DRAFT

TOWN OF SAUGUS
HAZARD MITIGATION PLAN 2021 UPDATE

Rumney Marsh - Image Source: Kevin Davis

DRAFT
June 28, 2021

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ACKNOWLEDGEMENTS & CREDITS

This plan was prepared for the Town of Saugus by the Metropolitan Area Planning Council (MAPC) under the guidance of the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) and the Massachusetts Emergency Management Agency (MEMA). The plan was funded by Municipal Vulnerability Preparedness (MVP) planning grant from EEA.

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Saugus Hazard Mitigation and Municipal Vulnerability Preparedness Planning Core Team

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SECTION 1: 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.

In 2017, the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) inaugurated the Municipal Vulnerability Preparedness (MVP) program to assist municipalities in planning for and implementing strategies to adapt to predicted changes in our warming climate. The predicted changes include both increased flooding from large rain events and a greater likelihood of drought, increased extreme heat days and heat waves, and increased flooding from sea level rise.

The program provides MVP Planning Grants to assist municipalities in preparing for the impacts of climate change through participation in a Community Resilience Building (CRB) Workshop and development of a climate change action plan. Communities who complete the MVP project become certified as an MVP Community and are eligible for follow-up funding through MVP Action Grants to implement some of the actions identified.

This plan provides for both a hazard mitigation planning approach, as well as incorporating MVP provisions for the Town of Saugus that are focused on identifying climate risks and resilience strategies. This provides the Town with a holistic assessment and implementation plan for both hazard mitigation and climate change resiliency.

PLANNING PROCESS

This is an updated Hazard Mitigation Plan to replace the Town of Saugus' previous plan, which was approved by FEMA on July10, 2015. This 2021 Hazard Mitigation Plan Update was led by the Saugus Hazard Mitigation and Municipal Vulnerability Preparedness Core Team (HMP/MVP Core Team; see Table 5). The HMP/MVP Core Team met on the following dates: October 9, 2019, December 17, 2019, March 12, 2020, and February 22, 2021. During these meetings, the Saugus HMP/MVP Core Team 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 Saugus HMP/MVP Core Team hosted two public meetings, the first on March 18, 2021, hosted by the Saugus Planning Board, and the second on June 3, 2021, to review the draft plan update. The draft plan update was posted on the Town's website for public review after that meeting. Key town stakeholders and neighboring communities were notified and invited to review

the draft plan and submit comments. As part of the MVP program, the town hosted an all-day workshop on January 14, 2020, where 45 participants identified climate resilience vulnerabilities and mitigation strategies. The top priority strategies were also presented at the March 18, 2021, Public Listening Session.

RISK ASSESSMENT

The Saugus Hazard Mitigation Plan 2021Update assesses the potential impacts to the town from flooding, high winds, winter storms, brush fire, geologic hazards, extreme temperatures, and drought. For each risk, the assessment identifies the current hazards as well as projected future impacts of a warming climate. These hazards are also shown in the hazards map series in Appendix A. The Saugus Core Team identified 94 Critical Facilities. These are also shown on the map series and listed in Table 37, identifying which facilities are located within the mapped hazard zones.

MAPC used Hazards U.S.– Multihazards (HAZUS-MH), a standardized computer methodology developed by FEMA that utilizes Geographic Information Systems (GIS), to estimate physical, economic, and social impacts of disasters. The HAZUS-MH analysis for Saugus estimates property damages from Hurricanes of Category 2 and 4 ($17.3 million to $87.5 million), earthquakes of magnitudes 5 and 7 ($602.8 million to $4,239.32 million), and the 1% and 0.2% chance of flooding ($164.5 million to $478 million).

HAZARD MITIGATION GOALS

The Saugus Core Team endorsed the following eleven hazard mitigation goals at the March 12, 2020, HMP/MVP Core Team meeting. The team added an eleventh goal focused on incorporating future climate change projections.

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

10. Ensure that hazard mitigation measures are in place to keep major roads open with a particular emphasis on Route 1.

11. Consider the potential impacts of climate change and incorporate climate mitigation and resilience in all planning efforts.

HAZARD MITIGATION STRATEGY

The Saugus HMP/MVP Core Team identified a number of mitigation measures that would serve to reduce the Town's vulnerability to natural hazard events. Overall, the hazard mitigation strategy recognizes that mitigating hazards for Saugus 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. Global climate change and a variety of other factors impact the Town's vulnerability 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 the Saugus Hazard Mitigation Plan 2021 Update is summarized in Table 1.

