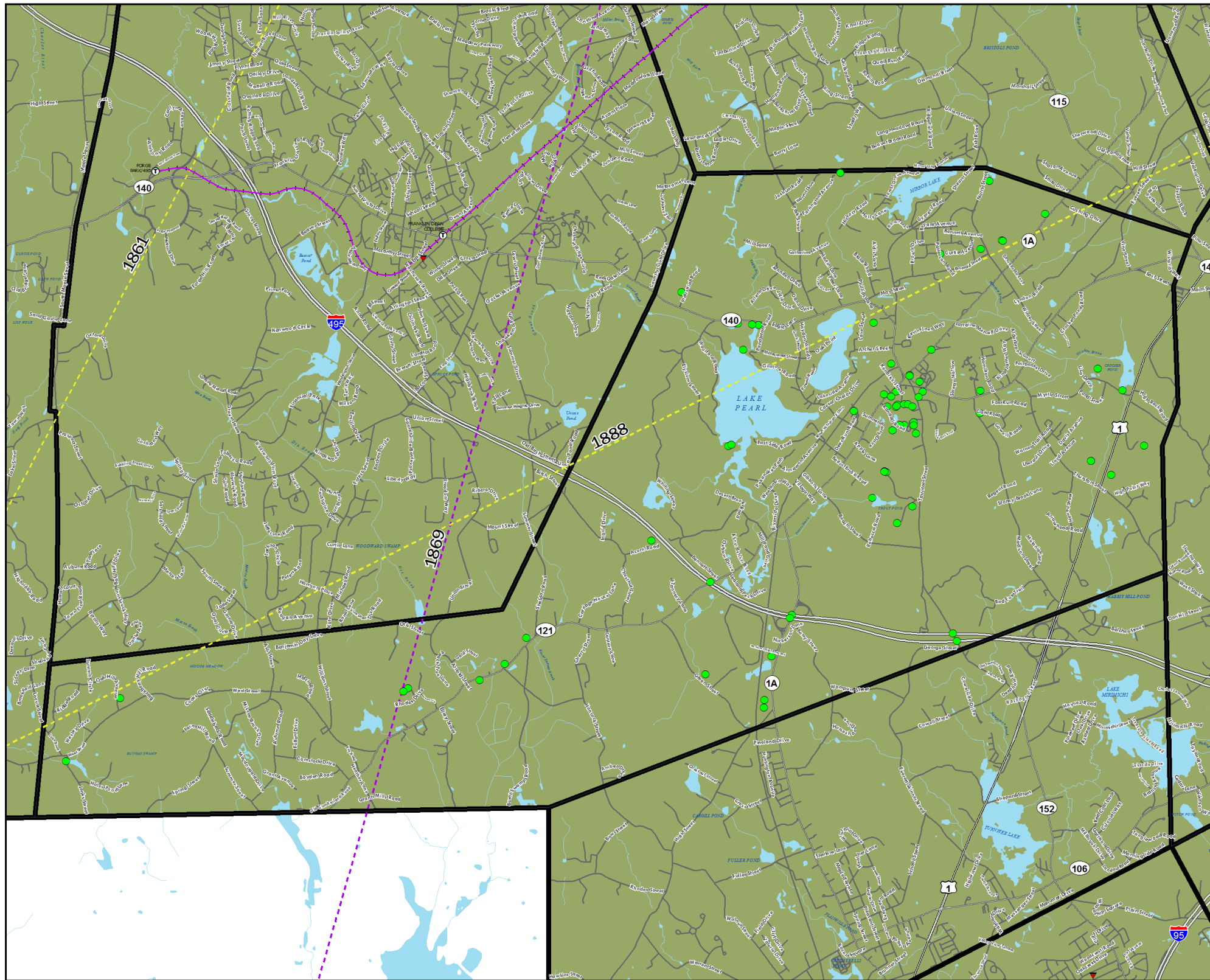


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
WRENTHAM, MA

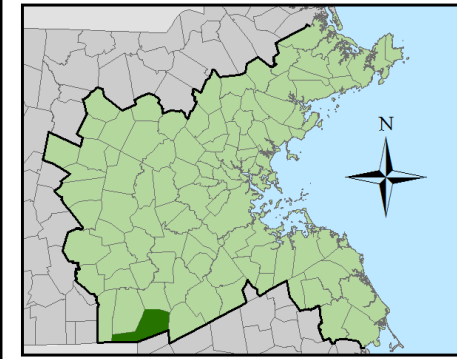
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Date: 6/7/2018



