TOWN OF MEDWAY
HAZARD MITIGATION PLAN
2018 PLAN UPDATE

FINAL PLAN
APPROVAL PENDING ADOPTION
ISSUED BY FEMA
SEPTEMBER 12, 2018

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ACKNOWLEGEMENT AND CREDITS

This plan was prepared for the Town of Medway by the Metropolitan Area Planning Council (MAPC) under the direction of the Massachusetts Emergency Management Agency (MEMA) and the Massachusetts Department of Conservation and Recreation (DCR). The plan was funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Grant Program.

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

MAPC would like to dedicate this plan to Stephanie Mercandetti, in recognition of her devoted public service to the Town of Medway and Norfolk County.

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I. 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.

PLANNING PROCESS

This is an update of the original Medway Hazard Mitigation Plan, which was approved by FEMA on May 7, 2010. Planning for the Hazard Mitigation Plan update was led by the Medway Local Hazard Mitigation Planning Team, composed of staff from a number of different Town Departments. This team met on October 12, 2017, February 7, 2018, and June 13, 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 with the Board of Selectmen. The first was on April 2, 2018 and the second on June 18, 2018, 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. No public comments were received.

RISK ASSESSMENT

The Medway 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 Medway Local Hazard Mitigation Planning Team identified 49 Critical Facilities. These are also shown on the map series and listed in Table 24, 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 Chance at $10 million and $36 million, respectively. Earthquakes of magnitudes 5 and 7 analysis provided $81,720,000 to $858,200,000 million respectively in property damages. Flood damage for the 1% and the 0.2% Annual Chance Flood at $15,510,000 and $19,290,000 respectively.

HAZARD MITIGATION GOALS

The Medway 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. Incorporate climate resilience and clean energy in hazard mitigation planning.

HAZARD MITIGATION STRATEGY

The Medway 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 these measures 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 and in the future, and local officials will need to work together across municipal lines 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.

PLAN REVIEW & UPDATE PROCESS

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

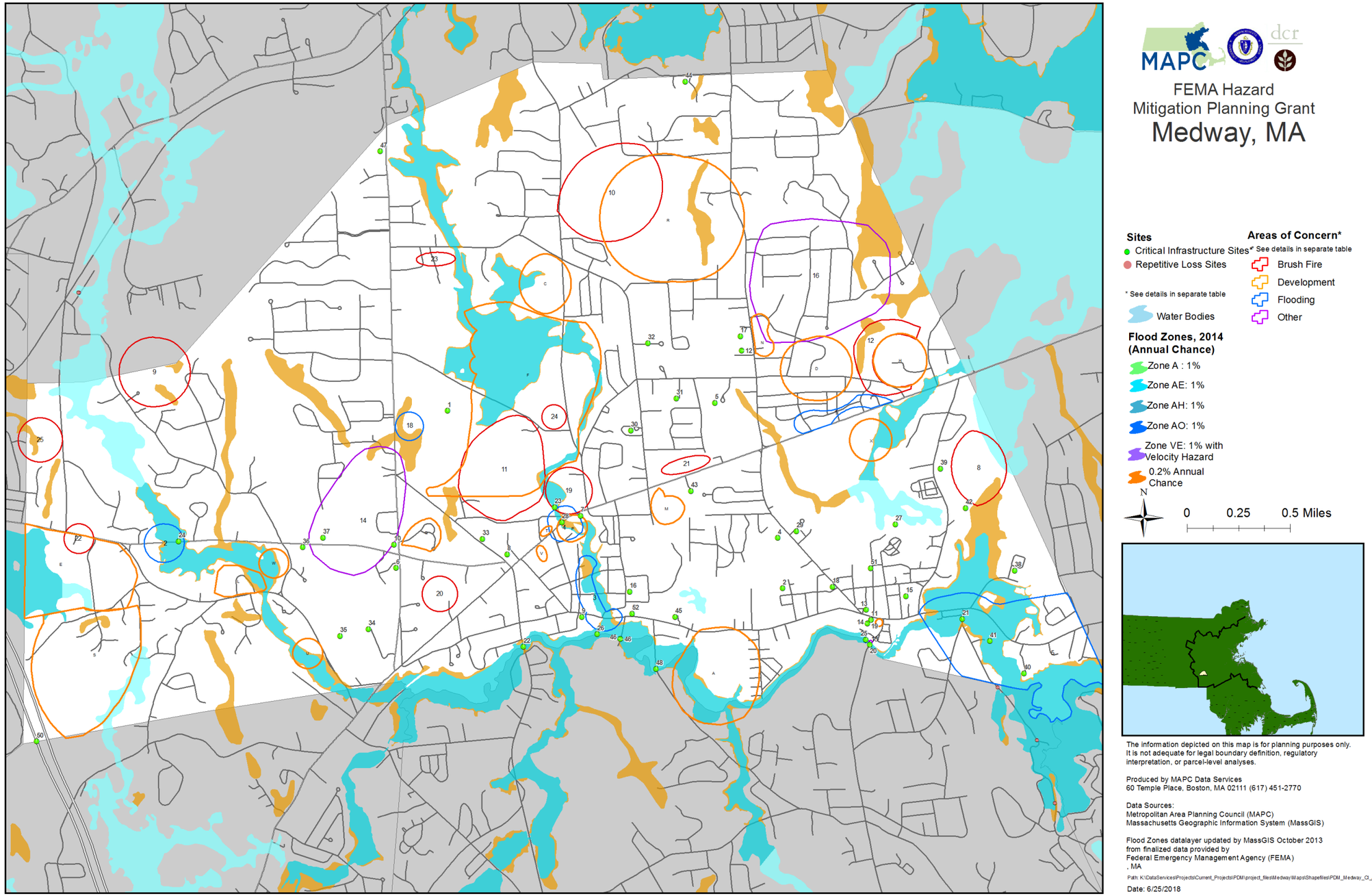
Table 1 Plan Review and Update Process

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 Board of Selectmen. The plan was also available on the Town's website for public comment. No comments were received by the town.
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 Medway 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 Medway 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



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II. INTRODUCTION

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 Medway 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 Medway to update its local Hazard Mitigation Plan, which was first adopted in 2010.

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.

PREVIOUS FEDERAL/STATE DISASTERS

The Town of Medway has experienced 20 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)

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
(1998)`	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
	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)	zard Mitigation Grant Program	Statewide

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
FLOODING (MARCH, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	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

FEMA FUNDED MITIGATION PROJECTS

Town of Medway has received funding from FEMA for one mitigation project under the Hazard Mitigation Grant Program (HMGP). This project totaled $680,719. The project is summarized in Table 3 below.

Table 3 FEMA-Funded Mitigation Projects

Grant	Project Title	Scope of Work	Total Cost
HMGP 1813-21	Brentwood Drainage Project	Drainage Improvements	$680,719

COMMUNITY PROFILE

The Town of Medway is a bucolic residential town in the southwestern suburbs of Boston with easy access to Route 495. It is predominantly a single-family home community with a handful of apartments and condos. Henry Gamsey was the first settler in town. Beginning in 1700 with the first modest home built by Henry for his wife Sarah, settlers filtered in and by 1713 residents had petitioned for a new town charter, and the town, to be known as Medway, was incorporated. By 1800, there had been many saw and grist mills and several textile mills established and Medway continued to grow over the years as an industrial center because of its location along its rivers (Chicken Brook and Charles River). Campbell Brothers ran a paper mill from 1854 to 1890 and the Sanford Mill was in operation in 1885. The establishment of a railroad through Medway did much to attract new mills to town. The charter for the railroad was granted by the state legislature in 1847 and served all the towns in the area, extending as far as Blackstone. The first post office was established in 1803, at which time there were just eight homes, a grist mill, two sawmills, and a store. Because of its proximity to Route 495 and other highways, Medway residents are confident the town will continue to grow residentially, industrially and commercially.

The town of Medway is located in Eastern Massachusetts and is bordered by Holliston on the north; Medway on the east; Norfolk, Franklin, and Bellingham on the south; and Milford on the west. Medway is 25 miles southwest of Boston, 24 miles southeast of Worcester, and 30 miles north of Providence, Rhode Island. Route 495, the outer belt around Boston, passes along the western border of Medway. State Routes 109 and 126 also serve the town. Commuter rail service to Back Bay Station and South Station is available in neighboring Franklin. Medway is not affiliated with a regional transit authority. Brush Hill Transportation provides rush hour service to Boston from West Medway-F. The Norfolk Airport, a General Aviation (GA) facility, is easily accessible. It has a 2,700' asphalt runway with a copter approach. The following regional facilities are located in Medway; the Medway Country Manor and Mary-land Rest Home.

Medway belongs to the Southwest subregion of the Metropolitan Area Planning Council. Medway is also a member of the I-495/Metrowest Partnership (also known as the Arc of Innovation). Through its participation in these organizations, Medway has participated in regional efforts addressing water resources, traffic problems, open space issues, economic development, town center development, and other issues. The town is governed by a Board of Selectmen with a Town Administrator. The town operates under the open town meeting format. The 2000 population was 12,448 people and there were 4,248 housing units.[1] The Town is governed by a Board of Selectmen with a Town Administrator. The town operates under the Town Meeting format. The 2010 population was 12,754 people and there were 4,613 housing units.
The town maintains a website at http://www.townofMedway.org/.

Challenges facing Medway when planning for natural disasters include:

- 23.2% of the housing units are old (built before modern building codes)
- 14.8% of the units are renter-occupied
- 2.5% of households do not own a car, posing challenges for evacuations
- 2% have limited English skills

[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.

Table 4 Medway Characteristics (Projected 2016)

Population = 13,308
• 5.4% are under age 5 • 28.1% are under age 18
• 10.4% are over age 65
• 1.6% speak English less than "very well" (over age 5)
• 5.6% of households have no vehicle
• 3.5% have a disability (over age 5)
Number of Housing Units = 4,816
• 14.8% are renter-occupied housing units
• 14.4% of housing units were built before 1940

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

- Medway has a diverse landscape that ranges from densely developed to rural and agricultural creating a bucolic and ideal community environment. [2]
- A defining characteristic of Medway is its rivers and streams, the Charles River, Hopping Brook, and Chicken Brook. These rivers and streams are all prone to extensive flood in severe storms or localized flooding during more frequent, minor storms.
- 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.
- Medway is home to historic structures surrounded by fields and forests[2] and sites that are irreplaceable and bring economic value to the town.
- Medway contains several major roadways that provide emergency routes for evacuation and for routes to medical facilities.
- Medway has some bridge crossings and dams that could be at risk in the event of flooding.
- Medway 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, often near areas of floodplain. These facilities are therefore at higher risk during natural hazards.

[2] PGC Associates. 2010. Town of Medway Open Space and Recreation Plan.

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III. PLANNING PROCESS & PUBLIC PARTICIPATION

This is an update of the original Medway Hazard Mitigation Plan, which was approved by FEMA on May 7, 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.

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 Medway, General Bylaws
    - Town of Medway, Zoning Bylaw
    - Town of Medway Master Plan 2009
    - Town of Medway Open Space Plan, 2010
    - 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
    - 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/
    - 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 X.

- 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 XI 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.

2010 PLAN IMPLEMENTATION & MAINTENANCE

The 2010 Town of Medway 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 new land-use regulations that promote smart growth (Open Space Residential Development, Multifamily housing overlay district, stormwater management regulations, and Adult Retirement Community Planned Unit Development) as well as created stormwater infrastructure improvements to mitigate localized flooding.

THE LOCAL MULTIPLE HAZARD COMMUNITY PLANNING TEAM

MAPC worked with the local community representatives to organize a Local Hazard Mitigation Planning Team for Medway. 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 Medway Hazard Mitigation Planning Team

Name	Representing
Susy Affleck-Childs	Planning and Economic Development Director
Allison Potter	Assistant Town Administrator
Bridget Graziano	Conservation Agent
Beth Hallal	Board of Health Director
Jeffrey Lynch	Fire Chief
Dave D'Amico	Director, Department of Public Services

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

October 12, 2017	*1st Meeting of the Medway Local Hazard Mitigation Planning Team*
March 7, 2018	2nd Meeting of the Medway Local Hazard Mitigation Planning Team
June 13, 2018	3rd Meeting of the Medway 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.

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 once the draft plan was complete and ready 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 Medway Hazard mitigation planning process during two public presentations before the Board of Selectmen meetings in April 2, 2018 and June 18, 2016.

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:

- Towns of Bellingham, Holliston, Medway, Norfolk, and Franklin
- Medway Public Library
- Council on Aging
- Medway Business Council
- Housing Authority
- Charles River Watershed Association
- Medway Community Farm
- Medway Historical Society
- Charles River Pollution Control District

See Appendix C for public meeting notices. The draft Medway Hazard Mitigation Plan 2018 Update was posted the following URL after the second public meeting: https://www.townofmedway.org/sites/medwayma/files/uploads/draft.medway_hazardmitigationplan.6.22.18.pdf

Members of the public could access the draft document and submit comments or questions to the Town and MAPC. There were no public comments received by the town.

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.

PLANNING TIMELINE

October 12, 2017	First Meeting of the Medway Local Hazard Mitigation Planning Team
March 7, 2018	Second Meeting of the Medway Local Hazard Mitigation Planning Team
June 13, 2018	Third Meeting of the Medway Local Hazard Mitigation Planning Team
April 2, 2018	First Public Meeting with Medway Board of Selectmen
June 18, 2018	Second Public Meeting with Medway Board of Selectmen
July 27, 2018	Draft Plan Update submitted to MEMA
September 12, 2018	Approval Pending Adoption (APA) issued by FEMA

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IV. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the Town of Medway 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.

OVERVIEW OF HAZARDS AND IMPACTS

In order to update Medway'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 in the Vulnerability Assessment).

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 5 summarizes the hazard risks for Medway. 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 Medway using the definitions for hazard frequency and severity listed below. Based on this, the Town set an overall priority for each hazard.

Table 5 Hazard Risks Summary

Hazard	Frequency		Severity	
	Massachusetts	**Medway**	**Massachusetts**	Medway
Flooding	High	High	Serious to extensive	**Serious to extensive**
Dam failures	Low	Low	Extensive	**Extensive**
Coastal Hazards	High	N/A	Serious	**N/A**
Tsunamis	Low	N/A	Extensive	**N/A**
Hurricane/Tropical Storm	Medium	Medium	Extensive to Catastrophic	**Extensive to Catastrophic**
Tornadoes	Medium	Medium	Serious	**Minor**
Thunderstorms	High	High	Minor	**Minor**
Nor'easter	High	High	Minor	**Minor**
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 Medway

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 Medway: (i) coastal hazards and tsunamis, due to the town's inland location away from the coast; (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 Medway's rivers are not typically completely frozen during the winter months and the US Army Corps of Engineers Ice Jam Database shows no documentation of ice jams occurring in the Town of Medway.

FLOOD RELATED HAZARDS

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

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 Medway. The best available local data is for Norfolk County through the National Centers for Environmental Information (see Table 6). Norfolk County, which includes the Town of Medway, 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 6 Norfolk County Flood Events, 1996-2016

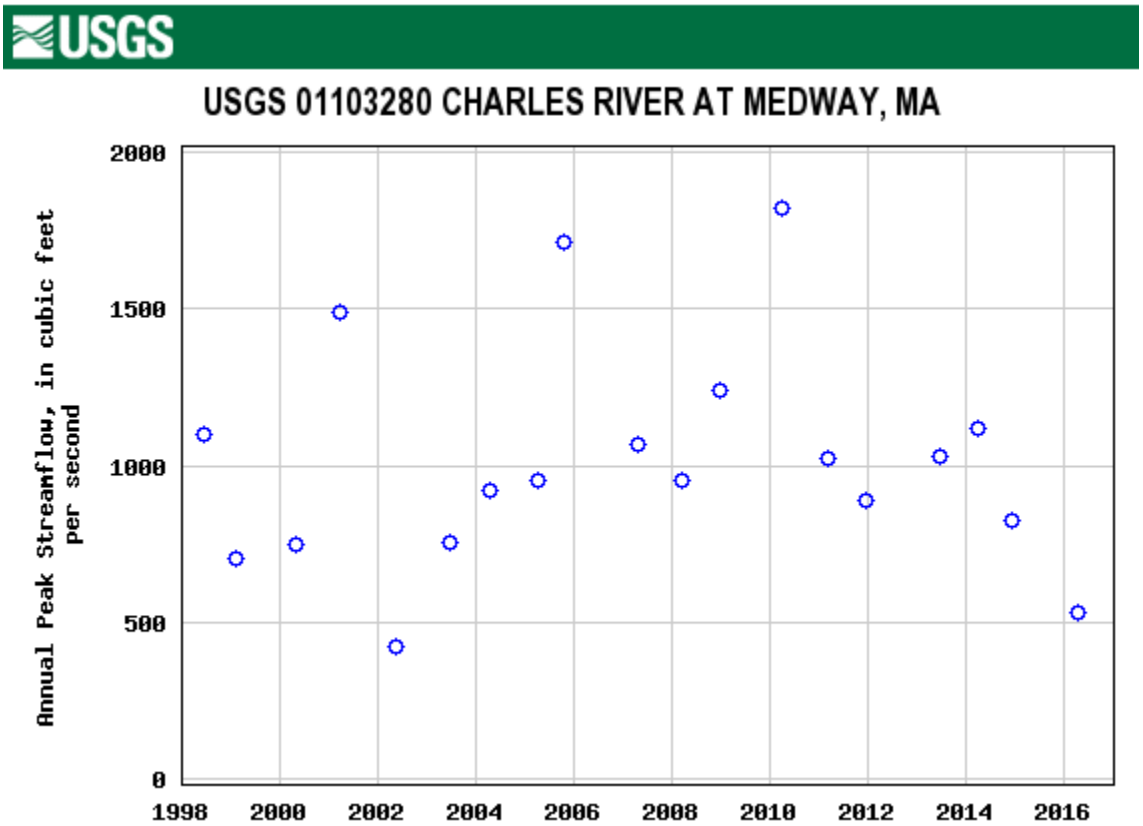
Date	Deaths	Injuries	Property Damage
01/27/1996	0	0	0.00K
09/18/1996	0	0	0.00K
10/21/1996	0	0	0.00K
05/12/1998	0	0	0.00K
06/13/1998	0	0	570.00K
06/15/1998	0	0	0.00K
03/05/2001	0	0	0.00K
03/22/2001	0	0	0.00K
03/22/2001	0	0	0.00K
04/01/2001	0	0	0.00K
03/28/2005	0	0	0.00K
10/15/2005	0	0	30.00K
10/15/2005	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

Date	Deaths	Injuries	Property Damage
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 Centers for Environmental Information

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 Medway



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 Medway were estimated using FEMA's HAZUS-MH program. The results, shown in Table 27, indicate potential damages from a 1% Annual Chance Flood (100-year) at $15,510,000 and from a 0.2% Annual Chance Flood (500-year) at $19,290,000.

OVERVIEW OF TOWN-WIDE FLOODING

As with most of eastern Massachusetts the natural hazard threat that is most prevalent in the town of Medway, and therefore the focus of most of the town's hazard mitigation efforts is flooding. Medway is bordered by the town of Milford on the west, Holliston to the north, Millis to the east and Franklin and Bellingham to the south.