Table 1 Plan Review and Update Process:

Section of Plan	Reviews and Updates
Section 3: Public Participation	The Saugus HMP/MVP Core 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 Saugus HMP/MVP Core Team. The plan was also available on the Town's website for public comment after the second meeting. In addition, as part of the concurrent MVP project, a Community Resilience Building Workshop was held on January14, 2020, and a Public Listening Session was held on March 18, 2021.
Section 4: 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. The Risk Assessment integrates projected climate impacts. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.
Section 5: Goals	The Hazard Mitigation Goals were reviewed and endorsed by the Saugus HMP/MVP Core Team.
Section 6: Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect the current status mitigation activities in the town.

Sections 7 and 8: Hazard Mitigation Strategy	Mitigation measures from the 2015 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 2021 Plan Update or modify or delete them. The Plan Update's hazard mitigation strategy reflects both new measures and measures carried forward from the 2015 plan. The Saugus HMP/MVP Core Team prioritized all of these measures based on current conditions.
Section 9: 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.

As indicated in Table 43, Saugus made good progress implementing mitigation measures identified in the 2015 Hazard Mitigation Plan. The Town made a significant improvement to address the drainage near Elm Street through a $1.6 million project to install a new 52-inch drainage pipe that discharges below the bridge. A new tide gate will also be installed in the summer of 2021. The also town completed GIS mapping of wetlands as well as stormwater outfalls. The Town conducted a Municipal Vulnerability Project (MVP) to address climate change impacts and identify resiliency opportunities in conjunction with this Hazard Mitigation Plan Update. The priority actions are summarized in Appendix XX, and the full MVP report accompanies this plan in a separate document.

Several projects that were not completed will be continued into this plan update. While the town has addressed stormwater challenges in several locations, more improvements are needed at key locations throughout the town. To facilitate further improvements, the town engaged a consultant to conduct a town-wide comprehensive assessment of the drainage system, resulting in 19 priority projects being identified, which are included in mitigation strategy for this 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. 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 Saugus HMP/MVP Core Team, as described in Section 9, Plan Adoption and Maintenance.

SECTION 2 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 Saugus contracted with the Metropolitan Area Planning Council (MAPC), to assist the Town in updating its local Hazard Mitigation Plan, which was first adopted as part of the multijurisdictional, North Shore Regional Hazard Mitigation Plan in 2007, and was subsequently updated as a single-jurisdictional plan for Saugus in 2015. The local Hazard Mitigation Plan update produced under this contract is designed to meet the requirements of the Disaster Mitigation Act for the Town of Saugus while listing regional concerns and hazards that could impact the Town.

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.

The Town of Saugus received an MVP Planning Grant to concurrently conduct a Municipal Vulnerability Preparedness project and prepare an updated Hazard Mitigation Plan. Many of the required steps of the MVP process also satisfy requirements for updating an HMP. As a result, the Town with assistance from MAPC prepared this Hazard Mitigation Plan 2021 Update in accordance with FEMA guidelines for hazard mitigation planning (Title 44 Code of Regulations (CFR) 201.6) and an MVP Final Report according to the Community Resilience Building (CRB) guidance provided by the Massachusetts Executive Office of Energy & Environmental Affairs' (EEA), This enabled Saugus to consider the effects of a warming climate in its hazard mitigation

planning, following the lead established by the Commonwealth when it adopted the first-ever Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018).

PREVIOUS FEDERAL/STATE DISASTERS

The Town of Saugus, a part of Essex County, has experienced 22 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 five 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)
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)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
(1998)	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	Hard Mitigation Grant Program	Statewide
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
Hurricane Earl (September 2010)	FEMA Public Assistance Project Grants	Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
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
Severe Winter Storm (March 2-3, 2018)	FEMA Public Assistance; Hazard Mitigation Grant Program	Salem, Suffolk, Norfolk, Bristol, Plymouth, Barnstable Counties
Severe Winter Storm (March 13-14, 2018)	FEMA Public Assistance; Hazard Mitigation Grant Program	Salem, Suffolk, Norfolk, Worcester Counties

Source: database provided by MEMA

FEMA FUNDED MITIGATION PROJECTS

The Town of Saugus has received funding from FEMA for four mitigation projects under the Hazard Mitigation Grant Program (HMGP). These projects totaled $1,365,502 with $1,024,661 covered by FEMA grants and $287,500 by local funding. The projects are summarized in Table 3.