FEMA Hazard Mitigation Planning Grant
WRENTHAM, MA
 Map 5: Hurricanes / Tornadoes

- Sites**
- Critical Infrastructure Sites*
- Repetitive Loss Sites
- * See details in separate table
- Tornadoes**
- ▼ Tornado
- Storm Tracks**
- Tropical Depression
- Tropical Storm
- Category 1 Hurricane
- Category 2 Hurricane
- Category 3 Hurricane
- Year of storm noted on map
- ☒ Hurricane Surge Inundation Areas
- Ⓜ Train Stations
- Commuter Rail Lines
- Trains
- All Roads**
- Interstate
- U.S. Highway
- State Route
- Street
- Water Bodies
- 100 Year Wind Speeds**
- Miles Per Hour**
- 90 MPH
- 100 MPH
- 110 MPH
- 120 MPH
- 130 MPH

0 0.25 0.5 Miles

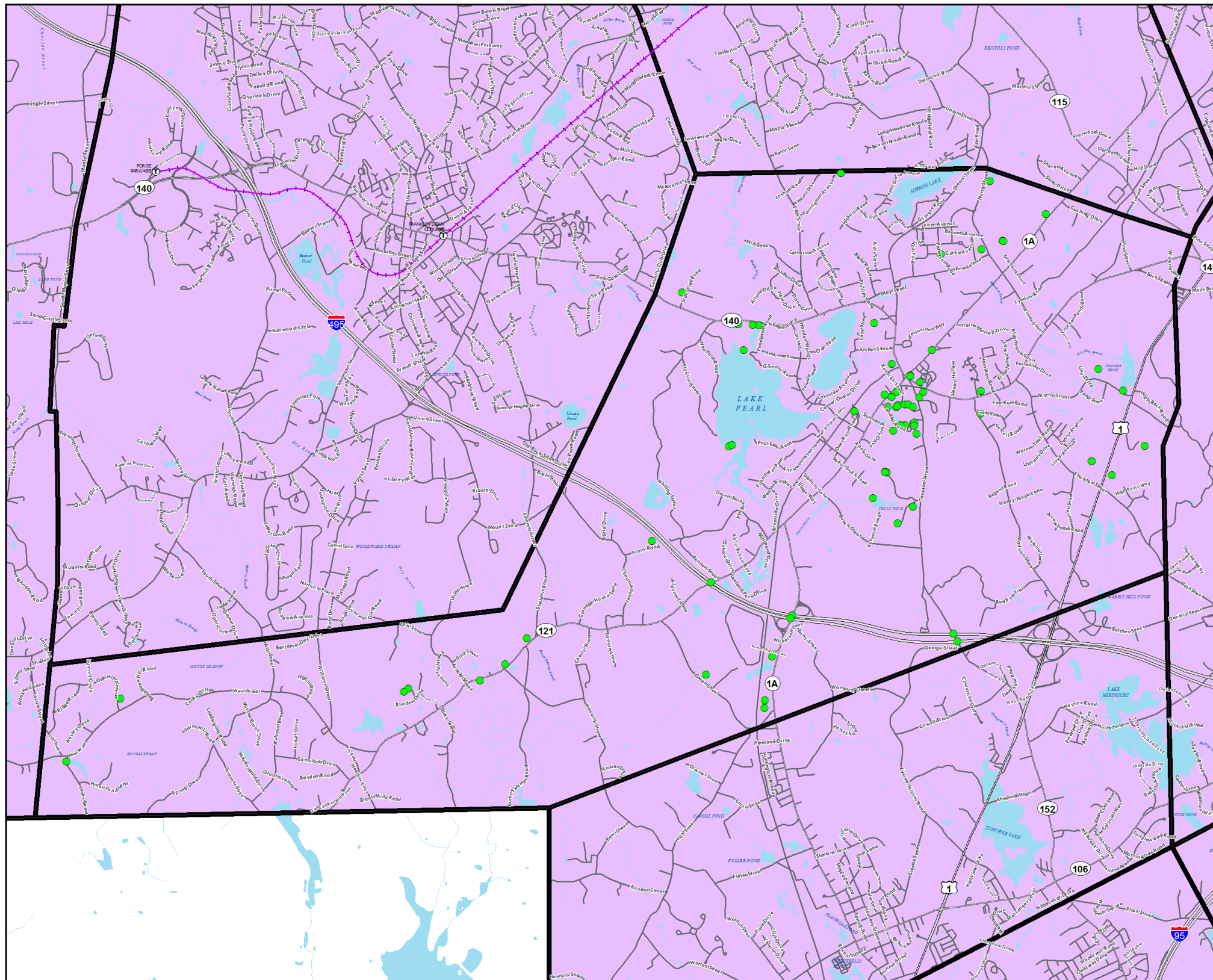


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

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Data Sources:
 Metropolitan Area Planning Council (MAPC)
 Massachusetts Geographic Information System (MassGIS)
 Northeast States Emergency Consortium (NESEC)
 Massachusetts Emergency Management Agency (MEMA)
 Federal Emergency Management Agency (FEMA)
 WRENTHAM, MA

Path: K:\Data Services\Projects\Current_Projects\FDM\project_files\FDM_Map5.mxd
 Date: 6/7/2018



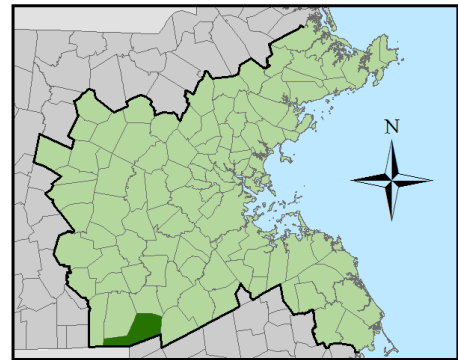
FEMA Hazard Mitigation Planning Grant
WRENTHAM, MA

Map 6: Average Snowfall

- Sites**
- Critical Infrastructure Sites*
- Average Annual Snowfall**
- 36.1 to 48.0 inches
 - 48.1 to 72.0 inches
- All Roads**
- Interstate
 - U.S. Highway
 - State Route
 - Street
- Water Bodies**
- Water Bodies
- Trains**
- Train Stations
 - Commuter Rail Lines
 - Trains