Medway has very little topographical relief and much of the flat, undeveloped land is wetland. The town is impacted by several bodies of water, including but not limited to the Charles River (and surrounding wetlands), Chicken Brook, Hopping Brook, Choate Pond, Green Stream, and Winthrop St. Pond. However, the Charles River, the largest river in Massachusetts and Chicken Brook tend to have the largest impact on flooding, as does beaver activity, inadequate flood storage and under-sized drainage systems.

The Charles River 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 and dense urban development. 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. Medway therefore, has the responsibility of preserving floodplains and other water storage areas in efforts reduce downstream flooding. 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.

Flooding within Medway usually occurs within or near floodplains. The 1% Annual Chance Flood zones are found throughout Medway, mainly along the town's water ways. Within populated areas, flooding occurs in a handful of select areas; however the town has been able to avoid significant damages by passing aggressive zoning, wetland, watershed, and groundwater regulations.

According to Local Hazard Mitigation Team, most of the town's flood-related hazards are related to high rain events, such as heavy rainstorms, tropical storms or winter storms as well as beavers. 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. Combined with the watershed from its neighboring towns to the north and west, the Medway area can accumulate a great deal of water in a short amount of time during heavy rains, severe storms and in the spring season.

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.

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

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."

LOCALLY IDENTIFIED AREAS OF FLOODING

The town identified the following local areas of potential flooding. These are summarized in Table 7 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) Brentwood (Flooding)
   Brentwood, a subdivision built in the 1970's, suffers from inadequate drainage systems. Water runoff from a hill located west of the community is the primary cause of the flooding. Additionally, development, which has increased impervious surface around the subdivision has decreased the ability for stormwater to absorb into the ground and has increased the rate of water flow. Rain water from the abutting hill coupled with increases in impervious has caused the culvert at Route 109 to exceed its capacity, further

exacerbating Brentwood flooding. Damages sustained from the flooding include street closures, property damage and basement flooding to several single family houses. These damages typically result in minor damages, but occur frequently. To the extent the Town has been allowed, they performed some drainage work in the Right of Way, but there are still some areas prone to flooding, especially through private property/residential areas. The Town received FEMA Hazard Mitigation Assistance funds to mitigate this challenge.

2) Hopping Brook (Flooding)
Each spring Hopping Brook exceeds its banks. Infrequently, the brook floods Route 109, a major roadway and escape route for Medway residents. Every spring and in larger rain storms, 4-5 five houses south of the brook sustain flood damages. Expanding the culvert under Route 109 could potentially mitigate this problem.

3) Chicken Brook at Village Street (Flooding)
During large rain storms and spring events, Chicken Brook exceeds its banks floods Village Street. The town also indicated that flooding occurs south of Chicken Brook in Bellingham causing the upstream portion in Medway to flood. The town has a pump station that runs year round, but exceeds capacity every spring and in large rain storms. While this is a frequent problem, there is little damage caused by the flooding. The town has identified a hydro analytics study of the area and/or building a retaining wall on the northern banks of Chicken Brook as potential mitigation measures.

4) Main Street by the Mill (Flooding)
During large storms water levels at Chicken Brook raise and threaten to flood the old Medway Mill. The brook flows directly under the mill, a site for potential development. In attempts to restore the natural flow of Chicken Brook, the town is looking to conduct stream restoration. Massachusetts Department of Transportation updated the drainage in the area with the Route 109 project including bio-retention, additional catch basins, new piping to manage water going through. The bridge has not been improved.

5) Charles River at Village Street (Flooding)
The Charles River rises every spring and causes or threatens flooding throughout its duration. The Charles River flows through the southern portion of Medway, which has low topography. During large storms, Village Street, a major roadway through Medway, sustains flooding resulting in partial to complete road closure. The town is currently working to mitigate flooding at this location.

6) Choate Dam (Dam/Flooding)
The Choate Dam is currently out for bid for renovation. If the dam were to break it would cause extensive to catastrophic southward/downstream damages. The dam is high significance, impounding four or five acres of water. The Town owns the dam and is liable. They completed a hydrology study on the dam.

7) Sanford Dam (Dam/Flooding)
The town is unsure of the condition of the Sanford Dam. It is a minor concern for the town since it does not own it. However, if the dam were to break it would cause extensive to catastrophic eastward/downstream damages.

17.) Walker Street Bridge (Flooding)

There is scouring present on the Walker Street Bridge walls from damage related to flooding. This a priority to repair and have requested $150,000 for repairs from the Town.

18.) High School Entrance Road

At the entrance road to the high school, beaver activity has raised the level of the water causing flooding. This could become more problematic in the future.

Table 7 Locally Identified Areas of Flooding

Locally Identified Hazards Site ID	Name	Type	Comments
1	Brentwood	Flooding	Flooding
2	Hopping Brook	Flooding	Flooding
3	Chicken Brook at Village Street	Flooding	Flooding
4	Main Street by the Mill	Flooding	Flooding
5	Charles River	Flooding	Flooding
6	Choate Dam	Flooding	Dam
7	Sanford Dam	Flooding	Dam
17	Walker Street Bridge	Flooding	Flooding scours bridge walls
18	High School Entrance Road	Flooding	Beaver causing flooding

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 Medway.

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 Medway.

According to data provided by the Massachusetts Department of Conservation and Recreation (DCR) and the town, there are three dams located in Medway. Two of these are privately owned one is owned by the Town of Medway. None of the dams in Medway were listed in the state auditor's report that identified dams in unsafe or poor condition. Medway's dams are summarized in Table 8 according to ownership and hazard potential. DCR defines dam hazard potential 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 8 Inventory of Dams in Medway

Dam Name	River	Owner	Owner Type	Hazard Potential Classification
Stanford Mill Pond Dam	Charles River	Private	Private	Significant Hazard
Medway(Choate) Park Dam	Chicken Brook	Town of Medway	Municipality	Significant Hazard
West Medway Dam	Charles River	Private	Private	Low Hazard

There have been no dam failures documented for the Town of Medway. Based on the record of previous occurrences, dam failure in Medway is a very low frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur less frequently than once in 100 years (less than 1% per year).

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 Medway. 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 Medway. Trees can knock out power lines and block major roadways, which hinders emergency response. While Medway 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. Medway would benefit from an effective tree trimming and removal programs.

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 Medway'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 9.

Table 9: 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 10 gives an overview of the wind speeds, surges, and range of damage caused by different hurricane categories:

Table 10: Saffir/Simpson Scale[3]

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

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. Falling trees and branches are a significant

[3] National Oceanic and Atmospheric Administration

problem because they can result in power outages or block traffic and emergency routes. Hurricanes are a town-wide hazard in Medway. Potential hurricane damages in Medway have been estimated using HAZUS-MH. Total damages are estimated at $6 million for a Category 2 hurricane and $36 million for a Category 4 hurricane. The hazard mapping indicates that the 100 year wind speed in Medway is 110 miles per hour.

Based on records of previous occurrences, hurricanes in Medway 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.

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[4] is summarized below:

Fujita Scale			Derived		Operational EF Scale	
F Number	**Fastest ¼ mile (mph)**	**3-second gust (mph)**	**EF Number**	**3-second gust (mph)**	**EF Number**	**3-second gust (mph)**
0	40 – 72	45 – 78	0	65 – 85	0	65 – 85
1	73 – 112	79 – 117	1	86 – 109	1	86 – 110
2	113 – 157	118 – 161	2	110 – 137	2	111 – 135
3	158 – 207	162 – 209	3	138 – 167	3	136 – 165
4	208 – 260	210 – 261	4	168 – 199	4	166 – 200
5	261– 318	262 – 317	5	200 – 234	5	Over 200

Source: Massachusetts State Hazard Mitigation Plan, 2013

[4] 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). [5]

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 four 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.

There has been one documented tornado within the limits of the Town of Medway, and since 1956 there have been 11 tornadoes in surrounding Norfolk County recorded by the Tornado History Project. One of these was an F2 tornado, and three were FI.

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.

Table 11 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 Medway, tornado impacts are relatively localized compared to severe storms and hurricanes. Damages from any tornado in Medway would greatly depend on

[5] Morrison, Sara. 2014. Tornados of Massachusetts Past.https://www.boston.com/weather/untagged/2014/07/28/tornadoes-of-massachusetts-past

the track of the tornado. The greatest potential damages would be in the most densely developed part of town in the town center. While there are no existing estimates for potential damages from tornadoes in Medway, the best available date for Norfolk County (Table 11) shows that 11 recorded tornadoes since 1956 resulted in a range of damages from &1,532,000 to $1,640,000 million. One fatality and six injuries were reported.

Based on the record of previous occurrences since 1950, Tornado events in Medway 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.

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 Medway is for Norfolk County through the National Centers for Environmental Information. Between the years 1995 and 2016 NOAA's National Centers for Environmental Information records show 69 thunderstorm events in Norfolk County (Table 12). These storms resulted in a total of $1,062,000 in property damages. There were no injuries or deaths reported.

Table 12 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	20,000
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	20,000

Date	Magnitude*	Deaths	Injuries	Damage ($)
6/16/2002	50	0	0	5000
7/15/2002	62	0	0	25,000
7/23/2002	50	0	0	7000
8/21/2004	50	0	0	25,000
8/5/2005	50	0	0	25,000
8/14/2005	50	0	0	20,000
5/21/2006	52	0	0	35,000
6/1/2006	50	0	0	15,000
6/23/2006	50	0	0	15,000
7/4/2006	50	0	0	40,000
7/21/2006	50	0	0	15,000
7/28/2006	50	0	0	20,000
8/2/2006	50	0	0	55,000
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	20,000
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	10,000
7/7/2009	50	0	0	500
7/8/2009	50	0	0	1000
7/31/2009	50	0	0	26,000
6/6/2010	53	0	0	10,000
6/20/2010	58	0	0	113,000
6/24/2010	50	0	0	1000
8/19/2011	50	0	0	7000
6/23/2012	50	0	0	41,000
8/10/2012	50	0	0	5000
8/15/2012	40	0	0	500
6/17/2013	50	0	0	11,000
7/29/2013	50	0	0	20,500
7/3/2014	50	0	0	20,000
7/28/2014	60	0	0	50,000
6/23/2015	50	0	0	5000
8/4/2015	50	0	0	30,000
8/15/2015	50	0	0	35,000
2/25/2016	56	0	0	94,000
6/7/2016	50	0	0	10,000
7/18/2016	50	0	0	90,000

Date	Magnitude*	Deaths	Injuries	Damage ($)
7/22/2016	50	0	0	65,000
7/23/2016	40	0	0	35,000
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 Medway. 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. While there are no existing estimates for potential damages from thunderstorms in Medway, the best available date for Norfolk County (Table 11) shows that from 1995 to 2016 thunderstorms resulted in $1,062,000 in property damages. There were no injuries or deaths reported.

Based on the record of previous occurrences, severe thunderstorms in Medway 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).

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 A indicates one snowfall band within Medway. The average annual snowfall in Medway 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.

Winter storms are a potential town-wide hazard in Medway. The impacts of winter storms are often related to the weight of snow and ice, which can cause roof collapses and also causes tree limbs to fall. This in turn can cause property damage and potential injuries. Power outages may also result from fallen trees and utility lines.. 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. Not all residents are able to clear their properties, especially the elderly. Refreezing of melting snow can cause dangerous roadway conditions.

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 ¼ 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 Service[6] 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[7]:

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"

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

[6] Kocin, Paul J. and Uccellini, Louis W. 2004. A snowfall impact scale derived from Northeast storm snowfall distributions. American Meteorological Society. October 14, 2003.
[7] 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 13 Severe Winter Storm Records for Massachusetts[8]

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

The Town of Medway does not keep local records of winter storms. Data for Norfolk County, which includes Medway, 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 Medway, the best available date 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 There were no deaths and one injury reported (Table 14).

Table 14 Heavy Snow events and Impacts in Norfolk County 1996 –2014

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	-

[8] National Oceanic and Atmospheric Administration

Date	Deaths	Injuries	Property Damage
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	-
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

Date	Deaths	Injuries	Property Damage
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

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

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.

Medway is vulnerable to both the wind and precipitation that accompanies nor'easters. 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.

The entire Town of Medway could be at risk from the wind, rain or snow impacts from a nor'easter, depending on the track and radius of the storm, but due to its inland location the town would not be subject to coastal hazards.

Based on the record of previous occurrences, nor'easters in Medway 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).

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:

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

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.

Town-specific data for previous ice storm occurrences are not collected by the Town of Medway. The best available local data is for Norfolk County through the National Centers for Environmental Information (Table

15) which experienced eight events from 1969 –2016. Since 1965, Norfolk County experienced eight events, but no damages, deaths, or injuries were recorded for these events.

Table 15 Norfolk County Ice Storm Events, 1965-2016[9]

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
5/24/2004		0.75	0	0	0
8/02/2006		0.75	0	0	0
7/02/2008		0.75	0	0	0
5/24/2009		0.88	0	0	0
7/2/2009	Hail	0.88	0	0	0
6/01/2011		1.0			
6/23/2012		0.88	0	0	0
9/01/2013		0.75	0	0	0
8/7/2014	Hail	1	0	0	0
5/12/2015		0.75	0	0	0
8/04/2015		1.0	0	0	0

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 may also be vulnerable to power outages due to fallen trees and utility lines.

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 five years to once in 50 years, with 2% to 20% chance of occurring each year.

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 Medway can be found on Map 4 in Appendix B.

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

[9] NOAA, National Centers for Environmental Information. Magnitude refers to diameter of hail stones in inches.

earthquake in New England affects a much wider area than a similar earthquake in California due to New England's solid bedrock geology.[10]

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[11].

Richter Magnitudes	Earthquake Effects
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.[10] 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 16.

Table 16 Historical Earthquakes in Massachusetts or Surrounding Area[12]

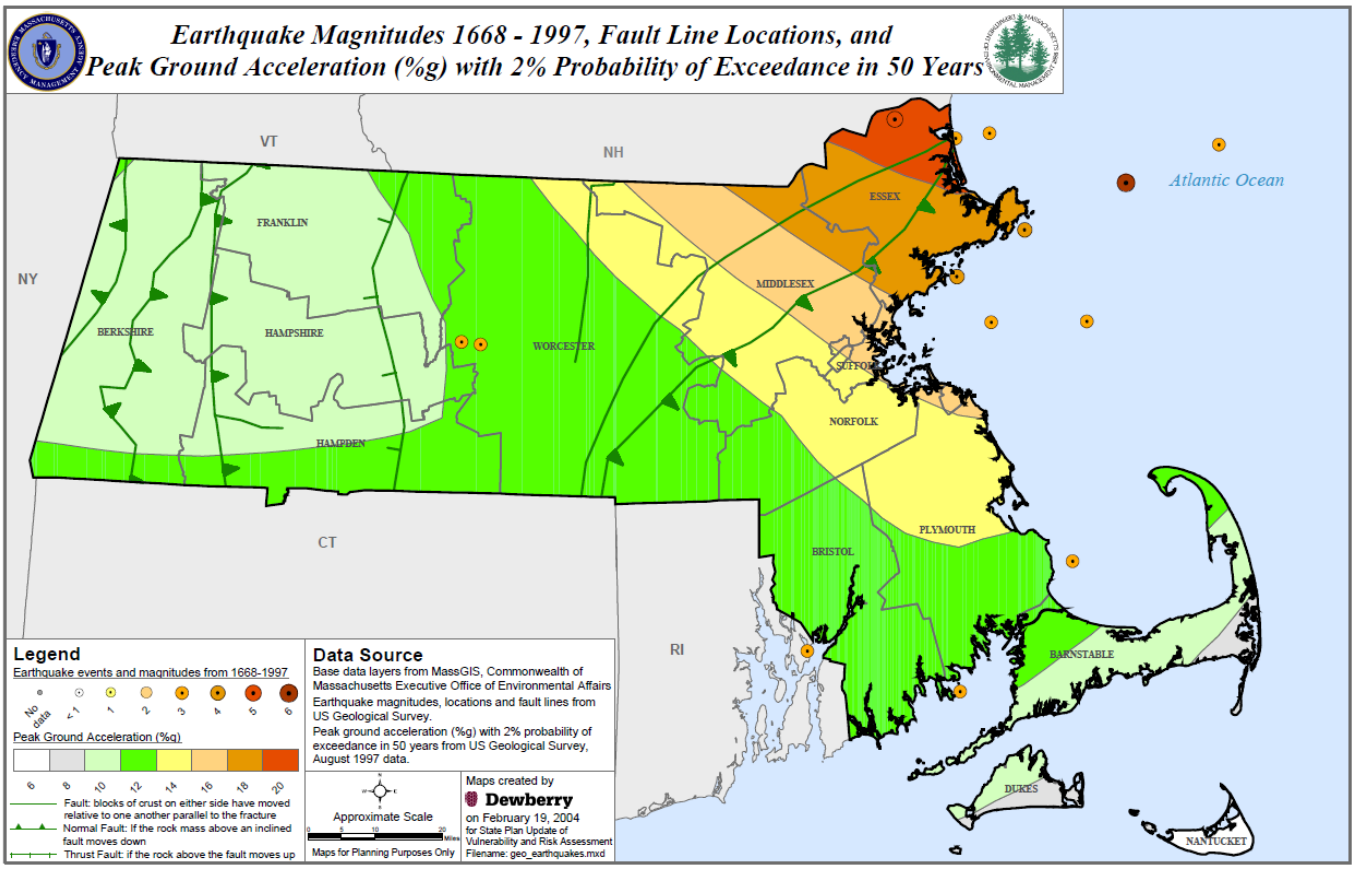
Location	Date	Magnitude
MA - Cape Ann	11/10/1727	5
MA - Cape Ann	12/29/1727	NA
MA – Cape Ann	2/10/1728	NA
Location	**Date**	**Magnitude**
MA – Cape Ann	3/30/1729	NA
MA – Cape Ann	12/9/1729	NA
MA – Cape Ann	2/20/1730	NA
MA – Cape Ann	3/9/1730	NA
MA – Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA – 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

[10]The Northeast States Emergency Consortium. http://nesec.org/earthquakes-hazards/
[11] Nevada Seismological Library (NSL), 2005
[12] United States Geological Society. https://earthquake.usgs.gov/earthquakes/

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: Boston HIRA

Figure 3 State of Massachusetts Earthquake Probability Map[13]



[13] Massachusetts Emergency Management Agency

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 (see Figure 3). Medway 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 earthquake epicenters within Medway.

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 Medway. 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 Medway have been estimated using HAZUS-MH. Total building damages are estimated at $81,720,000 for a 5.0 magnitude earthquake and $858,200,000 for a 7.0 magnitude earthquake. Other potential impacts are detailed in Table 26 Estimated Damages from Earthquakes.

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 Local Steering Committee s that earthquakes are not a major concern for the Town.

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.[14] 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; other causes include earthquakes weakening slopes, excess weight from accumulation of rain or snow, and stockpiling of rock or ore, from waste piles, or from man-made structures.

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

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.

Estimated Volume	**Expected Landslide Velocity**[15]		
(m^3)	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

Most of Medway has been classified as having a low risk for landslides (see Map 4, Appendix B), and the Local Steering Committee stated that they were unaware of any areas of geologic instability. There are not many steep slopes in the town and the Local Steering Committee concurs that landslides are not a major threat or occurrence in Medway. 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 Medway, 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 Medway, 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 Medway.

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).

[15] Cardinali et al, 2002. *A Geomorphological Approach to the Estimation of Landslide Hazards and Risks in Umbria, Central Italy.*

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.