Table 3: Federally Funded Mitigation Projects

Year/Grant #	Project Title	Scope of Work	Total Cost	Federal Funding	Local Funding
1998 CBDG 97-08	Pipeline Installation	500 linear ft. of concrete pipeline will be installed from 67R (rear) Main St. to north of Main St.	$215,502	$168,161	$0
2006 HMGP 1142-12	Drainage Improvements	Complete a drainage analysis for the Bristow Street, Serino Way, Wolcott Road, Greenwood Avenue, Lincoln Avenue, Seagrit Avenue.	$320,000	$234,000	$80,000
2008 HMGP 1142-37	Hamilton Street Drainage Improvements	Install storm drain line, manholes and catch basins; perform associated road work.	$130,000	$97,500	$32,500
2009 PDMC 05-13	Shute Brook Culvert Relief	Construct new culvert adjacent to exiting culvert running below Central Street in Saugus	$700,000	$525,000	$175,000

(Source: database provided by MEMA)

COMMUNITY PROFILE

The Town of Saugus is located in northeastern Massachusetts in Essex County. A coastal community 13 miles from Boston, Saugus has a population of 26,628 according to the 2010 US Census (Table 4). The Town is 10.99 square miles in area. The town has is served by a town manager form of government with a representative Town Meeting. The town is bisected by Route 1, which is a major thoroughfare into and out of Boston. The commercial businesses on this strip contribute heavily to the local economy in terms of providing jobs and lowering the tax burden of residents. The tremendous complex of various retail establishments along Route 1 brings in thousands of people daily to Saugus from a wide geographic area.

Saugus is characterized as predominantly family-oriented, working class community. Residents recognize and appreciate Saugus' small town feel and accompanying characteristics like locally owned shops and restaurants, an annual fall festival, and being able to walk down the street and feel safe in their neighborhood. Saugus is also home to the Saugus Iron Works, which is listed on the National Register of Historic Place as is the Town Hall.

The town maintains a website at https://www.saugus-ma.gov/

Table 4: Saugus Characteristics

Population = 28,158 people

- 4.3% are under age 5
- 17.8% are under age 18
- 20.6% are over age 65
- 6.2% of households are limited English-speaking
- 6.7% of households have no vehicle available
- Over 90% of the population is White

Number of Housing Units = 10,999

- 18.6% are renter-occupied housing units
- 29.6% of housing units were built before 1940

Source: 2018 American Community Survey

SECTION 3 PLANNING PROCESS & PUBLIC PARTICIPATION

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 two public meetings hosted by the Saugus HMP/MVP Core 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's 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.

Figure 1:Six-Step Planning Process

1. **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 A.

2. **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:

    - General Bylaws for the Town of Saugus
    - Zoning By-law for the Town of Saugus
    - Town of Saugus Open Space and Recreation Plan 2018
    - Blue Hill Observatory
    - FEMA, Flood Insurance Rate Maps for Essex County, MA, 2014
    - FEMA, Hazards U.S. Multi-Hazard
    - FEMA, Local Mitigation Plan Review Guide, October 2011
    - Fourth National Climate Assessment, 2018
    - Massachusetts Flood Hazard Management Program
    - Massachusetts Office of Coastal Zone Management Shoreline Change Data
    - Massachusetts Office of Dam Safety, Inventory of Massachusetts Dams 2018
    - Massachusetts State Hazard Mitigation Plan, 2013
    - Massachusetts State Hazard Mitigation and Climate Adaptation Plan, 2018
    - Metropolitan Area Planning Council, GIS Lab, Regional Plans and Data
    - National Weather Service
    - Nevada Seismological Library
    - 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 Climate Adaptation Science Center
    - Northeast States Emergency Consortium, http://www.nesec.org/
    - Tornado History Project
    - US Census, 2010 and American Community Survey 2017 5-Year Estimates
    - USGS, National Water Information System, http://nwis.waterdata.usgs.gov/usa/nwis

3. **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.

4. **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 Section 8.

5. **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 Section 9 and documentation of plan adoption can be found in Appendix D.

6. **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. Section 9 includes more detailed information on plan implementation.

2015 PLAN IMPLEMENTATION AND MAINTENANCE

The 2015 Town of Saugus 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 several projects for implementation, including a $1.6 million project to address flooding near Elm Street.

THE LOCAL MULTIPLE HAZARD COMMUNITY PLANNING TEAM

MAPC worked with the local community representatives to organize a Saugus HMP/MVP Core Team. Since the Town conducted a Municipal Vulnerability Preparedness project concurrently with this plan update, both projects were coordinated by a Saugus HMP/MVP Core Team. 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 Saugus HMP/MVP Core 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 HMP/MVP Core Team membership can be found in Table 5.

Table 5: Saugus HMP/MVP Core Team Members

Name	Title
Scott Crabtree	Town Manager
Alexander Mello	Planning and Development Department, Project Manager
Jeanette Meredith	Planning and Development Department
Ronald Giorgetti	Police Department
Kevin Murphy	Police Department
Fred Varone	Inspectional Services
Frank McKinnon	Conservation Commission
Brendan O'Regan	Department of Public Works
Debbie Nickolas	Building Department
Todd Baldwin	Facilities Engineer
Michael Newbury	Fire Department
Paul Rupp	Town Consultant

The Saugus HMP/MVP Core Team met on the following dates: October 9, 2019, December 17, 2019, March 12, 2020, and February 22, 2021. 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. The team also coordinated the Municipal Vulnerability Preparedness Workshop in early December. Earlier meetings focused on preparation for that event. Later meetings focused on verifying information gathered by MAPC staff and discussion of existing mitigation practices, the status of mitigation measures identified in the Saugus 2015 Hazard Mitigation Plan, and potential new or revised mitigation measures. The agendas for these meetings are included in Appendix B.