* See details in separate table

0 0.25 0.5 Miles

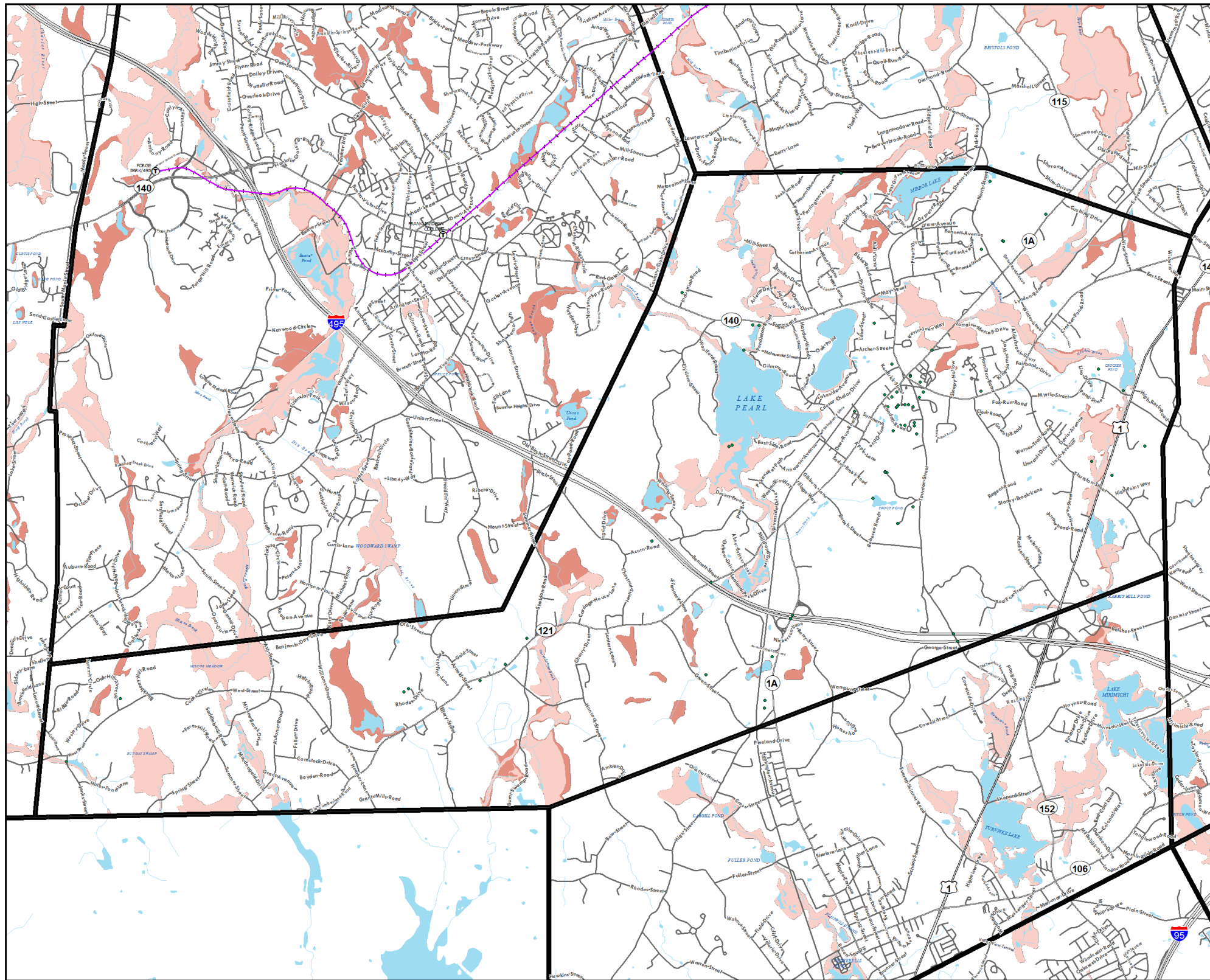


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

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60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
WRENTHAM, MA

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Date: 6/7/2018



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WRENTHAM, MA

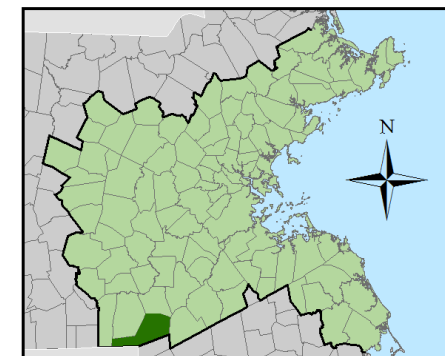
Map 7: Composite Natural Hazards

- Composite Natural Hazards**
- Low (2 Hazards)
 - Moderate (3 Hazards)
 - High (4 Hazards)
 - Very High (5 Hazards)
- Sites**
- Critical Infrastructure Sites*
 - Repetitive Loss Sites
- * See details in separate table
- Water Bodies**
- Water Bodies
- All Roads**
- Interstate
 - U.S. Highway
 - State Route
 - Street
 - Train Stations
 - Commuter Rail Lines
 - Trains