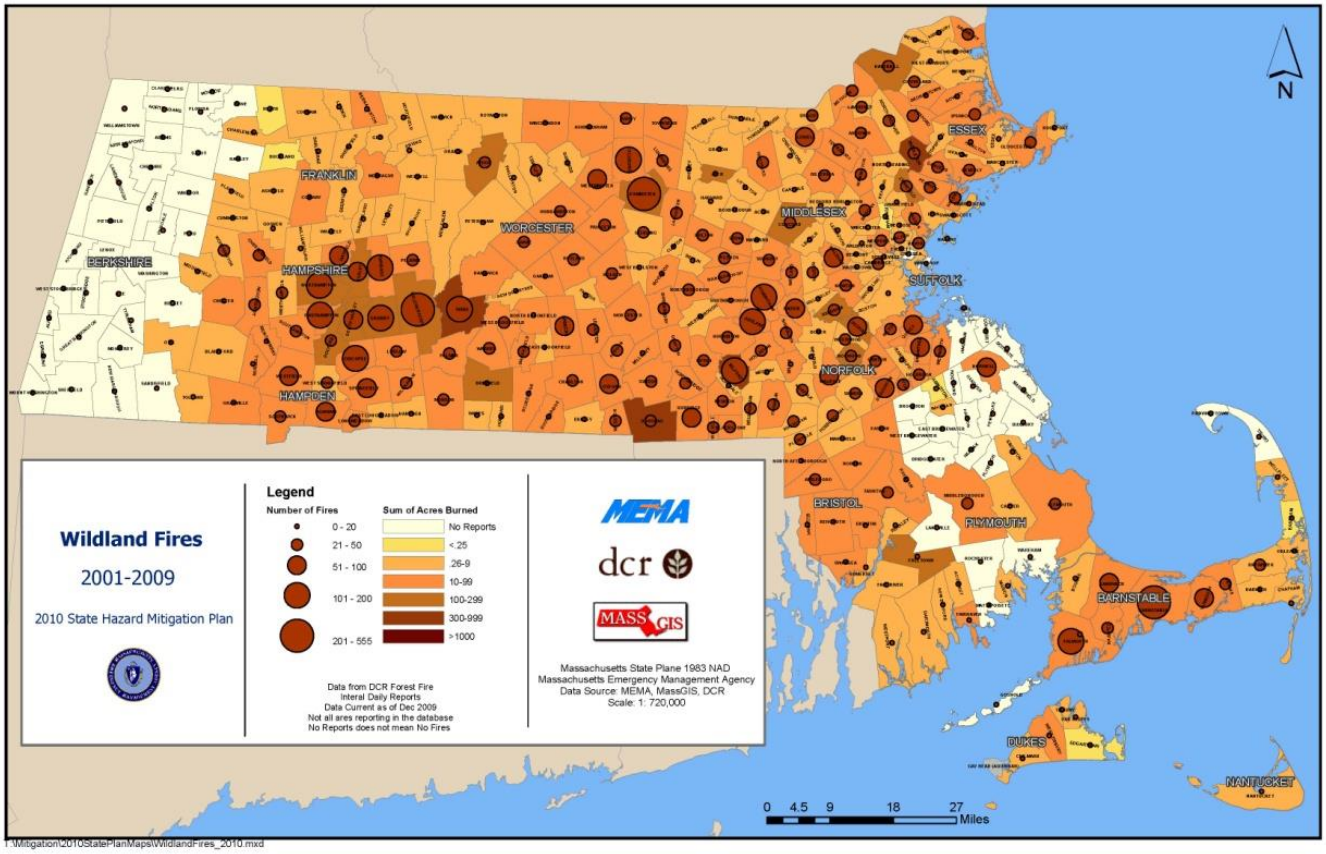
A wildfire differs greatly from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to unexpectedly change direction, and its ability to jump gaps such as roads, rivers and fire breaks. These fires can present a hazard where there is the potential 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 4 below, indicates that the wildfire extent in Medway consists of 9 to 26 acres burned, with 51 to 100 recordable fires from 2001 to 2009.

The Medway Fire Department responds to approximately 35 brush fires annually. There have been no reports of significant property damage or deaths related to brush fires. In most areas of town, fires are inadvertently caused by pedestrian recreational use, careless disposal of cigarettes, and by weather conditions such as lack of rainfall, winds and lightning. Most of these fires are small, but some are larger. There is a potential for severe fires, especially during dry summers and fall months. The Fire Chief, indicated that the town has all-terrain vehicles capable of fighting remote brush fires located off existing roadways.

Figure 4 Massachusetts Wildfires 2001-2009[16]



The Local Steering Committee identified the following fire hazard areas. The numbers correspond to the numbers on Map 8, "Hazard Areas" and do not reflect priority order.

Locally Identified Hazards Site ID	Name	Type
8	Oakland Park	Brush Fire
9	Fisher Street	Brush Fire
10	High Tension Lines	Brush Fire
11	High School	Brush Fire
12	Industrial Park	Brush Fire
19	Winthrop/Temple/Main	Brush Fire
20	240-250 Main Street	Brush Fire
21	108/114 Main Street	Brush Fire
22	119/124 Milford Street	Brush Fire
23	153-157 Lovering	Brush Fire
24	27-38 Winthrop Street	Brush Fire
25	23 Clark Street	Brush Fire

[16] Massachusetts State Hazard Mitigation Plan

Less than 1% result in any significant property damage and there have been no deaths as a result of brush fires. The areas with the highest incidence of brush fires are around the Interstate 495 corridor from careless disposal of cigarettes.

Potential vulnerabilities to wildfires in Medway could include damage to adjacent structures and impacts to natural resources such a forested conservation land. Potential damages in Medway 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).

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.

Medway 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.

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 5 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.[17]

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 Medway, 10.4% of the population people are over 65 years old, and 3.5% of the population have a disability.

[17] National Weather Service. https://www.weather.gov/lwx/WarningsDefined#Wind%20Chill%20Advisory

Figure 5 Wind Chill Temperature Index and Frostbit Risk

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

Source: NOAA and National Weather Service.

The Town of Medway 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 17). Three other occurrences in February 2016 did not lead to any reported deaths or damages.

Table 17 Norfolk County Extreme Cold and Wind Chill Occurrences[18]

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

[18] NOAA, National Centers for Environmental Information

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 6) 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 degrees F.

Figure 6 Heat Index Chart[19]

NOAA's National Weather Service

Heat Index

Temperature (°F)

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

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

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.[20,21] In Medway children under 5 years old make up 5.4 perceten of the population, and 10.4 percent are over 65 years old.

[19] National Weather Service

[20] 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

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

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.[22] Loss of electricity not only impair a resident's ability to cool, but can cause significant medical emergency for those who require electronic medical equipment or from food-borne illnesses from contaminated food, ingested after loss of refrigeration.

The Town of Medway does not collect data on excessive heat occurrences. The best available local data are for Norfolk County, through the National Climatic Data Center. From 1999 - 2011, 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 18). Further, climate change scientists project that extreme heat events are projected to be to occur more frequently. According to the Northeast Climate Science Center, Medway 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.[23]

Table 18 Norfolk County Extreme Heat Occurrences[24]

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**

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.

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.

[22] 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.

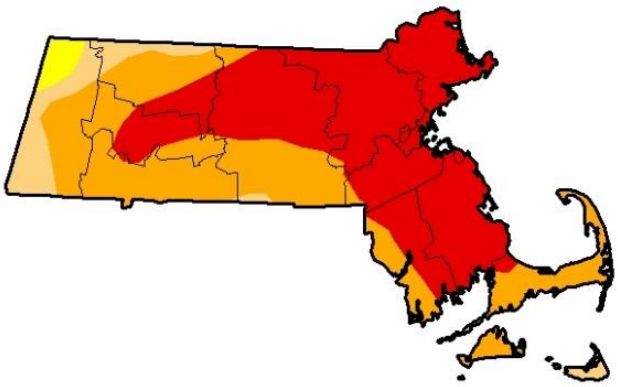
[23] *Northeast Climate Science Center. UMass Amherst. Massachusetts Climate Change Projections. December 2017*

[24] NOAA, National Centers for Environmental Information

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.[25] This is considered to be the drought of record I Massachusetts.

Figure 7 Extreme Drought Conditions in Massachusetts 2016.



U.S. Drought Monitor

Massachusetts

October 4, 2016

(Released Thursday, Oct. 6, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	98.15	89.95	52.13	0.00
Last Week 9/27/2016	0.00	100.00	98.15	89.95	52.13	0.00
3 Months Ago 7/5/2016	0.70	99.30	54.99	29.65	0.00	0.00
Start of Calendar Year 12/29/2015	22.85	77.15	26.34	0.00	0.00	0.00
Start of Water Year 9/27/2016	0.00	100.00	98.15	89.95	52.13	0.00
One Year Ago 10/6/2015	22.34	77.66	13.81	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Brian Fuchs
National Drought Mitigation Center

http://droughtmonitor.unl.edu/

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

According to the US Drought Monitor, 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 communities to buy drinking water from the Massachusetts Water Resources Authority,[26] and prompting State aid to farmers for crop losses.

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. Medway is located in the Northeast Region. In Medway, 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.

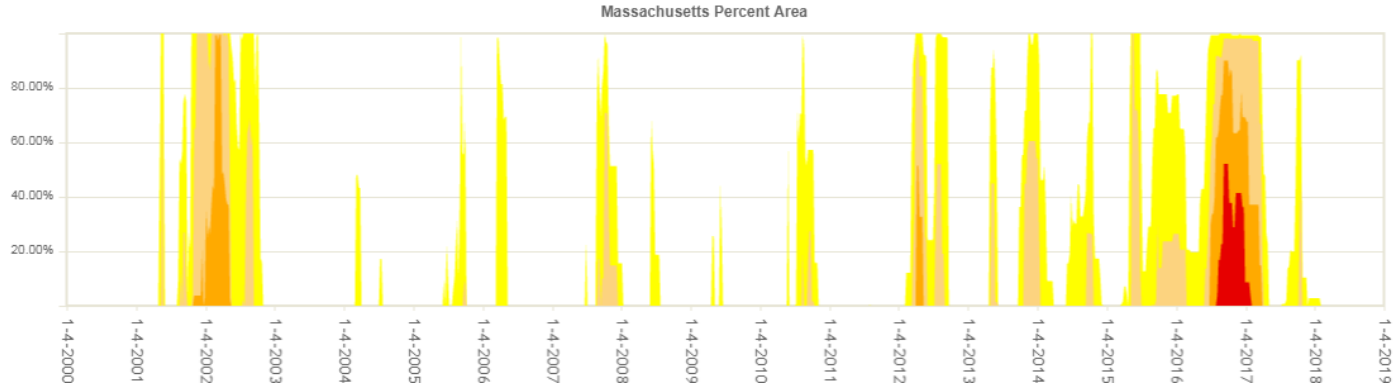
Previous Occurrences

Medway 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).

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

Figure 8 depicts the incidents of drought levels' occurrence in Massachusetts from 1850 to 2012 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 19 summarizes the chronology of major droughts since the 1920's.

Figure 8 Percent Area in Massachusetts with Drought Conditions 2000-2017[27]



Drought Emergency

Drought emergencies have been reached infrequently, with 5 events occurring in the period between 1850 and 2012: 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. As of July 2016, a Drought Warning has been declared for the Northeast region, which includes the Town of Medway. December, 2016 marked the ninth consecutive month of below average rainfall (see Figure 9). In response to the drought, the Medway Water Department instituted restrictions on outdoor watering.

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.

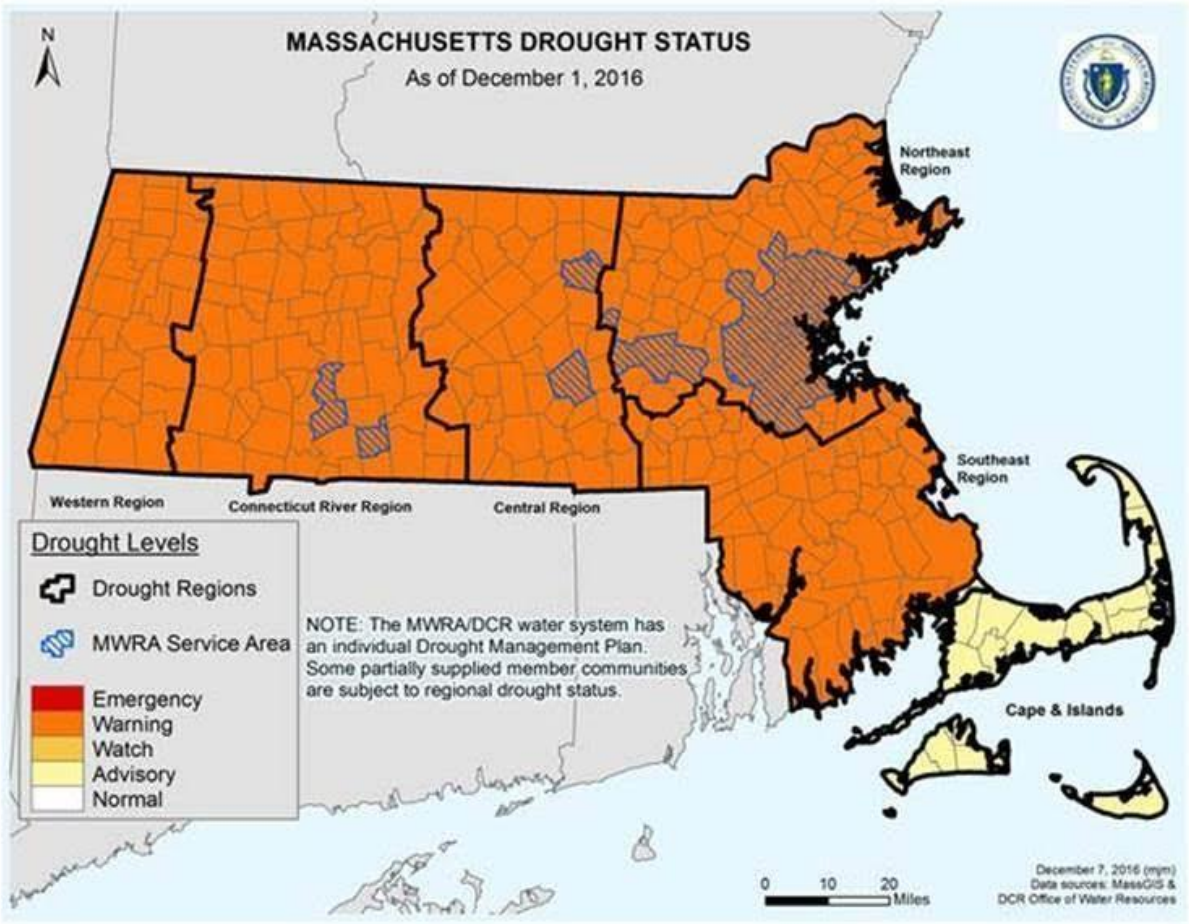
[27] U.S. Drought Monitor

Table 19 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.

Under a severe long term drought the Town of Medway 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 Medway, 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.

Figure 10 Massachusetts Drought Status as of December 2016[28]



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.

[28] MA Department of Conservation and Recreation, Office of Water Resources

LAND USE AND DEVELOPMENT TRENDS

EXISTING LAND USE

The most recent land use statistics available from the state are from aerial photography done in 2005. Table 18 shows the acreage and percentage of land in 25 categories. The majority of the Town is comprised of forest at 37.1% with low density residential use being the second most significant land use at 22.5%. Commercial and industrial combined make up 1.5% of the town, or 115 acres.

Table 20 Town of Medway, MA 2005 Land Use

Land Use	Acres	Percentage
Brushland/Successional	7	0.1
Cemetery	23	0.3
Commercial	115	1.5
Cropland	153	2.0
Forest	2,768	37.1
Forested Wetland	613	8.2
High Density Residential	134	1.8
Industrial	102	1.4
Junkyard	3	0.0
Low Density Residential	1,681	22.5
Medium Density Residential	399	5.3
Multi-Family Residential	132	1.8
Non-Forested Wetland	421	5.6
Nursery	10	0.1
Open Land	43	0.6
Orchard	4	0.0
Participation Recreation	94	1.3
Pasture	208	2.8
Powerline/Utility	228	3.1
Transitional	35	0.5
Transportation	12	0.2
Urban Public/Institutional	76	1.0
Very Low Density Residential	136	1.8
Waste Disposal	28	0.4
Water	43	0.6
Total	**7,467**	**100%**

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.

NATURAL, CULTURAL, AND HISTORIC RESOURCE AREAS

Medway has experienced significant growth since the 1990s but still maintains a desirable mix of a rural and suburban feel. A survey completed by residents in 2009 indicated that the majority of respondents place high value on preserving natural resources and Medway's rural, small town character.[29] Medway adopted the Community Preservation Act in 2001 providing a dedicated source of funding for acquiring land for open space, historic preservation, and affordable housing.

Medway contains 25 designated scenic roads and important open space and recreation areas such as Choate Park, Idylbrook Park, Medway Community Farm and trails and forest around Medway High School. The Town has protected 320 acres of land, constituting 4.3 % of the total land area. Of its total area, 352 acres are considered BioMap2 Core Habitat and 163 acres of BioMap2 Critical Natural Landscape. 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 and important natural ecosystems that support the biodiversity and protect the nature of Massachusetts. Of Medway's total Core Habitat and Critical Natural Landscape, 23.5% of that land is protected. Medway's forests and natural areas support three State-listed Species of Critical Concern, including the Spotted Turtle and Four-toed Salamander.[30] Further, 55.8% of Medway is covered by tree canopy. The tree canopy serves as a great resource for community health, beauty and livability. The Tree canopy mitigates 318,000 pounds of air pollutants per year, intercepts 62.5 million gallons of stormwater a year and sequesters 3,402 tons of carbon a year.[31]

The Charles River is also a prominent natural and recreational amenity which in part has shaped Medway's community character. Combined with Chicken and Hopping Brooks which flow into the Charles, Medway was an ideal location for mills during the Industrial Revolution.[32] Beginning as an agrarian society, it evolved with home-based industries and mills. The Town currently has two historic districts the Rabbit Hill Historic district, and the Medway Village Historic district, recognized by both the Massachusetts Historical Commission and National Parks Service in 1988 and 2008 respectively. Overall, the town has 336 historic structures registered with the Massachusetts Historic Commission. One notable is the Torrent Engine House, one of the few remaining unaltered examples of later 19th century firehouse architecture in the state.
Medway has a Demolition Delay Bylaw and the Historical Commission has been active in the review of Demolition Permit to preserve historic resources. This is in addition to 19 historic preservation projects completed in Medway using Community Preservation Act funds.

Of the 336 historic structures, seven lie within a 1% Annual Chance Flood and 15 lie within the 0.2% Annual Chance Flood. Most of these are historic homes with the exception of the Stanford Mill Dam and Bridge.

[29] Town of Medway. 2009. Medway Master Plan.
[30] MADFW and TNC. 2012. Preserving the Biodiversity of Massachusetts in a Changing World. Medway. http://maps.massgis.state.ma.us/dfg/biomap/pdf/town_core/Medway.pdf
[31] iTreeLandscape.v.3.1.Modeled April 6, 2018
[32] PGC Associates. 2010. Town of Medway Open Space and Recreation Plan

DEVELOPMENT TRENDS

According to the town's Community Development Plan , 45% of the land in Medway, equating to 3,381 acres, is developed. Developed land almost doubled (an increase of 95%) from 1971 to 1999. Meanwhile, the population increased by only 63% (from 7,938 to 12,448) between 1970 and 2000. Acreage devoted to commercial and industrial uses only increased by 98 acres during this period. Residential land area, however, increased by 1,518 acres, accounting for 92% of the increased developed land. Almost two-thirds of this increase in residential land was in the category of low density residential (lots larger than ½ acre). Thus, the 1970 population of 7,938 occupied a total of 1,478 acres or about 0.19 acres per person. The 2000 population of 12,448 occupied 2,996 acres in 1999. This is 0.24 acres per person. Another way of looking at it is that Medway was able to accommodate 7,938 people in 1971 on 1,478 residential acres. In order to add 4,510 people by 2000, it required an additional 1,518 acres of residential land. This is 0.34 acres per person, almost twice the amount of land per person used in 1971.

Table 21 Summary of Medway New Developments[33]

Development Name	Completion Year	Project Acres	Residential Units	Commercial Square Feet
Wingate Farm	2016	1.74	6	0
Williamsburg Condominium	2015	13.86	37	0
Norwood Acres	2015	3	4	0
Millstone Village	2018	51	161	0
Summer Valley Lane	2015	2	4	0
Bay Oaks	2015	8.8	8	0
Cumberland Farms	2014	1.35	0	4,500
Tri Valley Commons	2016	4.6	0	35,000
Salmon Retirement	2017	57	251	5,000
Granite Woods Medway	2009	8	8	0
Evergreen Meadow	2011	23	31	0
Franklin Creek	2011	2.7	6	0
Pine Meadow Medway	2016	6.3	16	0
Ishmael Coffee Estates	2010	0	36	0
Grapevine Estates	2009	0	10	0
Applegate Farm	2015	0	44	0

[33] MAPC Development Database

Development Name	Completion Year	Project Acres	Residential Units	Commercial Square Feet
Winchester	2009	5	6	0
Woodside/Deerview Meadow	2010	0	105	0
Hartney Acres	2010	15	16	0
Morgan Heights	2009	5	6	0
Granite Estates	2009	0	36	0
Charles River Village	2016	7.6	23	0
Village at Pine Ridge	2010	18.34	41	0
Fox Run Farm	2014	0	31	0
Total		**234**	**886**	**44,500**

Development trends throughout the metropolitan region are tracked by MAPC's Development Database, which provides an inventory of new development over the last decade. The database tracks both completed developments and those currently under construction. The database includes 24 new developments in the Town of Medway. 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 24 developments in Medway include a total of 886 housing units, 44,500 square feet of commercial space, and are sited on a total of 234 acres (see Table 21).

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. The analysis shows that one development, Williamsburg Condominiums is within a 0.2% Annual Chance Flood Zone and Evergreen Meadows is at the edge of a 0.2% Annual Chance Flood. 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 Medway; the entire town is in the same category, which has a 100-year wind maximum speed of 110 miles per hour. Overall, Medway's new development does not significantly increase the town's vulnerability to natural hazards.

POTENTIAL FUTURE DEVELOPMENT

MAPC consulted with town 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 and shown on Map 8 in Appendix B and Table 22.

Table 22 Potential Future Development Sites

Development Areas Site ID	Name	Type*
A	The Willows/ Walnut Grove on the Charles	Future Development
C	Millstone/ Betania II	Development
D	Applegate Farm	Development
F	Shady Oaks	Potential Development
E	Oak Grove	Potential Development
H	CommCan., Inc./ Industrial Park	Development
L	Williamsburg Condominiums/ West street Meadow	Development
M	Maritime 40B	Future Development
N	Morningside Run/ Fox Run 40b	Development
P	Medway Mill Redevelopment	Potential Development
Q	Ishmael Coffee Estates	Development
R	Timber Crest Estates	Future Development
S	Industrial/Business Park at 1-495	Development
T	Medway Greens	Future Development
U	Glen Brook Way	Potential Development
V	179/181 Main Street	Potential Development
W	The Haven	Potential Development
X	Paul Revere Estates	Future Development
Y	143 Village Street	Future 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.

FUTURE DEVELOPMENT IN HAZARD AREAS

Table 23 shows the relationship of these 19 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 11 of the 19 development sites are partially within a flood hazard area, typically a portion of the site that is not built on.. 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 19 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 Medway; 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, Medway's potential future development would not significantly increasing the town's vulnerability.

Table 23 Future Development Sites in Hazard Areas

Map ID	Name	Status	FEMA Flood Zone
A	The Willows/ Walnut Grove on the Charles	Permitted	29.6% in AE (1% Annual Chance)
C	Millstone/ Betania II	Under Construction	20.4% in AE (1% Annual Chance) and 5.1% in X (0.2% Annual Chance)
R	Timber Crest Estates	Permitted 40B Potential Development	0.2% Annual Chance Flood
D	Applegate Farm	Under Construction	No
S	Industrial/Business Park at 1-495	Under Construction	6.5% in A and 4.2% in AE (1% Annual Chance) and 1.7% in X (0.2% Annual Chance)
F	Shady Oaks	Potential Development	31.4% in AE (1% Annual Chance Flood) and 1% in X (0.2% Annual Chance)
H	CommCan., Inc./ Industrial Park	Under Construction	No
E	Oak Grove	Urban Renewal Plan approved. Residential, commercial and industrial uses.	No
L	Williamsburg Condominiums/ West street Meadow	Under Construction	32% in AE (1% Annual Chance Flood) and 10% in X (0.2% Annual Chance)
M	Maritime 40B	Future Development	No
N	Morningside Run/ Fox Run 40b	Under Construction	No
P	Medway Mill Redevelopment	Potential Development	12% in AE (% Annual Chance Flood) and 22.2 % in X (0.2% Annual Chance)
Q	Ishmael Coffee Estates	Development	No
T	Medway Greens	Permitted	No
U	Glen Brook Way	In Permitting Process	1% Annual Chance Flood and 0.2% Annual Chance
V	179/181 Main Street	Future Development	No
W	The Haven	Under Construction	1% Annual Chance Flood and 0.2% Annual Chance
X	Paul Revere Estates	Permitted	1% Annual Chance Flood
Y	143 Village Street	Permitted	No

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 50 facilities identified in Medway. These are listed in Table 24 and are shown on the maps in Appendix B.

Explanation of Columns in Table 24

- ***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 24 Critical Facilities and Relationship to Hazard Areas

Map ID	Name	Type	Landslides	FEMA Flood Zone	Locally Identified Hazard	Average Annual Snowfall
1	Medway High School	School	Low	No	No	36"-48"
2	Burke Memorial Elementary School	School	Low	No	No	36"-48"
2	Burke Memorial Elementary School	School	Low	No	No	36"-48"
4	Medway Middle School	School	Low	No	No	36"-48"
5	John D McGovern Elementary School	School	Low	No	No	36"-48"
6	Country Cottage Children's Center	Daycare	Low	No	No	36"-48"
7	Meeting House School Inc	Daycare	Low	No	No	36"-48"
8	Little Lamb Nursery School	Daycare	Low	No	No	36"-48"
9	Medway Police Station	Police station	Low	No	No	36"-48"
10	Medway Fire Station I	Fire station	Low	No	No	36"-48"
11	Town Hall	Town Hall	Low	No	No	36"-48"
12	Medway Country Manor	Nursing home	Low	No	No	36"-48"
13	Good Shepard Nursery School	Daycare	Low	No	No	36"-48"
14	Medway Fire Station II	Fire Station	Low	No	No	36"-48"
15	Medway Episcopal Church Nursery School	Daycare	Low	No	No	36"-48"
16	Shining Stars Nursery School	Daycare	Low	No	No	36"-48"
17	VFW Hall	Proposed Municipal Property	Low	No	No	36"-48"
18	SMOC	Family Shelter	Low	No	No	36"-48"
19	Town Hall	EOC	Low	No	No	36"-48"
20	Sanford Street Bridge	Bridge	Low	AE 1% Annual Chance with BFE	No	36"-48"
21	Walker Street Bridge	Bridge	Low	AE 1% Annual Chance with BFE	Flooding	36"-48"
22	Franklin Street Bridge	Bridge	Low	AE 1% Annual Chance with BFE	No	36"-48"
23	Choate Dam	Dam	Low	AE 1% Annual Chance with BFE	Flooding	36"-48"
24	Milford Street Culvert	Bridge	Low	AE Regulated Floodway	Flooding	36"-48"
25	Sanford Dam	Dam	Low	AE 1% Annual Chance with BFE	No	36"-48"
26	Village Street Dam	Dam	Low	AE 1% Annual Chance with BFE	No	36"-48"
27	DPS Garage	DPW Garage	Low	AE 1% Annual Chance with BFE	No	36"-48"
28	Main Street Culvert	Bridge	Low	AE 1% Annual Chance with BFE	Flooding	36"-48"
29	Medway Housing Authority	Elderly Housing	Low	No	No	36"-48"
30	Medway Housing Authority	Elderly Housing	Low	No	No	36"-48"
31	Stand Pipe 2	Water stand pipe/ Communication Repeater	Low	No	No	36"-48"
32	Medway Housing Authority	Elderly Housing	Low	No	No	36"-48"
33	Stand Pipe 1	Water stand pipe/ Communication Repeater	Low	No	No	36"-48"
34	Exelon Energy	Power generating plant	Low	No	No	36"-48"
35	Eversource	Power substation	Low	No	No	36"-48"
36	Osterman Propane	Gas and Propane distribution	Low	No	No	36"-48"

Map ID	Name	Type	Landslides	FEMA Flood Zone	Locally Identified Hazard	Average Annual Snowfall
37	Algonquin Gas	Gas transmission	Low	No	Tornado/Micro Bursts	36"-48"
38	Charles River Pollution Control District	Sewer treatment plant	Low	No	No	36"-48"
39	Medway Senior Center	Senior center	Low	No	No	36"-48"
40	Village Street Well	Well	Low	No	Flooding	36"-48"
41	Populatic Street Well	Well	Low	No	Flooding	36"-48"
42	Oakland Street Well	Well	Low	No	No	36"-48"
43	Main Street Communication Tower	Communication Tower/ Town Repeater	Low	No	No	36"-48"
44	Sprint Communication Tower	Communication Tower	Low	No	No	36"-48"
45	The Willows	Assisted Living/Senior Housing	Low	No	No	36"-48"
46	Kadin Lane Bridge	Bridge	Low	AE 1% Annual Chance with BFE	No	36"-48"
47	Claybrook Dam	Dam	Low	No	No	36"-48"
48	Shaw Street Bridge	Bridge	Low	AE 1% Annual Chance with BFE	No	36"-48"
50	Electric Utility Right of Way	Electricity Lines	Low	No	No	36"-48"
51	Medway Oil & Propane	Fuel Storage	Low	No	No	36"-48"
52	Verizon	Utility	Low	No	No	36"-48"

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."[34]

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 Medway, 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.

[34] http://www.fema.gov/plan/prevent/hazus/index.shtm

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 25 Estimated Damages from Hurricanes

	Category 2	Category 4
Building Characteristics		
Estimated total number of buildings	4,429	
Estimated total building replacement value (2010 $)	$1,671,000,000	
Building Damages		
# of buildings sustaining minor damage	155	778
# of buildings sustaining moderate damage	10	123
# of buildings sustaining severe damage	0	7
# of buildings destroyed	0	3
Population Needs		
# of households displaced	0	1
# of people seeking public shelter	0	0
Debris		
Building debris generated (tons)	4,213	11,429
Tree debris generated (tons)	1,419	3,658
# of truckloads to clear building debris (25 ton trucks)	19	93
Value of Damages		
Total property damage (buildings and content)	$5,710,830	34,177,850
Total losses due to business interruption	$ 342,510	$1,971,500

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 26 Estimated Damages from Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	4,000	
Estimated total building replacement value (2010 $)	$1,671,000,000	
Building Damages		
# of buildings sustaining slight damage	615	889
# of buildings sustaining moderate damage	301	784
# of buildings sustaining extensive damage	83	629
# of buildings completely damaged	21	1,040
Population Needs		
# of households displaced	81	1,252
# of people seeking public shelter	41	640
Debris		
Building debris generated (tons)	200,000	180,000
# of truckloads to clear debris (@ 25 tons/truck)	600	7,320
Value of Damages (Millions of dollars)		
Total property damage	$81,720,000	$858,200,000
Total losses due to business interruption	$149,550,000	$1,039,200,000

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 27 Estimated Damages from Flooding

	100 Year Flood	500 Year Flood
Building Characteristics		
Estimated total number of buildings	4,429	
Estimated total building replacement value (2010 $)	$1,671,000	
Building Damages		
# of buildings sustaining moderate damage	18	13
# of buildings sustaining extensive damage	15	15
# of buildings substantially damaged	1	3
Population Needs		
# of households displaced	145	173
# of people seeking public shelter	100	117
Value of Damages		
Total property damage	$15,510,000	$19,290,000
Total losses due to business interruption	$15,530,000	$19,310,000

V. HAZARD MITIGATION GOALS

The Medway Local Hazard Mitigation Planning Team reviewed and discussed the goals from the 2009 Hazard Mitigation Plan for the Town of Medway. 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 and incorporate climate mitigation and adaptation in hazard mitigation planning.

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VI. EXISTING MITIGATION MEASURES

The existing protections in the Town of Medway 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 29 below.

FLOOD-RELATED EXISTING MITIGATION

Medway 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)* – Medway participates in the National Flood Insurance Program. NFIP provides access to funds in the case of flood related damages. Table 28 provides and overview of NFIP information for the Town of Medway (reporting period covers through June 2018. FEMA maintains a database on flood insurance policies and claims 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.

Table 28 National Flood Insurance Program Statistics for Medway

Flood insurance policies in force	112
Coverage amount of flood insurance policies	$28,454,400
Premiums paid	$75,120
Total losses (all losses submitted regardless of the status)	7
Closed losses (Losses that have been paid)	5
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)	$ 112,880

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 Medway Department of Public Services conducts year-round 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* –Catch basins are cleaned out once a year. Included in the town's Stormwater Management program is a provision to keep catch basins free and clear of snow, ice and debris.

- *Roadway Treatments* – The town uses a mixture of sand and salt with a bit more salt in the mix. This is done to minimize the amount of sand that enters catch basins and streams. 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.
- *The Massachusetts Stormwater Policy* – This policy is applied to developments within the jurisdiction of the Conservation Commission.
- *Community Preservation Act (CPA)* – The town adopted the CPA (permitted by Massachusetts General Law Chapter 44B, Sections 3 through 7), in 2001. CPA establishes a dedicated funding source, derived from a 3% surcharge on the annual property tax and state matching funds, for the purpose of preserving open space, historical preservation, community housing and recreation.
- *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.

DAM FAILURE EXISTING MITIGATION

- *DCR dam safety regulations* – All dams are subject to the Division of Conservation and Recreation's dam safety regulations. The dams must be inspected regularly and reports filed with the DCR Office of Dam Safety.
- *Permits required for construction* – State law requires a permit for the construction of any dam.
- *The Comprehensive Emergency Management Plan* (CEMP)– The CEMP addresses dam safety.

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 Medway Tree Warden and local electric company conduct regular tree trimming. The town responds to downed tree limbs caused by winds, lightning strike reports and other weather related incidents. The town utilizes a bucket truck for tree removal efforts.

WINTER-RELATED HAZARDS EXISTING MITIGATION

- *Snow Disposal* – The town does not do any snow disposal except for removing snow at municipal buildings.
- *Roadway Treatments* – The town uses salt to pre-treat roadways during storms.

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 Medway Water Department 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 all-terrain vehicles for fighting forest fires. These vehicles provide access to remote areas that otherwise would not be reachable.

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).
- *Portable Water Pumps* – Rivers and ponds in town are available to be tapped into for water supply if necessary.
- *FEMA Resources* – A tanker task force is available through State Fire mobilization. FEMA has 8-12 tankers that can be deployed anywhere in the US within 72 hours.

LANDSLIDE HAZARD EXISTING MITIGATION

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

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.

COMPILATION OF EXISTING MITIGATION

Table 29 summarizes the many existing natural hazard mitigation measures already in place in Medway. 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 29 Table of existing hazard mitigation measures in Medway.

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.

Type of Existing Protection	Description	Effectiveness /Enforcement	Changes Needed
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)	Homeowners in the floodplain can purchase flood insurance.	There are 100 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 1.900 catch basins are cleaned out once a year.	Effective.	None.
Roadway Treatments	The town uses a mixture of sand and salt on the roads.	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.
Community Preservation Act	The town adopted CPA in 2001.	Most effective for new construction.	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, Floodplain Protection District, Open Space Residential Development, NPDES	Effective.	None.
Comprehensive Emergency Management Plan (CEMP)	The CEMP addresses dam safety issues.	Emphasis is on emergency response.	Plan needs to be updated.
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 system for dam inspections.

Type of Existing Protection	Description	Effectiveness /Enforcement	Changes Needed
DCR Dam Safety Regulations	The state has enacted dam safety regulations mandating inspections and emergency action plans.	Enforcement is an issue.	Staffing and budgeting needs to be addressed.
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	Town-wide hydrant regulations.	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.
Portable Water Pumps	Rivers and ponds in town are available to be tapped into for water supply if necessary.	Effective.	None.
All-Terrain Vehicles	The town maintains all-terrain vehicles for fighting forest fires	Effective.	None.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	The Town enforces the Massachusetts State Building Code.	Effective for most situations.	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 Department and local electric company, National Grid, conducts regular tree trimming. The Town responds to local calls.	Effective for most situations.	None.
WINTER-RELATED HAZARDS			
Roadway Operations & Treatments	The town DPS conducts salting, sanding and plowing services throughout the town during winter storms.	Effective for most situations.	None.

Type of Existing Protection	Description	Effectiveness /Enforcement	Changes Needed
Snow Disposal	The town does not do any snow disposal except for removing snow at the library	Effective for most situations.	None.

MITIGATION CAPABILITIES AND LOCAL CAPACITY FOR IMPLEMENTATION

Under the Massachusetts system of "Home Rule," the Town of Medway 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, 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 Medway 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 Medway 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.

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VII. MITIGATION MEASURES FROM THE 2010 PLAN

IMPLEMENTATION PROGRESS ON THE PREVIOUS PLAN

At a meeting of the Medway Hazard Mitigation Planning Committee, Town staff reviewed the mitigation measures identified in the 2009 Medway 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 2017 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 30 summarizes the status of mitigation measures from the 2010 plan and identification of measures that are being continued as part of the 2018 update.

Medway has made considerable progress on implementing mitigation measures identified in the 2010 Hazard Mitigation Plan. Some policy and regulation mitigation measures include implementing a Stormwater Bylaw, expansion of the water resource protection district to protect water flowing into surrounding communities and protecting all Zone II drinking water recharge areas, implementing Open Space Residential Development and Adult Retirement Community Planned Unit Development. Some infrastructure projects for flood mitigation include culvert upgrades at the Brentwood Subdivision and some other drainage improvements and construction of a retaining wall at Chicken Brook/Village Street. The Town has also acquired GIS mapping technology for municipal services and has also undertaken an update on its Open Space and Recreation Plan for prioritizing land for protection and flood control.

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.