Composite natural hazards shown for areas of existing development. Hazards include:

- 100 year wind speed of 110 MPH or higher
- Moderate landslide risk
- FEMA flood zones (100 year and 500 year)
- Average snowfall of 36.1" or more
- Hurricane surge inundation areas

0 0.25 0.5 Miles



The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources

Composite Natural Hazard:
Wind, Landslide Risk, Snow -Northeast States Emergency Consortium (NESEC)
Flood Zones - 2013 FEMA/MassGIS
Hurricane Surge - 2013 U.S. Army Corps of Engineers, New England District

Roads/Trains: MassDOT/ CTPS

Repetitive Loss Sites: DCR/Office of Flood Hazard Management

Critical Infrastructure: Metropolitan Area Planning Council (MAPC) / WRENTHAM, MA

Path: \\C:\Data\Services\Projects\Current_Projects\FDM\project_files\FDM_Map7.mxd

Date: 6/7/2018

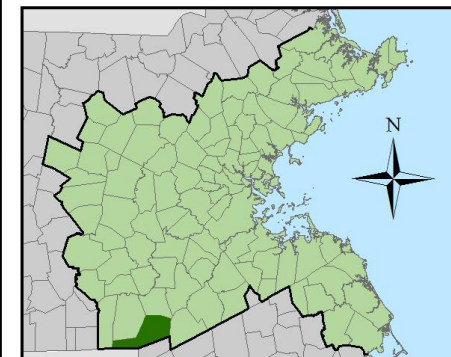


FEMA Hazard Mitigation Planning Grant
WRENTHAM, MA

Map 8: Local Hazard Areas

- | | |
|--|-----------------------|
| Sites | 🚂 Train Stations |
| ● Critical Infrastructure Sites* | 🚊 Commuter Rail Lines |
| ● Repetitive Loss Sites | 🚆 Trains |
| * See details in separate table | |
| Locally Identified Hazard Areas | All Roads |
| 🔴 Brush Fires | 🛣 Interstate |
| 🔵 Flooding | 🛣 U.S. Highway |
| 🟪 Historic | 🛣 State Route |
| * See Section IV Risk Assessment | |
| 🟡 Development Sites | 🛣 Street |
| * See details in separate table | |

0 0.5 1 Miles

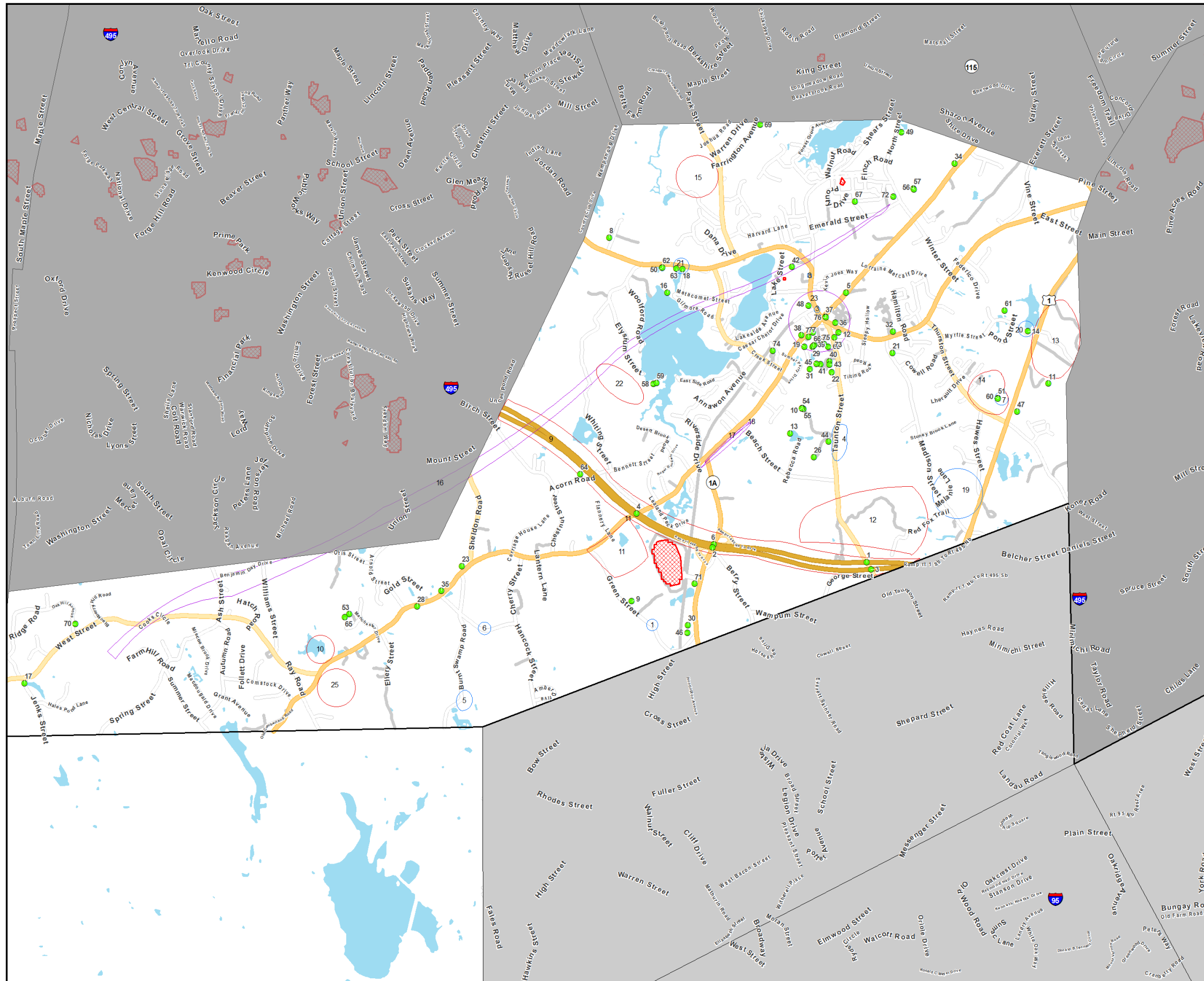


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services
 60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:
 Metropolitan Area Planning Council (MAPC)
 Massachusetts Geographic Information System (MassGIS)
 Northeast States Emergency Consortium (NESEC)
 Massachusetts Emergency Management Agency (MEMA)
 Federal Emergency Management Agency (FEMA)
 Imagery © Google
 WRENTHAM, MA

Path: K:\Data Services\Projects\Current\Projects\FDM\project_files\FDM_Map8.mxd
 Date: 6/7/2018



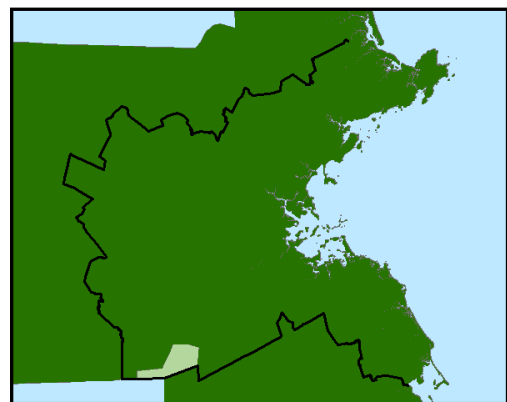
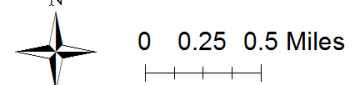
FEMA Hazard Mitigation Planning Grant

Areas of Extreme Heat Wrentham, MA

- Sites**
- Critical Infrastructure Sites* See details in separate table
 - Repetitive Loss Sites
 - ▨ Areas of Extreme Heat
 - * See details in separate table
- Areas of Concern***
- ▨ Brush Fire
 - ▨ Development
 - ▨ Flooding
 - ▨ Other

Flood Zones, 2014 (Annual Chance)