Table 30 Medway Hazard Mitigation Measures from the 2010 Plan

Mitigation Measure		Priority in 2010 Plan	Current Status	Include in 2018 Plan Update?
FLOOD HAZARDS				
Brentwood Subdivision-Culvert Upgrades		High	Completed	No
Brentwood Subdivision-Comprehensive Drainage Improvements		High	Not Completed. The East portion (highest priority) is complete. Mid-section did not receive local support from residents. East section will be a future development project.	Yes
Hopping Brook Culvert Enlargement		High	Not Completed	Yes
Chicken Brook & Village Street Mitigation-Hydro Analysis/Drainage Study		Medium	Not Completed	Yes
Chicken Brook & Village Street Mitigation-Retaining Wall		Medium	Completed	No
Choate Dam Restoration & Repairs		Medium	Not Completed	Yes
Sanford Dam Restoration & Repairs		Medium	Not Completed	Yes
Chicken Brook Stream Restoration		Low	Not Completed	Yes
Charles River Drainage Improvements		Low	Not Completed	Yes
FLOOD HAZARDS-For NFIP Compliance				
Open Space Protection-ensure future development does not increase flooding.	Acquire additional conservation land to develop conservation areas centered around the Town's natural resource areas	High	Ongoing	Yes
	Continue open space purchases and negotiate conservation restrictions and easements	High	Ongoing	Yes
	Prioritize land acquisition or protection based on groundwater recharge standards.	High	Ongoing	Yes
	Designate clearly significant parcels as permanently protected open space.	High	Ongoing	Yes
	Continue to develop criteria to prioritize lands for protection and find ways to acquire those lands or the development rights.	High	Completing Open Space and Recreation Plan (OSRP) Update	No
	Develop partnerships with private landowners or pursue easements to protect sensitive open space or recreation lands where land acquisition is not an option.	High	Ongoing	Yes
	Promote compact development to reduce sprawl Objectives.	High	Completing Open Space and Recreation Plan Update	Yes

Mitigation Measure		Priority in 2010 Plan	Current Status	Include in 2018 Plan Update?
Open Space Protection-ensure future development does not increase flooding.	Identify key parcels of land which are most important for protecting natural resources and wildlife corridors	High	Completing Open Space and Recreation Plan Update	Yes- Implement the OSRP
	Identify key parcels of land which are most important for protecting historic landscapes and/or community character	High	Completing Open Space and Recreation Plan Update	Yes- Implement the OSRP
	Develop/implement a system of prioritizing parcels for potential acquisition	High	Completing Open Space and Recreation Plan Update	Yes- Implement the OSRP
	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) sections of the Zoning Bylaw), and use these tools to establish "eco-corridors" or greenbelts where appropriate	High	Open Space Residential Developments and ARCPUD	No
	Acquire additional conservation and open space lands. Encourage donations of open space by landowners.	High	Ongoing	Yes- Implement the OSRP
	Establish an Open Space and Recreation Plan Implementation Committee to coordinate among Town Boards and Commissions, and contact land owners	High	Ongoing	Yes- Implement the OSRP
	Increase public awareness of the value of open space, and encourage citizen input.	High	Ongoing	Yes- Implement the OSRP
	Preserve historically significant buildings and sites	High	Ongoing	Yes
Revisions to Development Bylaws and Regulations to further prevent flooding	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.	High	Completed. Town Meeting voted to accept new stormwater bylaw.	No
	Incorporate the proposed Traditional Neighborhood Development Overlay District By-Law into the town's Zoning By-Laws. This By-Law, proposed in 2007 as part of a Smart Growth Technical assistance Grant would reduce lot sizes and environmental impacts through low impact developments.	High	Completed	No
	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	Completed	No

Mitigation Measure		Priority in 2010 Plan	Current Status	Include in 2018 Plan Update?
Revisions to Development Bylaws and Regulations to further prevent flooding	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	Not Completed	Yes
	Amend zoning bylaws to exclude wetlands from the density calculations.	High	Completed	No
	Expand the Water Resource Protection District to protect water flowing into surrounding communities.	High	Completed	No
	Continue to address the on-going issue of non-point source pollution to protect the drinking water supply.	High	Completed	No
	Require aggressive and legally-binding operation and maintenance plans and reporting, with enforcement mechanisms, for private drainage facilities.	High	Not Completed	Yes
	Include construction and post-construction slope stabilization requirements in the site plan and subdivision regulations.	High	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.	High	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.	High	Completed. Town Meeting voted to accept new stormwater bylaw.	No
Flood-Related Public Education on water resources such as flood prevention and stormwater management.		High	Ongoing	Yes
BRUSH FIRE				
Brush Fire Regulation-Back yard setback requirements for fire protection		Medium	Completed	Yes
Brush Fire Education-Public Education on Brush Fire Prevention		Medium	Completed	Yes
MULTIPLE HAZARDS				
Acquire GIS Mapping Technology		High	Completed	No
Inter-municipal Collaboration to improve communications between municipalities.		Medium	Completed	Yes
Communications for Emergency Operations by upgrading to wireless communications.		Medium	Completed	No

VIII. HAZARD MITIGATION STRATEGY

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:[35]

- *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.

[35] FEMA Local Multi-Hazard Mitigation Planning Guidance

IDENTIFICATION OF POTENTIAL MITIGATION MEASURES

During the Local Steering Committee meetings, officials in Medway 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 Table 31 below.

Table 31 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.

INTRODUCTION TO POTENTIAL MITIGATION MEASURES TABLE

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 31, 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 31

FEMA Mitigation Grants includes:
- FMA = Flood Mitigation Assistance Program.
- HMGP = Hazard Mitigation Grant Program.
- PDM = Pre-Disaster Mitigation Program

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
EEA=MA Executive Office of Energy and Environmental Affairs
MAPC= Metropolitan Area Planning Council
MVP= MA Municipal Vulnerability Preparedness Program
TOM= Town of Medway

Table 31 Potential Mitigation Measures for the 2018 Hazard Mitigation Strategy

Mitigation Measures	Priority 2018	Priority 2010	Geographic Coverage	Lead Implementation	Time Frame	Estimated Cost	Potential Funding
BRUSH FIRE HAZARDS							
Brush Fire Regulation-Back yard setback requirements for fire protection	Low	Medium	Town-wide	Fire Department	2018-2023	<$10,000	Town General Fund
Brush Fire Education-Public Education on Brush Fire Prevention (Senior, Student existing)	Low	Medium	Town-wide	Fire Department	2018-2023	<$10,000	Town General Fund
DROUGHT HAZARDS							
Impose water restrictions for town facilities, residents, businesses, and institutions with exceptions for emergency response training.	High	N/A	Town-wide	DPS	2018-2023	<$10,000	Town General Fund
Public Education around drinking water supply, where drinking water comes from.	High	N/A	Town-wide	DPS	2019-2023	<$10,000	Town General Fund, MAPC
Promote drought tolerant landscaping and site design measures	Medium	N/A	Town-wide	Planning Department	Begin 2019	<$10,000	Town General Fund, MAPC
Audit water use with existing household meters, particularly during times with use restrictions.	High	N/A	Town-wide	DPS	2018-2023	<$10,000	Town General Fund
Provide Rain barrels to residents, commercial/industrial/institutions, and municipal facilities.	Low	N/A	Town-wide	DPS	2018-2023	<$10,000	Town General Fund
GEOLOGIC HAZARDS (EARTHQUAKES/LANDSLIDES)							
Assessment /feasibility study of town buildings earthquake vulnerability, especially public safety facility. Police and Fire.	Low	N/A	Town-wide	DPS/ Selectmen's Office	2020	$50,000-$100,000	Town General Fund
Assessment/ feasibility study of roadways and stormwater infrastructure vulnerable to earthquakes and landslides.	High	N/A	Town-wide	DPS/Selectmen's Office	2022	$50,000-$100,000	Town General Fund
EXTREME TEMPERATURES							
Encourage Site Design to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways.	Low	N/A	Town-wide	Planning Department	2019	<$10,000	Town General Fund
Public education campaign on extreme heat and cold to prevent health challenges or property damages (extreme cold).	Medium	N/A	Town-wide	Health Department	2018	<$10,000	Town General Fund

Mitigation Measures	Priority 2018	Priority 2010	Geographic Coverage	Lead Implementation	Time Frame	Estimated Cost	Potential Funding
WIND-RELATED HAZARDS (TORNADOS, HURRICANES, THUNDERSTORMS)							
Create a tree inventory and risk assessment. Tree trimming.	High	N/A	Town-Wide	Tree Warden	2020	$35,000	Town General Fund
WINTER STORMS							
Salt roads during winter storms	High	High	Town-wide	DPS	2018-2023	>$100,000	Town General Fund
Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.	High	N/A	Town-wide	Building Commissioner	2019	$50,000	Town General Fund
FLOODING AND DAM RELATED HAZARDS							
Open Space Protection-ensure future development does not increase flooding. Implement Open Space and Recreation Plan 2018.	Medium	High	Town-wide	Conservation Department, Planning Department	2018-2023	>$100,000	Town General Fund
Require the use of the new Low Impact Development guidance manual for all developments in Town, not just those within the Aquifer Protection District.	Medium	N/A	Town-wide	Planning	2019	Staff Time	Town General Fund
Flood-related Public Education on water resources such as flood prevention and stormwater management.	Medium	High	Town-wide	Planning Department, Conservation Commission, Building Department	2018-2023	<$10,000	Town General Fund, MAPC
Brentwood Subdivision-Comprehensive Drainage Improvements	High	High	northeast Medway	DPS, TOM	2020	$5 million	PDM, ACOE, CMRP, DEP, NCMCP, Town General Fund
Hopping Brook Culvert Enlargement	High	High	northwest Medway	DPS, TOM	2019	$250,000-$300,000	PDM, TOM
Chicken Brook & Village Street Mitigation-Hydro Analysis/Drainage Study	Medium	Medium	central Medway	TOM DPS, DCR	2020	$25,000-$100,000	PDM, ACOE, DCR, DEP, Town General Fund
Choate Dam Restoration & Repairs	Medium	Medium	Choate Pond	TOM DPS, DCR	2021-2023	$50,000-$300,000	Town General Fund, DCR, DOER
Sanford Dam Restoration & Repairs	Medium	Medium	Charles River at Medway and Franklin	TOM DPS, DCR	2021-2023	N/A	Town of Franklin
Chicken Brook Stream Restoration-better bank stabilization, development management, buy land around Chicken Brook. More plantings, wildlife buffer. Medway Block leaks into Chicken Brook. Establish vegetated cover. To prevent washouts.	Medium	Low	Chicken Brook Corridor	Conservation Department	2020	$5,000-$100,000	PDM, ACOE, CMRP, DCR, DEP, NCMCP, Town General Fund

Mitigation Measures	Priority 2018	Priority 2010	Geographic Coverage	Lead Implementation	Time Frame	Estimated Cost	Potential Funding
Charles River Drainage Improvements	Low	Low	Charles River Corridor	TOM DPS	2018-2023	$50,000-$1million	PDM, ACOE, CMRP, DCR, DEP, NCMCP, Town General Fund
Clark Street roadway and drainage improvements and resource protection. Install a bridge at Clark street over the wetland which is in the 1% Annual Chance Flood zone.	Medium	N/A	northwest Medway	TOM DPS	2022	$500,000-$1 million	PDM, ACOE, CMRP, DCR, DEP, NCMCP, TOM
MULTIPLE HAZARDS							
Inter-municipal Collaboration to improve communications between municipalities.	Medium	Medium	Regional	Selectmen's Office	2018-2023	<$10,000	Town General Fund
First Net-nationwide communication system. Participate First Net.	High	Medium	Regional/nationwide	Fire Department/Police Department	2018-2023	$50,000	HMS, Town General Fund
CLIMATE CHANGE HAZARDS							
Promote Net Zero in new buildings/new development in town. DPS is Net Zero building.	Low	N/A	Town-wide	Planning Department, Energy Manager	2020	<$10,000	Town General Fund
Investigate performing greenhouse gas inventory.	Low	N/A	Town-wide	Planning Department, Energy Manager	2020	$25,000-$35,000	Town General Fund, MAPC, DER

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 Steering Committee 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 Steering Committee 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 32 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 32 Prioritization of Potential Hazard Mitigation Measures

Mitigation Measures	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority 2018
Brush Fire Mitigation Measures				
Brush Fire Regulation-Back yard setback requirements for fire protection.	Town-wide	Low	Low	Low
Brush Fire Education-Public Education on Brush Fire Prevention.	Town-wide	Medium	Low	Low
DROUGHT HAZARDS				
Impose water restrictions for town facilities, residents business, institutions with exceptions for emergency response training.	Town-wide	High	Low	High
Public Education around drinking water supply, where drinking water comes from.	Town-wide	Medium	Low	High
Promote drought tolerant landscaping and site design measures.	Town-wide	Medium	Low	Medium
Audit water use with existing household meters, particularly during times with use restrictions.	Town-wide	Medium	Low	High
Provide Rain barrels to residents, commercial/industrial/institutions, and municipal facilities.	Town-wide	Low	Low	Low
GEOLOGIC HAZARDS (EARTHQUAKES/LANDSLIDES)				
Assessment /feasibility study of town buildings earthquake vulnerability, especially public safety facilities, police and fire.	Town-wide	Low	Medium	Low
Assessment/ feasibility study of roadways and stormwater infrastructure vulnerable to earthquakes and landslides.	Town-wide	Low	Medium	High
EXTREME TEMPERATURES				
Encourage Site Design to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways.	Town-wide	Medium	Low	Low

Mitigation Measures	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority 2018
Public education campaign on extreme heat and cold to prevent health challenges or property damages (extreme cold).	Town-wide	Medium	Low	Medium
WIND-RELATED HAZARDS (TORNADOS, HURRICANES, THUNDERSTORMS)				
Create a tree inventory and risk assessment. Tree trimming.	Town-Wide	Medium	Low	High
WINTER STORMS				
Salt roads during winter storms.	Town-wide	High	High	High
Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.	Town-wide	Low	Medium	High
FLOODING AND DAM RELATED HAZARDS				
Open Space Protection-ensure future development does not increase flooding. Implement Open Space and Recreation Plan 2018.	Town-wide	High	High	Medium
Require the use of the new Low Impact Development guidance manual for all developments in Town, not just those within the Aquifer Protection District.	Town-wide	High	Low	Medium
Flood-related Public Education on water resources such as flood prevention and stormwater management.	Town-wide	Medium	Low	Medium
Brentwood Subdivision-Comprehensive Drainage Improvements.	northeast Medway	High	High	High
Hopping Brook Culvert Enlargement.	northwest Medway	High	High	High
Chicken Brook & Village Street Mitigation-Hydro Analysis/Drainage Study.	central Medway	High	Medium	Medium
Choate Dam Restoration & Repairs.	Choate Pond	High	High	Medium
Sanford Dam Restoration & Repairs.	Charles River at Medway and Franklin	High	High	Medium

Mitigation Measures	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority 2018
Chicken Brook Stream Restoration-better bank stabilization, development management, buy land around Chicken Brook. More plantings, wildlife buffer. Medway Block leaks into Chicken Brook. Establish vegetated cover. To prevent washouts.	Chicken Brook Corridor	High	Medium	Medium
Charles River Drainage Improvements.	Charles River Corridor	High	High	Low
Clark Street roadway and drainage improvements and resource protection. Install a bridge at Clark street over the wetland which is in the 1% Annual Chance Flood zone.	northwest Medway	High	High	Medium
MULTIPLE HAZARDS				
Inter-municipal Collaboration to improve communications between municipalities.	Regional	Medium	Low	Medium
First Net-nationwide communication system. Participate First Net.	Regional/nationwide	Medium	Medium	High
CLIMATE CHANGE HAZARDS				
Promote Net Zero in new buildings/new development in town. DPS is Net Zero building.	Town-wide	Medium	Low	Low
Investigate performing greenhouse gas inventory.	Town-wide	Medium	Medium	Low

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 limit future risks. Taking into consideration the Town's stormwater requirements town-wide, the Wetlands Bylaw enforced by the Conservation Commission, the Comprehensive Plan, 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 and drainage upgrades are also priorities in this plan.

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 Department of Conservation and Recreation (DCR), the Charles River Pollution District, Massachusetts Department of Transportation (MassDOT) and the Massachusetts Bay Transportation Authority (MBTA). 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 Medway and a discussion of inter-municipal issues.

OVERVIEW OF REGIONAL FACILITIES WITHIN MEDWAY

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

- Interstate I-495 (Mass Highways)
- State roads Routes 109 and 126 (Mass Highways)
- Charles River
- Sanford Dam at the Charles River on the boundary of Medway and Franklin
- Major power utility lines, power plants, and substations
- Charles River Pollution Control District, a regional wastewater treatment facility servicing Medway, Millis, Franklin, and Bellingham

INTER-COMMUNITY CONSIDERATIONS

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

A) Coordinate on New Development on a Regional Basis

As Medway 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.

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) Stormwater Management within and along the Charles River Watershed

Medway lies along the Charles River and is one of the municipalities serviced by the Charles River Pollution Control District. Collaboration and cooperation on stormwater with the Towns of Millis, Bellingham, and Franklin, will minimize potential infrastructure capacity challenges during extreme precipitation events, minimize localized flooding, and enhance the water quality of the Charles River.

IX. PLAN ADOPTION & MAINTENANCE

PLAN ADOPTION

The Medway 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*].

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 Medway 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 five-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.

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 Health Director, 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 Medway Hazard Mitigation Plan Update will be forwarded to MEMA and DCR for review and to FEMA for approval.

INTEGRATION OF THE PLANS WITH OTHER PLANNING INITIATIVES

Upon approval of the Medway Hazard Mitigation Plan 2018 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
- Planning and Community Development
- Conservation Commission
- Public Health
- Building
- Land Use

Other groups that will be coordinated with include large institutions, Chambers of Commerce, 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 Medway Comprehensive Plan, Open Space Plan, Comprehensive Emergency Management Plan, and Capital Investment Program.