- ▨ Zone A : 1%
- ▨ Zone AE: 1%
- ▨ Zone AH: 1%
- ▨ Zone AO: 1%
- ▨ Zone VE: 1% with Velocity Hazard
- ▨ 0.2% Annual Chance



The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)

Flood Zones datalayer updated by MassGIS October 2013 from finalized data provided by Federal Emergency Management Agency (FEMA), MA

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Date: 6/8/2018

APPENDIX C: PUBLIC PARTICIPATION



HAZARD MITIGATION PLAN PUBLIC MEETING

Natural hazards can have serious impacts
on Wrentham and its residents



The Wrentham Hazard Mitigation Plan is being updated to help the town reduce its vulnerability to natural hazard events such as flooding, hurricanes and winter storms. Please join the Town for a public presentation and discussion about the update to the Wrentham Hazard Mitigation Plan at a public meeting of the Planning Board:

Date: Wednesday, May 2, 2018
Time: 7:00 PM
Location: Wrentham Town Hall,
Second Floor Meeting Room
79 South Street, Wrentham, MA

For more information, please contact Darci Schofield via phone at (617) 933-0794 or email dschofield@mapc.org





Wrentham Planning Board
Wrentham Town Hall, 79 South Street
Wrentham, Massachusetts 02093
(508) 384-5441 / Fax: (508) 384-3174
www.wrentham.ma.us

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2018 APR 26 PM 2:32

Meeting Agenda
Wednesday, May 2, 2018
Town Hall 2nd Floor Meeting Room
79 South St. Wrentham, Massachusetts

- 7:00 PM Call to Order / Agenda Overview
630/650 South Street ANR Application
- 7:15 PM New Public Hearing – Zoning By-Law Amendments
- Art. 3.4.b “Non-Conforming Lots, Structures and Uses”
- 7:15 PM Continued Public Hearing – 685 South Street
- Special Permit and Site Plan Approval
- 7:15 PM Continued Public Hearing – 91 Taunton Street
- Special Permit and Site Plan Approval for a Private Kennel
- Wrentham Natural Hazard Mitigation Plan Presentation - MAPC
- Discussion: Howard Bailey re: Park Place Earth Removal Bond and Project Update
- Discussion: Patrick Moore re: potential OSPD
- Discussion: Tim Callahan re: project at Route 1 @ Thurston St.
- Discussion: Hatch Road (Demetra Estates)
- Plan Endorsement: 630/650 South Street Special Permit/Site Plan Approval
- General Business:
- A. Meeting Minutes (April 4, 2018)
 - B. Correspondence
 - C. Planner’s Report / Long Range Planning Update
 - Sr. Living Community Pre-Application Meeting
 - April 12, 2018 MPO Meeting
 - MGC Grant Conference Call
 - Town Center Zoning
 - D. Public Input

HAZARD MITIGATION PLAN PUBLIC MEETING

Natural hazards can have serious impacts
on Wrentham and its residents



The Wrentham Hazard Mitigation Plan is being updated to help the town reduce its vulnerability to natural hazard events such as flooding, hurricanes and winter storms. Please join the Town for the final public presentation to the Wrentham Hazard Mitigation Plan at a public meeting of the Board of Selectmen:

Date: Tuesday, June 19, 2018
Time: 6:45 PM
Location: Wrentham Town Hall
Second Floor Conference Room
79 South Street, Wrentham, MA

For more information, please contact Darci Schofield via phone at (617) 933-0794 or email dschofield@mapc.org





Commonwealth of Massachusetts
Town of Wrentham
Board of Selectmen
79 South Street, Wrentham, MA 02093

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2018 JUN 15 AM 11:07

TEL: (508) 384-5400
FAX: (508) 384-5403

AGENDA
TUESDAY, JUNE 19, 2018
2nd FLOOR CONFERENCE ROOM, 79 SOUTH STREET (TOWN HALL)

CALL TO ORDER at 6:45 P.M. (by the Chairman):