X. LIST OF REFERENCES

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

Resilient MA Climate Change Clearinghouse for the Commonwealth. www.resilientma.org

The Northeast States Emergency Consortium. http://nesec.org/earthquakes-hazards/

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APPENDIX A: LOCAL TEAM MEETINGS

AGENDA

Medway Hazard Mitigation Plan Update
Medway Local Hazard Mitigation Planning Team

Meeting #1
October 12, 2017
9:30AM
Medway Town Hall

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1. Review Project Scope of Work and Schedule

2. Update Critical Facilities Inventory and Mapping

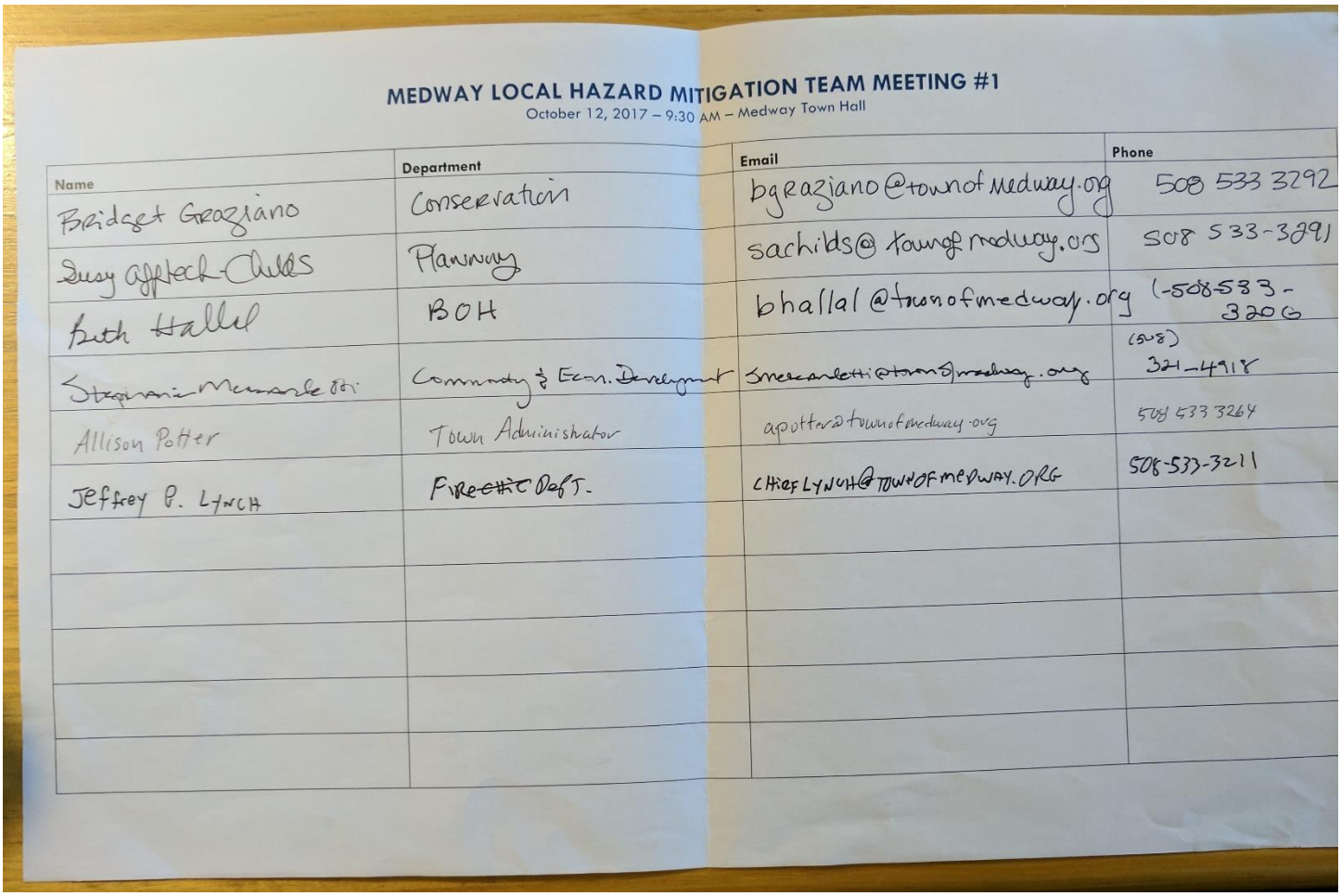
3. Identify/update local hazards:

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



MEDWAY LOCAL HAZARD MITIGATION TEAM MEETING #1

October 12, 2017 – 9:30 AM – Medway Town Hall

Name	Department	Email	Phone
Bridget Graziano	Conservation	bgraziano@townofmedway.org	508 533 3292
Susy Affleck-Childs	Planning	sachilds@townofmedway.org	508 533-3291
Beth Hallal	BOH	bhallal@townofmedway.org	(508-533-3206
Stephanie Mercandetti	Community & Econ. Development	smercandetti@townofmedway.org	(508) 321-4918
Allison Potter	Town Administrator	apotter@townofmedway.org	508 533 3264
Jeffrey P. Lynch	Fire Chief Dept.	CHIEFLYNCH@TOWNOFMEDWAY.ORG	508-533-3211

Wednesday, March 7, 2018
10:30 -12:30
Team Meeting #2

AGENDA

1. Introductions
2. Review Map and Data from Last Meeting (20 Minutes)
3. Review original existing mitigation measures from 2010 plan (15 minutes)
   - confirm effectiveness
   - note any needed changes
4. Review recommended mitigation measures from 2010 plan (40 minutes)
   - current status
   - decide which to carry forward into 2018 plan
5. Review Mitigation Goals and update as needed (20 minutes)
6. Next Steps (10 minutes)
   - Schedule a public meeting (Planning Board, Conservation Commission, etc.)
   - Create Stakeholder List for Comment (includes business, institutions, public agencies, watershed organizations)

Metropolitan Area Planning Council
MAPC
50 YEARS
dschofield@mapc.org
617-933-0794

MAPC Town of Medway
Natural Hazard Mitigation Plan 2018 Update

Team Meeting #2

Name	Title	Email
Susy Affleck-Childs	Planning & Eco. Dev Coordinator	sachilds@townofmedway.org
Allison Potter	Asst. Town Admin	apotter@townofmedway.org
Bridget Graziano	Conservation	bgraziano@townofmedway.org
Beth Hallal	BOH	bhallal@townofmedway.org
Jeffrey P. Lynch	FIRE CHIEF	CHIEFLYNCH@TOWNOFMEDWAY.ORG
Dave D'Amico	DPS Director	ddamico@townofmedway.org

MAPC

AGENDA

Medway Local Hazard Mitigation Planning Team
Meeting #3

Wednesday, June 13, 2018
2:00 PM

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1. HAZARD MITIGATION PLAN TIMELINE AND STATUS UPDATE
MVP REVIEW

2. PROPOSE NEW MITIGATION MEASURES FOR THE 2018 PLAN

Mitigation catagories:

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

3. PRIORIZITE NEW MITIGATION STRATEGIES/COST ESTIMATE

4. STAKEHOLDER LIST AND ANNOUNCEMENT

4. NEXT STEPS

Final public meeting before the Board of Selectmen – June 18, 2018

MAPC

MAPC Sign-In Sheet –Medway **LOCAL HAZARD MITIGATION TEAM MEETING** – 2018 Plan Update

June 13, 2018 – 2:00 PM – Medway Town Hall

Name	Department	Email
Bridget R Grazziano	Conservation	bgrazziano@gmail.com
Beth Hallal	B.O.H.	bhallal@townofmedway.org
Allison Potter	Town Admin	apotter@townofmedway.org
Jeffrey P. Lynch	Fire Chief	JLYNCH@TOWNOFMEDWAY.ORG

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/Medway/

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

Map1: 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 Medway 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.

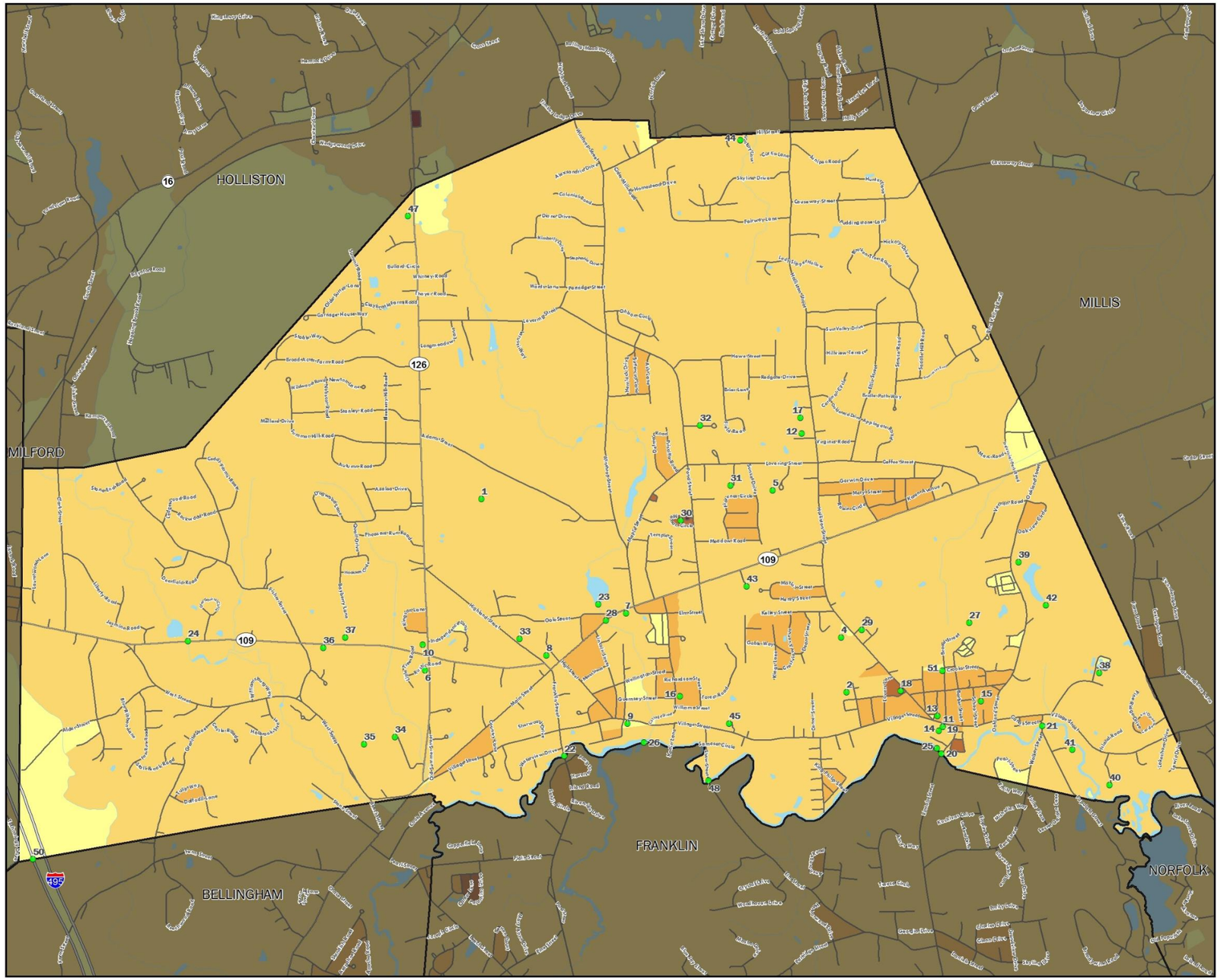
Map 6: Average Snowfall - - This map shows the average snowfall. It also shows storm tracks for nor'easters, if any storms tracked through the community.

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.

Table 33 Medway Locally Identified Hazards

Locally Identified Hazards Site ID	Name	Type	Comments
1	Brentwood	Flooding	Flooding
2	Hopping Brook	Flooding	Flooding
3	Chicken Brook at Village Street	Flooding	Flooding
4	Main Street by the Mill	Flooding	Flooding
5	Charles River	Flooding	Flooding
6	Choate Dam	Flooding	Dam
7	Sanford Dam	Flooding	Dam
8	Oakland Park	Brush Fire	Brush Fire
9	Fisher Street	Brush Fire	Brush Fire
10	High Tension Lines	Brush Fire	Brush Fire
11	High School	Brush Fire	Brush Fire
12	Industrial Park	Brush Fire	Brush Fire
13	Sanford Street	Other	Erosion Area
14	High Tension Lines at Rt. 109	Other	Tornado/Micro Bursts
16	Residential Area	Other	Winter Storm
17	Walker Street Bridge	Flooding	Flooding scours bridge walls
18	High School Entrance Road	Flooding	Beaver causing flooding
19	Winthrop/Temple/Main	Brush Fire	Brush Fires in this vicinity
20	240-250 Main Street	Brush Fire	Brush Fire report
21	108/114 Main Street	Brush Fire	Brush Fires reported
22	119/124 Milford Street	Brush Fire	Brush Fires reported
23	153-157 Lovering	Brush Fire	Brush Fires Reported
24	27-38 Winthrop Street	Brush Fire	Brush Fires Reported
25	23 Clark Street	Brush Fire	Brush Fires Reported



FEMA Hazard
Mitigation Planning Grant

MEDWAY, MA

Map 1: Population Density

Sites
- Critical Infrastructure Sites*

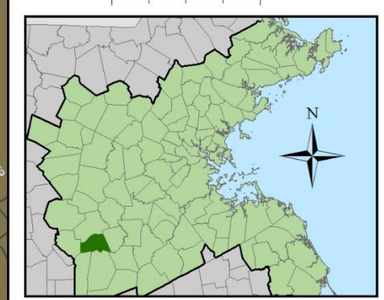
* See details in separate table

- Water Bodies
- Train Stations
- Commuter Rail Lines
- Trains

All Roads
- Interstate
- U.S. Highway
- State Route
- Street

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

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)
MEDWAY, MA

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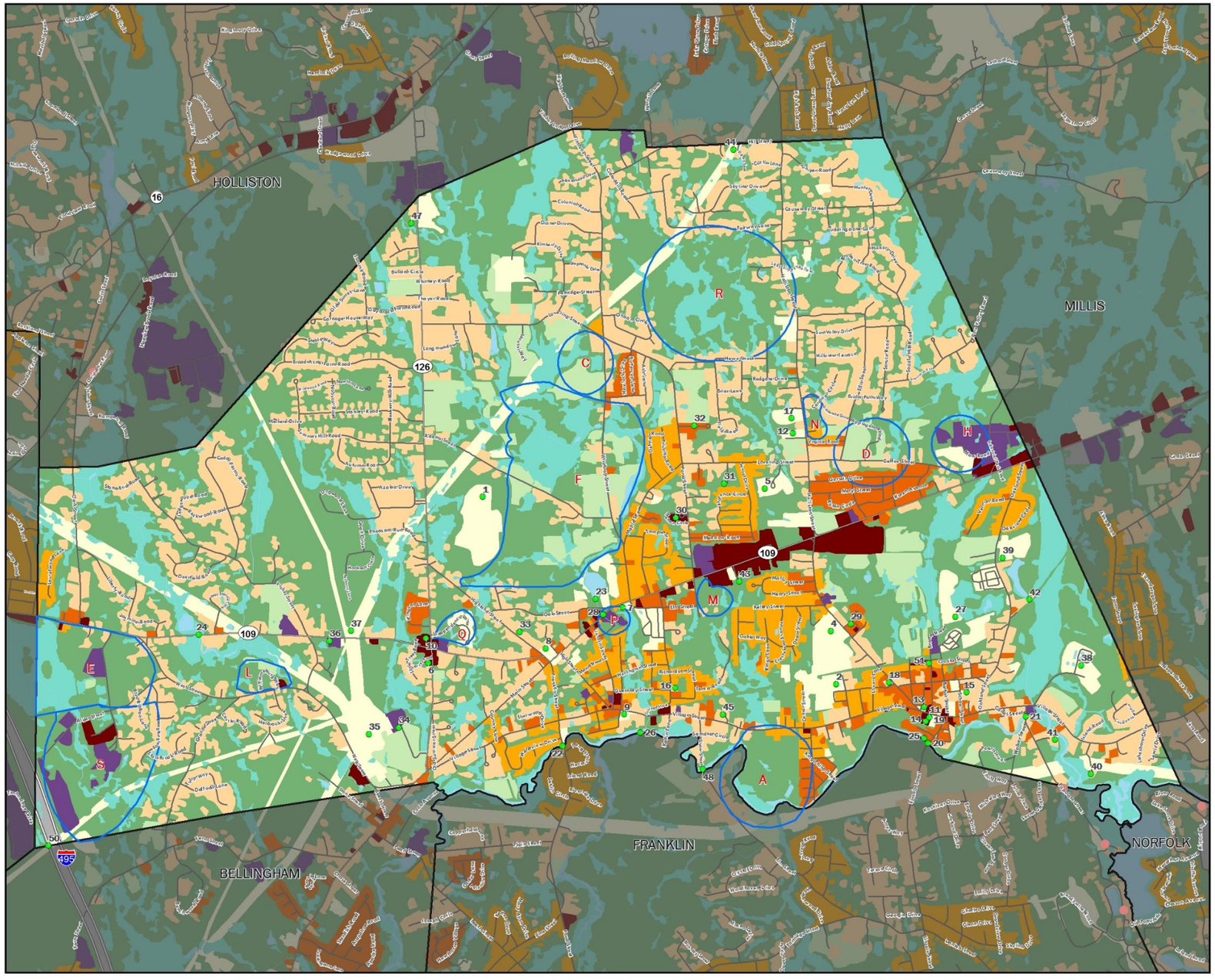
Date: 4/10/2018



MAPC dcr

FEMA Hazard
Mitigation Planning Grant

MEDWAY, MA

Map 2: Land Use

Sites
- Critical Infrastructure Sites*
- Repetitive Loss Sites

* See details in separate table

- Development Areas

* See details in separate table

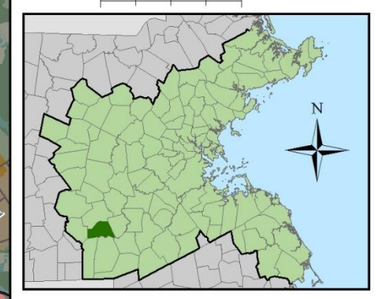
Land Use (2005)
- High Density Residential
- Medium Density Residential
- Low Density Residential
- Non-Residential Developed
- Commercial
- Industrial
- Transportation
- Agriculture
- Undeveloped
- Undeveloped Wetlands

- Train Stations
- Commuter Rail Lines
- Trains

All Roads
- Interstate
- U.S. Highway
- State Route
- Street

- Water Bodies

0 0.25 0.5 Miles



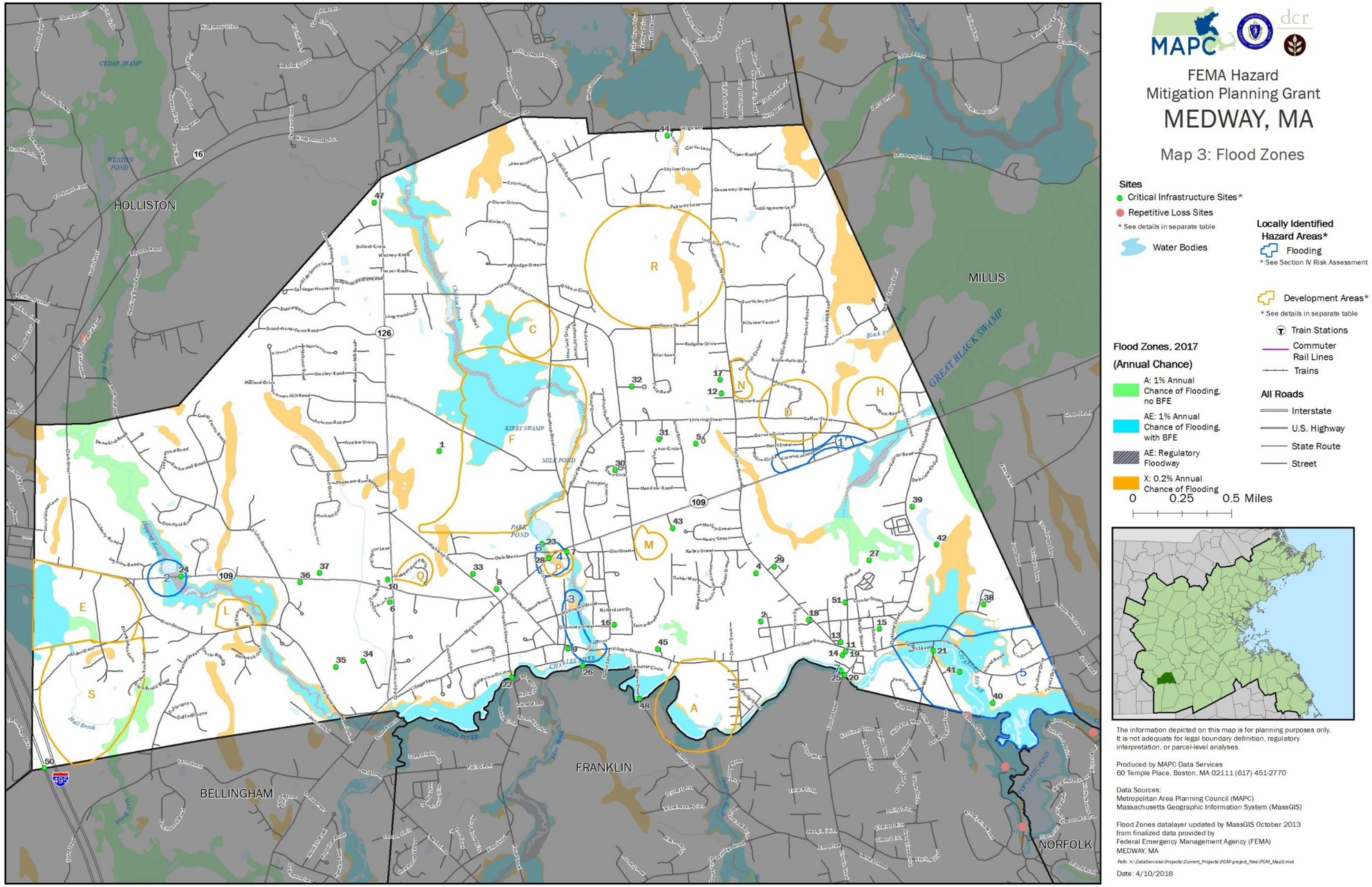
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

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)
MEDWAY, MA

Path: K:\DataServices\Projects\Current_Projects\PDM\project_files\PDM_Map2.mxd

Date: 4/10/2018



MAPC dcr

FEMA Hazard
Mitigation Planning Grant

MEDWAY, MA

Map 3: Flood Zones

Sites
- Critical Infrastructure Sites*
- Repetitive Loss Sites

* See details in separate table

Water Bodies

Locally Identified Hazard Areas*
- Flooding

* See Section IV Risk Assessment

Development Areas*

* See details in separate table

Train Stations
Commuter Rail Lines
Trains

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

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.