ANNOUNCEMENTS: **TAB 1**

APPROVAL OF MINUTES: **TAB 2**
June 5, 2018 Open Session

NEW BUSINESS:
Final Public Meeting, Wrentham Natural Hazard Mitigation Plan **TAB 3**
Re-Appointments of Board's Committees and Commissions **TAB 4**
Vote to Appoint Steve Hearon to the Employee Group Health Insurance Advisory **TAB 5**
Committee
Approval of Year End Transfers **TAB 6**
Approve Memorandum of Agreement Wrentham Permanent Firefighters Association **TAB 7**
Town Administrator Contract Addendum **TAB 8**

TOWN ADMINISTRATOR'S REPORT: **TAB 9**

PUBLIC FORUM:

ADJOURNMENT:

EXECUTIVE SESSION: M.G.L. Chap. 30A, Sec. 21A (2)(3)
Discussion of Strategy Sessions w/Union & Non-Union Personnel
Discussion of Strategy w/Respect to Collective Bargaining or Litigation

This Agenda is Subject to Change
The next Meeting of the Board of Selectmen is scheduled for 6:45 p.m. on
Tuesday, July 10, 2018



Wed 6/13/2018 3:54 PM

Sweet, Kevin <ksweet@wrentham.ma.us>

Wrentham Hazard Mitigation Plan

To Sweet, Kevin

Cc BOS; Schofield, Darci

[Bing Maps](#)

+ Get more apps

Dear Town of Wrentham stakeholder:

The Town of Wrentham and the Metropolitan Area Planning Council have been working on an update of the *Wrentham Hazard Mitigation Plan*, a plan intended to reduce the Town's vulnerability to the impacts of natural hazard events such as flooding and hurricanes.

A draft plan update has been developed which identifies a set of hazard mitigation measures, including structural improvements, regulatory changes for development in hazard areas, educational and outreach efforts related to natural hazards in the Town, and other actions.

The draft plan update will be available for public review from June 21 to July 5, 2018 on the Town's website.

The plan will be discussed at a meeting of the Wrentham Board of Selectmen to be held on:

When: Tuesday, June 19th

Time: 6:45 pm

Location: Wrentham Town Hall, Second Floor Conference Room, 79 South Street, Wrentham

Comments and questions may be submitted at this meeting or in writing to Darci Schofield, 60 Temple Place, Boston, MA 02111, or by email to dschofield@mapc.org. Comments should be submitted by July 5, 2018 in order to be incorporated into the final draft of the plan that will be submitted to the Massachusetts Emergency Management Agency (MEMA) and Federal Emergency Management Agency (FEMA).

Thank you.

Sincerely,
Kevin Sweet
Town Administrator

Kevin A. Sweet, MS, MPA, ICMA-CM
Town Administrator
Town of Wrentham
79 South Street
Wrentham, MA 02093
Tel: 508-394-5400
Fax: 508-394-5403
www.wrentham.ma.us



APPENDIX D: PLAN ADOPTION

Certificate to Document Adoption of the
Hazard Mitigation Plan Update
By the Board of Selectmen

<TOWN LETTERHEAD>

**CERTIFICATE OF ADOPTION
BOARD OF SELECTMEN
TOWN OF WRENTHAM, Massachusetts**

A RESOLUTION ADOPTING THE
TOWN OF WRENTHAM HAZARD MITIGATION PLAN 2017 UPDATE

WHEREAS, the Town of Wrentham established a Committee to prepare the *Town of Wrentham Hazard Mitigation Plan 2018 Update*; and

WHEREAS, the *Town of Wrentham Hazard Mitigation Plan 2018 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Wrentham, and

WHEREAS, duly-noticed public meetings were held by the Planning Board on May 2, 2018 and the Board of Selectmen on June 19, 2018, and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Wrentham Board Of Selectmen adopts the *Town of Wrentham Hazard Mitigation Plan 2018 Update*, in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Wrentham.

ADOPTED AND SIGNED this Date. _____

Name(s)

Title(s)

Signature(s)

ATTEST

i