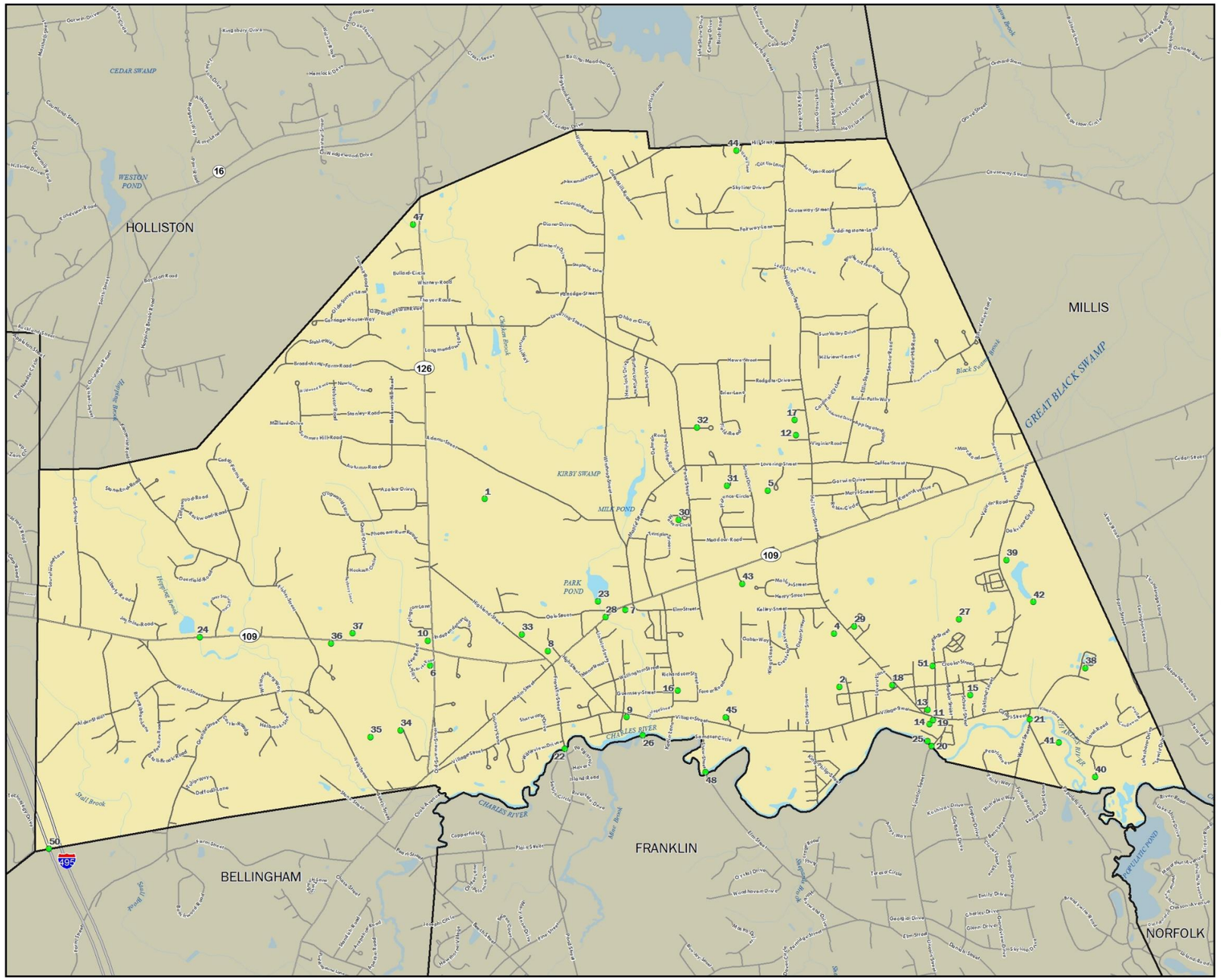
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

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

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

Path: K:\DataServices\Projects\Current_Projects\PDM\project_files\PDM_Map3.mxd

Date: 4/10/2018



MAPC dcr

FEMA Hazard
Mitigation Planning Grant

MEDWAY, MA

Map 4: Earthquakes / Landslides

Sites
- Critical Infrastructure Sites*
- Water Bodies

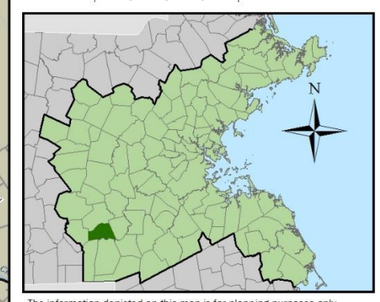
* See details in separate table

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



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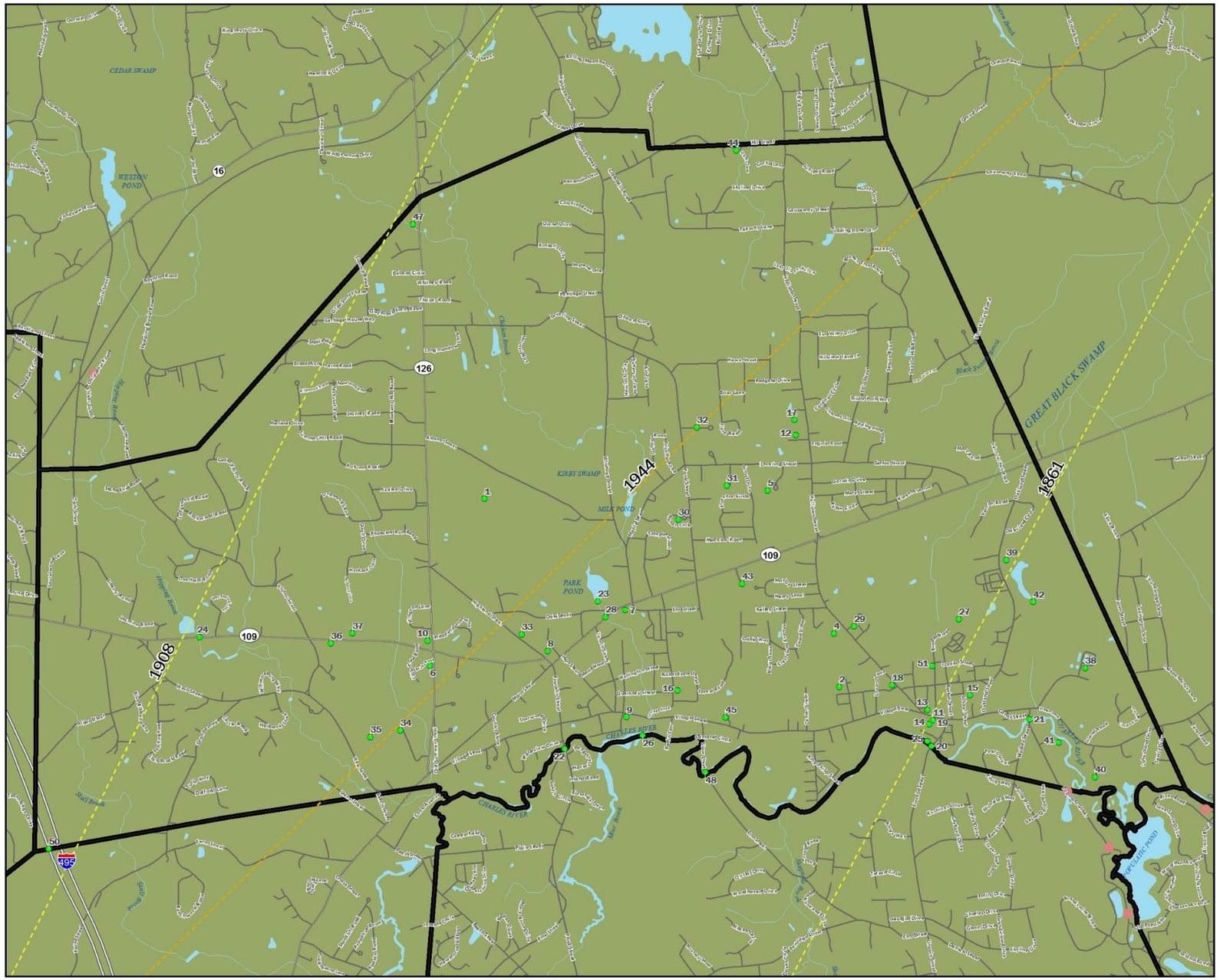
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

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)
MEDWAY, MA

Path: K:\DataServices\Projects\Current_Projects\PDM\project_files\PDM_Map4.mxd

Date: 4/10/2018



MAPC

dcr

FEMA Hazard
Mitigation Planning Grant

MEDWAY, 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

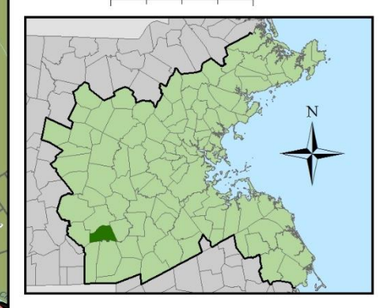
- Hurricane Surge Innudation Ares
- Train Stations
- Commuter Rail Lines
- Trains

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



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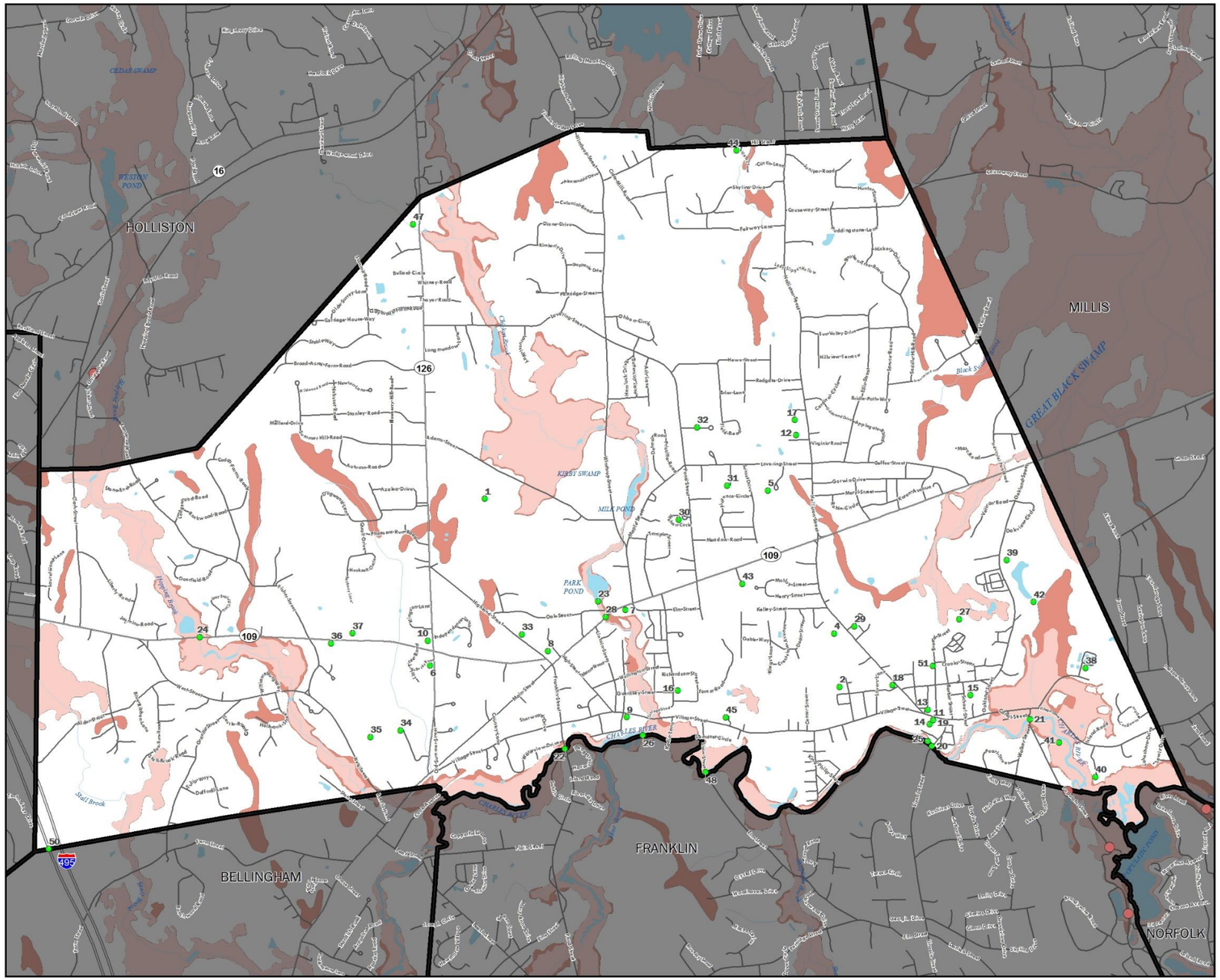
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

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)
MEDWAY, MA

Path: K:\DataServices\Projects\Current_Projects\PDM\project_files\PDM_Map5.mxd

Date: 4/10/2018

HOLLISTON
MILLIS
BELLINGHAM
FRANKLIN
NORFOLK
KIRBY SWAMP
MILL POND
PARK POND
CHARLES RIVER
GREAT BLACK SWAMP
CEDAR SWAMP
Hopkinton Brook
Stall Brook
Chickatabot Brook
Black Swamp Brook
Mill Brook
Mill Street
Milford Street
Hartford Street
Main Street
Village Street
Lincoln Street
Oak Street
Pulaski Boulevard
Coolidge Street
Medway Grove Road
Medway Cove Road
Cedar Swamp Road
Holliston Road
Bellingham Road
Franklin Road
Norfolk Road
Pond Street
Hill Street
Adams Street
Spruce Street
Rockwood Road
Fairbanks Road
Hartshorn Road
Hickory Road
Hickory Drive
Hickory Circle
Hickory Lane
Hickory Ridge
Hickory Hill
Hickory Hill Road
Hickory Hill Drive
Hickory Hill Circle
Hickory Hill Lane
Hickory Hill Ridge
Hickory Hill Terrace
Hickory Hill Way
Hickory Hill Place
Hickory Hill Court
Hickory Hill Square
Hickory Hill Crossing
Hickory Hill Estates
Hickory Hill Meadows
Hickory Hill Woods
Hickory Hill Farms
Hickory Hill Manor
Hickory Hill Park
Hickory Hill Heights
Hickory Hill Valley



MAPC dcr

FEMA Hazard
Mitigation Planning Grant

MEDWAY, MA

Map 7: Composite Natural Hazards

Composite Natural Hazards

- Low (2 Hazards)
- Moderate (3 Hazards)
- High (4 Hazards)
- Very High (5 Hazards)

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 innundation areas

Sites

- Critical Infrastructure Sites*
- Repetitive Loss Sites

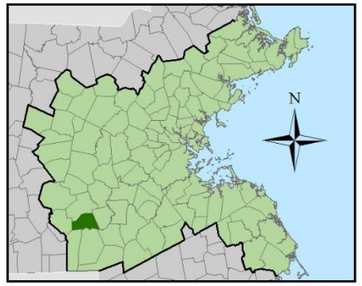
* See details in separate table

- Water Bodies

All Roads

- Interstate
- U.S. Highway
- State Route
- Street
- Train Stations
- Commuter Rail Lines
- Trains

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) / MEDWAY, MA

Path: K:\DataServices\Projects\Current_Projects\PDM\project_files\PDM_Map7.mxd

Date: 4/10/2018

FEMA Hazard
Mitigation Planning Grant

MEDWAY, MA

Map 8: Local Hazard Areas

Sites
- Critical Infrastructure Sites*
- Repetitive Loss Sites

* See details in separate table

Locally Identified Hazard Areas
- Brush Fires
- Flooding
- Historic

* See Section IV Risk Assessment

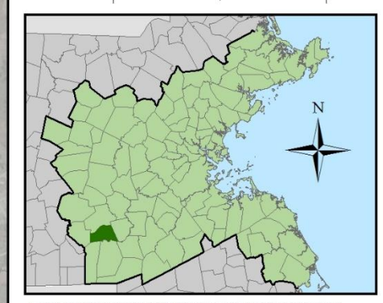
- Development Sites

* See details in separate table

- Train Stations
- Commuter Rail Lines
- Trains

All Roads
- Interstate
- U.S. Highway
- State Route
- Street

0 0.5 1 Miles



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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
MEDWAY, MA

Path: K:\DataServices\Projects\Current_Projects\PDM\project_files\PDM_Map8.mxd

Date: 4/11/2018

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APPENDIX C: PUBLIC PARTICIPATOIN

HAZARD MITIGATION PLAN PUBLIC MEETING

Natural hazards can have serious impacts on the Town of Medway and its residents

The Medway 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 Medway Hazard Mitigation Plan at a public meeting of the Board of Selectmen:

Date: Monday, April 2, 2018
Time: 7:00 PM
Location: Medway Town Hall, Sanford Hall
155 Village Street, Medway, MA

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

MAPC

Board of Selectmen
Maryjane White, Chair
Richard M. D'Innocenzo, Vice-Chair
Dennis P. Crowley, Clerk
Glenn D. Trindade
John A. Foresto

Medway Town Hall
155 Village Street
Medway, MA 02053
Phone (508) 533-3264
Fax (508) 321-4988

TOWN OF MEDWAY

COMMONWEALTH OF MASSACHUSETTS

Board of Selectmen's Meeting
April 2, 2018 7:00 PM
Sanford Hall, Town Hall
155 Village Street
Agenda

7:00 PM

- Call to order; Recitation of the Pledge of Allegiance
- Public Comments

Other Business

1. Approval of Minutes: March 26, 2018
2. Appointment Considerations: Memorial Committee – William Pride and Gordon White
3. Hazard Mitigation Plan Update: Public Input Session
4. Presentation of Fiscal Year 2017 Financial Statements – Melanson Heath
5. Discussion/Vote: May 21, 2018 Annual Town Meeting Warrant – Zoning Articles 21-27
6. Approval: Contract with Clean Harbors Environmental Services, Inc. for Household Hazardous Waste Day – $10,000
7. Vote: Request to Increase Affordable Housing Unit Price at Millstone
8. Discussion: Veterans Only Parking
9. Consideration/Vote: Town Administrator Vacation Carryover
10. Special Event Permit Applications:
    a. Medway Youth Baseball Parade – April 22, 2018
    b. Rooney's Trail Run - April 22, 2018
    c. Bikes Not Bombs Bike-A-Thon – June 10, 2018
    d. Ride for Food – September 23, 2018
11. One-day liquor License Applications:
    a. Jennifer Fitzgerald – Thayer Homestead – 4/21/2018
    b. Medway Foundation for Education – Thayer Homestead – 5/5/2018
    c. Laurie Insel – Thayer Homestead – 6/1/2018
    d. Jean Gilman – Thayer Homestead – 6/3/2018
    e. Jane Regan – Thayer Homestead – 6/8/2018
    f. Linda DiFonzo – Thayer Homestead – 6/9/2018
12. Action Items from Previous Meeting
13. Town Administrator's Report
14. Selectmen's Reports

Amanda Linehan, Communications Manager, Metropolitan Area Planning Council
617-933-0705, alinehan@mapc.org

CALENDAR LISTING / MEDIA ADVISORY

MEDWAY'S DRAFT HAZARD MITIGATION PLAN TO BE PRESENTED AT JUNE 18 PUBLIC MEETING

Meeting to present the 2018 update of Medway's Hazard Mitigation Plan and solicit public comments

Who: Medway residents, business owners, representatives of non-profit organizations and institutions, and others who are interested in preventing and reducing damage from natural hazards.

What: The Medway Hazard Mitigation Team will hold a public meeting to present an overview of the draft Medway Hazard Mitigation Plan Update 2018. The Metropolitan Area Planning Council (MAPC) is assisting the Town on the plan update, and a representative of MAPC will present an overview of the plan update.

The Town of Medway adopted its first Hazard Mitigation Plan in 2010, which was approved by the Federal Emergency Management Agency (FEMA). The plan identifies natural hazards affecting Medway such as flooding, hurricanes, winter storms, extreme temperatures and earthquakes, as well as actions that the Town can take to reduce the impacts of these hazards. FEMA requires that plans be updated regularly, so MAPC is assisting the Town prepare a 2018 updated plan.

When: Monday, June 18, 2018, 7:00 PM
Medway Board of Selectmen meeting

Where: Medway Town Hall, Sanford Hall, 155 Village Street, Medway, MA

MAPC is the regional planning agency for 101 communities in the metropolitan Boston area, promoting smart growth and regional collaboration. More information about MAPC is available at www.mapc.org.

###

HAZARD MITIGATION PLAN PUBLIC MEETING

Natural hazards can have serious impacts on the Town of Medway and its residents

The Medway 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 Medway Hazard Mitigation Plan at a public meeting of the Board of Selectmen:

Date: Monday, June 18, 2018
Time: 7:00 PM
Location: Medway Town Hall, Sanford Hall
155 Village Street, Medway, MA

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

MAPC

Board of Selectmen
Dennis P. Crowley, Chair
John A. Foresto, Vice-Chair
Richard D. Innorvino, Clerk
Glenn D. Trindade
Maryjane White

Medway Town Hall
155 Village Street
Medway, MA 02053
Phone (508) 533-3264
Fax (508) 321-4988

TOWN OF MEDWAY

COMMONWEALTH OF MASSACHUSETTS

Board of Selectmen's Meeting
June 18, 2018 7:00 PM
Sanford Hall, Town Hall
155 Village Street
Agenda

7:00 PM

- Call to order; Recitation of the Pledge of Allegiance
- Public Comments

Other Business

1. Approval of Minutes: May 31, 2018 and June 4, 2018
2. Appointment Consideration: Evaluation of Parks, Fields, and Recreational Areas Committee (EPFRAC) Youth Sports Representative (1) – Lyle Core, Jim Daly and John Farrell
3. Discussion/Vote: Millstone Village: Acceptance of Walking Trail Easement
4. Discussion/Vote: Millstone Village: Request to Increase Affordable Housing Unit Price
5. Report of the Library Board of Trustees
6. Approval: Contract with Tetra Tech for Engineering & Consulting Services
7. Approval: Contract with Salmon Home Care, LLC for Public Health Nursing Services - $14,150
8. Discussion/Vote: Other Post Employment Benefits (OPEB) Trust Investment Policy and Consideration of Investment Advisory Committee
9. Authorization to Borrow $3,310,000 (Bond Anticipation Note: Land Acquisition $510,000.00 and Parks/Recreation $2,800,000.00)
10. Public Hearing: Hazard Mitigation Plan – Metropolitan Area Planning Council (MAPC)
11. Discussion: Senior Walking Trail at Oakland Park
12. Discussion/Vote: Oakland Park Playground Naming
13. Live Entertainment Application: Medway Community Farm – September 8, 2018
14. One-day liquor License Applications:
    a. Christine Phenegar – Thayer Homestead – 6/22/2018
    b. Katherine Powers – Thayer Homestead – 7/6/2018 & 7/7/2018
    c. Mayra Santiago – Thayer Homestead – 7/8/2018
    d. Doueihi ElDoueihi – Thayer Homestead – 7/14/2018
    e. **Donna O'Connor – Thayer Homestead – 7/15/2018***
    f. Ann Lim & Daniel Fields – Thayer Homestead – 8/18/2018
    g. Elizabeth Shepard – Thayer Homestead – 8/19/2018

Amanda Linehan, Communications Manager, Metropolitan Area Planning Council
617-933-0705, alinehan@mapc.org

CALENDAR LISTING / MEDIA ADVISORY

MEDWAY'S DRAFT HAZARD MITIGATION PLAN TO BE PRESENTED AT JUNE 18 PUBLIC MEETING

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Medway Board of Selectmen meeting

Where: Medway Town Hall, Sanford Hall, 155 Village Street, Medway, MA

MAPC is the regional planning agency for 101 communities in the metropolitan Boston area, promoting smart growth and regional collaboration. More information about MAPC is available at www.mapc.org.

###

Schofield, Darci

Wed 6/13/2018 12:02 PM

To:dfraine@bellinghamma.org <dfraine@bellinghamma.org>; ritterj@holliston.k12.ma.us <ritterj@holliston.k12.ma.us>; mguzinski@millisma.net <mguzinski@millisma.net>; jhathaway@norfolk.ma.us <jhathaway@norfolk.ma.us>; jnutting@franklinma.gov <jnutting@franklinma.gov>; mperkins@minlib.net <mperkins@minlib.net>; criley@townofmedway.org <criley@townofmedway.org>; helen.luccio@verizon.net <helen.luccio@verizon.net>; charles@crwa.org <charles@crwa.org>; seth.terramane@medwaycommunityfarm.org <seth.terramane@medwaycommunityfarm.org>; itaglieri@charlesriverpcd.org <itaglieri@charlesriverpcd.org>; sdubrawski@aol.com <sdubrawski@aol.com>; julie@dennehypr.com <julie@dennehypr.com>; wteixeira@dfmurphy.com <wteixeira@dfmurphy.com>;

CcAllison Potter <apotter@townofmedway.org>;

Dear Town of Medway stakeholder:

The Town of Medway and the Metropolitan Area Planning Council have been working on the *Medway Hazard Mitigation Plan Update*, 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 22 to July 6, 2018 on the Town's web site.

The plan will be discussed at a meeting of the Medway Board of Selectmen to be held on:
When: Monday, June 18th
Time: 7:00 pm
Location: Medway Town Hall, Sanford Hall, 155 Village Street, Medway, MA

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 6, 2018 in order to be incorporated into the final draft of the plan that will be submitted to the Massachusetts Emergency Management Agency and FEMA.

Thank you.

Sincerely,

Darci Schofield
Senior Environmental Planner
Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111
617-451-2770 x 794
dschofield@mapc.org

https://mail.mapc.org/owa/#viewmodel=ReadMessageItem&ItemID=AAMkADlmNWFhYjg5LTBjZGtNDNmZS05MzRkLWZkNDk5NDhZ0M5NgBGAA... 1/2

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 MEDWAY, Massachusetts

A RESOLUTION ADOPTING THE
TOWN OF MEDWAY HAZARD MITIGATION PLAN 2018 UPDATE

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

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

WHEREAS, duly-noticed public meetings were held by Board of Selectmen in April 2, 2018 and June 18, 2018.

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

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

ADOPTED AND SIGNED this Date. _____

Name(s)

Title(s)

Signature(s)

ATTEST

APPENDIX E: FEMA PLAN REVIEW TOOL

The FEMA Plan Review Tool itemizes the features of the plan that meet each of FEMA's requirements for Hazard Mitigation Plans contained in the federal regulations at 44 CFR §201.6

The Plan Review Tool also includes comments and suggestions from FEMA on how the plan could be improved and strengthened in the future. The Town should consider these comments when it reviews and updates the plan. Also included are lists of available resources and funding for hazard mitigation.

The Plan Review Tool is included in this Appendix to incorporate it this plan for future reference.

LOCAL MITIGATION PLAN REVIEW TOOL

Jurisdiction Name & State: Town of Medway, MA

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

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

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

Jurisdiction: Town of Medway, MA	**Title of Plan:** Town of Medway Hazard Mitigation Plan Draft 2018 Update	**Date of Plan:** July 27, 2018
Single or Multi-jurisdiction plan? Single-jurisdiction	**New Plan or Plan Update?** Update	
Regional Point of Contact: Martin Pillsbury Environmental Planning Director Metropolitan Area Planning Council 60 Temple Place, Boston, MA 02111 617-933-0747; mpillsbury@mapc.org	**Local Point of Contact:** Allison Potter Assistant Town Administrator 155 Village Street Medway, MA 02053 (508) 533-3200; apotter@townofmedway.org	

State Reviewer:	**Title:**	**Date:**
Jeffrey Zukowski	Hazard Mitigation Planner	8/22/2018

FEMA Reviewer:	**Title:**	**Date:**
Gabriella Spitzer Brigitte Ndikum-Nyada	CERC FEMA Community Planner	9/7/2018 9/12/2018
Date Received in FEMA Region I	8/22/2018	
Plan Not Approved		
Plan Approvable Pending Adoption	9/12/2018	
Plan Adopted by Jurisdiction		
Plan Approved		

SECTION 1:
REGULATION CHECKLIST

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

Regulation (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Exec., pp. 1-3; Sec. III, pp. 13-17	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Sec. III, pp. 13-17	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Exec., p. 3; Sec. III, pp. 13-17	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Sec. III, p. 14; Sec. X, pp. 97-98	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Sec. III, p. 17; Sec. IX, pp. 95-96	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Sec. IX, pp. 95-96	X	
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Sec. IV, pp. 19-55 App. B, pp. 110-115	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Intro., pp. 7-8; Sec. IV, pp. 19-55	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Sec. IV, pp. 19-55, 62-68	X	

Regulation (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or	**Met**	**Not Met**
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Sec. IV, p. 27	X	
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Sec. VI, pp. 71-77	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Sec. VI, pp. 71-72	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Exec., p. 2; Sec. V, p. 69	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Sec. VIII, pp. 83-92	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Sec. VIII, pp. 84-94	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Sec. IX, p. 96	X	
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Sec. IV, pp. 58-61 App. B, pp. 108-115	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Sec. VII, pp. 79-82	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Sec. VIII, pp. 86-92	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	App. D, p. 126		

Regulation (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or	**Met**	**Not Met**
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))			
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 2:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

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

Recommended Corrections:

- Page 34 refers to winter storms being a town-wide hazard **in Sharon**. Please correct this to Medway *[NOTE: This has been corrected in the Final Plan]*.

Element A: Planning Process

Strengths:

- A range of existing studies, reports, and plans were reviewed and incorporated, resulting in a plan that is comprehensive and current.
- Community officials were effectively engaged in the planning process. Their feedback shaped the content of the plan.

Opportunities for Improvement:

- Expand the supporting documentation of the planning process by including meeting summaries. Recording the planning team's discussion and decision-making process will be useful during plan updates.
- Consider incorporating specific mitigation measure evaluation criteria into the plan monitoring procedures so that progress can be better quantified.
- Provide more detail about what stakeholder feedback was received and how it was incorporated into the plan. Documenting feedback will be useful for evaluating the plan during future updates.

Element B: Hazard Identification and Risk Assessment

Strengths:

- There is a well-grounded rationale provided for why certain hazards were omitted from analysis.
- Hazard profiles are well-defined, with detailed information about the context of the hazard and the risk it presents to the community.
- The plan contains a thorough hazard identification and risk assessment. When quantitative data was not available at the local level, data from the county or state was used and a qualitative discussion was provided.

Opportunities for Improvement:

- Consider addressing how the probability or severity of hazards may change in the future due to changes in climate, population, and/or land use.
- Incorporate existing watershed studies into the risk assessment.

Element C: Mitigation Strategy

Strengths:

- The plan includes of a variety of different types of mitigation actions (local plans and regulations, structure and infrastructure projects, natural system protections, and education and awareness programs).

- The plan includes specific, targeted mitigation actions that address the community's key vulnerabilities. Actions are detailed with information on funding, resources, timeframes, and responsible personnel.
- The community's mitigation goals are unique and customized to the community.

Opportunities for Improvement:

- Integrate and align the plan's goals with the goals of other current planning initiatives within the community.
- Further develop the analysis of how existing capabilities could be expanded. As part of the analysis, specify what is currently lacking (funding, personnel, equipment, regulations, authority, community consensus, etc.).

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

Strengths:

- The plan clearly describes the community's development changes since the last update.
- The plan includes a projection of planned and/or potential future development.
- Progress on mitigation actions is clear and comprehensive.
- Priorities in the plan recognize current conditions. They are reflective of the planning process, risk assessment, and mitigation strategy.

Opportunities for Improvement:

- Including a discussion of lessons learned about implementing mitigation actions would strengthen the plan, as would a short narrative on some “success stories” about their implementation.

B. Resources for Implementing Your Approved Plan

Refer to the State Hazard Mitigation Plan to learn about hazards relevant to Massachusetts and the state's action plan.

Technical Assistance:

FEMA

- FEMA Climate Change: Provides resources that address climate change.
- FEMA Hazard Mitigation Planning Online Webliography: This compilation of government and private online sites is a useful source of information for developing and implementing hazard mitigation programs and plans in New England.
- FEMA Library: FEMA publications can be downloaded from the library website. These resources may be especially useful in public information and outreach programs. Topics include building and construction techniques, NFIP policies, and integrating historic preservation and cultural resource protection with mitigation.
- FEMA RiskMAP: Technical assistance is available through RiskMAP to assist communities in identifying, selecting, and implementing activities to support mitigation planning and risk reduction. Attend RiskMAP discovery meetings that may be scheduled in the state, especially any in neighboring communities with shared watersheds boundaries.

Other Federal

- EPA Resilience and Adaptation in New England (RAINE): A collection of vulnerability, resilience and adaptation reports, plans, and webpages at the state, regional, and community levels. Communities can use the RAINE database to learn from nearby communities about building resiliency and adapting to climate change.
- EPA Soak Up the Rain: Soak Up the Rain is a public outreach campaign focused on stormwater quality and flooding. The website contains helpful resources for public outreach and easy implementation projects for individuals and communities.
- NOAA C-CAP Land Cover Atlas: This interactive mapping tool allows communities to see their land uses, how they have changed over time, and what impact those changes may be having on resilience.
- NOAA Sea Grant: Sea Grant's mission is to provide integrated research, communication, education, extension and legal programs to coastal communities that lead to the responsible use of the nation's ocean, coastal and Great Lakes resources through informed personal, policy and management decisions. Examples of the resources available help communities plan, adapt, and recovery are the Community Resilience Map of Projects and the National Sea Grant Resilience Toolkit
- NOAA Sea Level Rise Viewer and Union for Concerned Scientists Inundation Mapper: These interactive mapping tools help coastal communities understand how their hazard risks may be changing. The "Preparing for Impacts" section of the inundation mapper addresses policy responses to protect communities.
- NOAA U.S. Climate Resilience Toolkit: This resource provides scientific tools, information, and expertise to help manage climate-related risks and improve resilience to extreme events. The "Steps to Resilience" tool may be especially helpful in mitigation planning and implementation.

State

- Massachusetts Emergency Management Agency: The Massachusetts State Hazard Mitigation Officer (SHMO) and State Mitigation Planner(s) can provide guidance regarding grants, technical assistance, available publications, and training opportunities.
- Massachusetts Departments of Conservation and Recreation and Environmental Protection can provide technical assistance and resources to communities seeking to implement their hazard mitigation plans.
- MA Mapping Portal: Interactive mapping tool with downloadable data)

Not for Profit

- Kresge Foundation Online Library: Reports and documents on increasing urban resilience, among other topics.
- Naturally Resilient Communities: A collaboration of organizations put together this guide to nature-based solutions and case studies so that communities can learn which nature-based solutions can work for them.
- Rockefeller Foundation Resilient Cities: Helping cities, organizations, and communities better prepare for, respond to, and transform from disruption.

Funding Sources:

- Massachusetts Coastal Resilience Grant Program: Funding for coastal communities to address coastal flooding, erosion, and sea level rise.
- Massachusetts Municipal Vulnerability Preparedness program: Provides support for communities to plan for climate change and resilience and implement priority projects.
- Massachusetts Water Quality Grants: Clean water grants that can be used for river restoration or other kinds of hazard mitigation implementation projects.
- Federal Grants Resource Center and Grants.gov: Lists of grant opportunities from federal agencies (HUD, DOT/FHWA, EPA, etc.) to support rural development, sustainable communities and smart growth, climate change and adaptation, historic preservation, risk analyses, wildfire mitigation, conservation, Federal Highways pilot projects, etc.
- FEMA Hazard Mitigation Assistance (HMA): FEMA's Hazard Mitigation Assistance provides funding for projects under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). States, federally recognized tribes, local governments, and some not for profit organizations are eligible applicants.
- GrantWatch: The website posts current foundation, local, state, and federal grants on one website, making it easy to consider a variety of sources for grants, guidance, and partnerships. Grants listed include The Partnership for Resilient Communities, the Institute for Sustainable Communities, the Rockefeller Foundation Resilience, The Nature Conservancy, The Kresge Climate-Resilient Initiative, the Threshold Foundation's Thriving Resilient Communities funding, the RAND Corporation, and ICLEI Local Governments for Sustainability.
- USDA Natural Resource Conservation Service (NRCS) and Rural Development Grants: NRCS provides conservation technical assistance, financial assistance, and conservation innovation grants. USDA Rural Development operates over fifty financial assistance programs for a variety of rural applications.