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 on March 18, 2021, during the planning process, and one on June 3, 2021, after a draft plan was available for review.

In addition to the two public meetings, Saugus held an all-day Municipal Vulnerability Preparedness workshop attended by 45 people, including town staff, board and committee members, and representatives of community organizations. The workshop focused on climate

impacts on infrastructure, natural resources, and society. The MVP project and results of the workshop are presented in Appendix E.

The public had an opportunity to provide input to the Saugus hazard mitigation planning process during a public meeting held remotely via Zoom by the Saugus Planning Board on March 18, 2021. The draft plan update was presented at a remote public meeting via Zoom on June 3, 2021. Both meetings were publicized in accordance with the Massachusetts Public Meeting Law. The meeting announcements, press advisories, meeting agendas, and press coverage for the public meetings can be found in Appendix C.

LOCAL STAKEHOLDER INVOLVEMENT

The Saugus HMP/MVP Core 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:

- National Grid (NGRID)
- Saugus Senior Citizen Center
- Saugus River Watershed Council
- Saugus Public Library
- Massachusetts Water Resources Authority (MWRA)
- Saugus Family YMCA
- Saugus Youth & Recreation Department
- Saugus Housing Authority
- City of Lynn
- City of Malden
- City of Melrose
- City of Revere
- Town of Lynnfield
- Town of Wakefield

See Appendix C for public meeting notices. The draft Saugus Hazard Mitigation Plan 2021 Update was posted on the Town's website for the second public meeting. Members of the public could access the draft document and submit comments or questions to the Town.

PUBLIC COMMENT

In the MVP workshop that took place on January 14, 2020, participants developed a robust list of priorities to increase resilience to climate-related natural hazards. Participants in the Listening Session/HMP public meeting on March 18, 2021reviewed the results of the workshop. The top priorities from the workshop are shown in Appendix E. In the second HMP public meeting on June 3, 2021, the draft updated Hazard Mitigation Plan was presented and made available on the Town website for public review and comment.

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 state open meeting laws.

PLANNING TIMELINE

October 9, 2019	Meeting#1 of the Saugus Hazard Mitigation and MVP Core Planning Team
December 17, 2019	Meeting#2 of the Saugus Hazard Mitigation and MVP Core Planning Team
January 14, 2020	All day MVP Workshop
March 12, 2020	Meeting#3 of the Saugus Hazard Mitigation and MVP Core Planning Team
February 22, 2021	Meeting#4 of the Saugus Hazard Mitigation and MVP Core Team (Virtually)
March 18, 2021	First Public Meeting hosted by the Saugus Planning Board (Virtually)
June 3, 2021	Second Public Meeting hosted by the Saugus Planning Board (Virtually)
TBD	Draft Plan Update submitted to MEMA
TBD	Notice of Approvable Pending Adoption sent by FEMA
TBD	Plan Adopted by the Saugus Town Manager
TBD	FEMA final approval of the plan for 5 years, until [TBD]

POST-PLAN APPROVAL IMPLEMENTATION TIMELINE

After the plan has been approved by FEMA, the Town will observe the following timeline to implement the plan over the five-year approval period and prepare for the next plan update.

If the Town wishes to apply for a FEMA grant to prepare the next plan update, due in 2025, a grant application should be submitted approximately two years before this plan expires, in order to allow time for the grant to be approved, and the next plan update to be completed before this plan expires. See Section 9 for more details on plan adoption and maintenance.

2023	Conduct Mid-Term Plan Survey on Progress
2023	Seek FEMA grant to prepare next plan update
2024	Begin process to update the plan
2025	Submit Draft 2025 Plan Update to MEMA and FEMA
2025	FEMA approval of 2025 Plan Update

SECTION 4: RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the Town of Saugus 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. In order to update Saugus' 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.

In this 2021 plan update, the projected impacts of our warming climate on natural hazards are integrated throughout the risk assessment. Key impacts include rising temperatures, which in turn affect precipitation patterns, sea level, and extreme weather.

> *"Global climate is changing rapidly compared to the pace of natural variations in climate that have occurred throughout Earth's history. Global average temperature has increased by about 1.8°F from 1901 to 2016, and observational evidence does not support any credible natural explanations for this amount of warming; instead, the evidence consistently points to human activities, especially emissions of greenhouse or heat-trapping gases, as the dominant cause."*
>
> *Fourth National Climate Assessment, 2018 (Chapter 2-1)*

Climate Change Observations and Projections

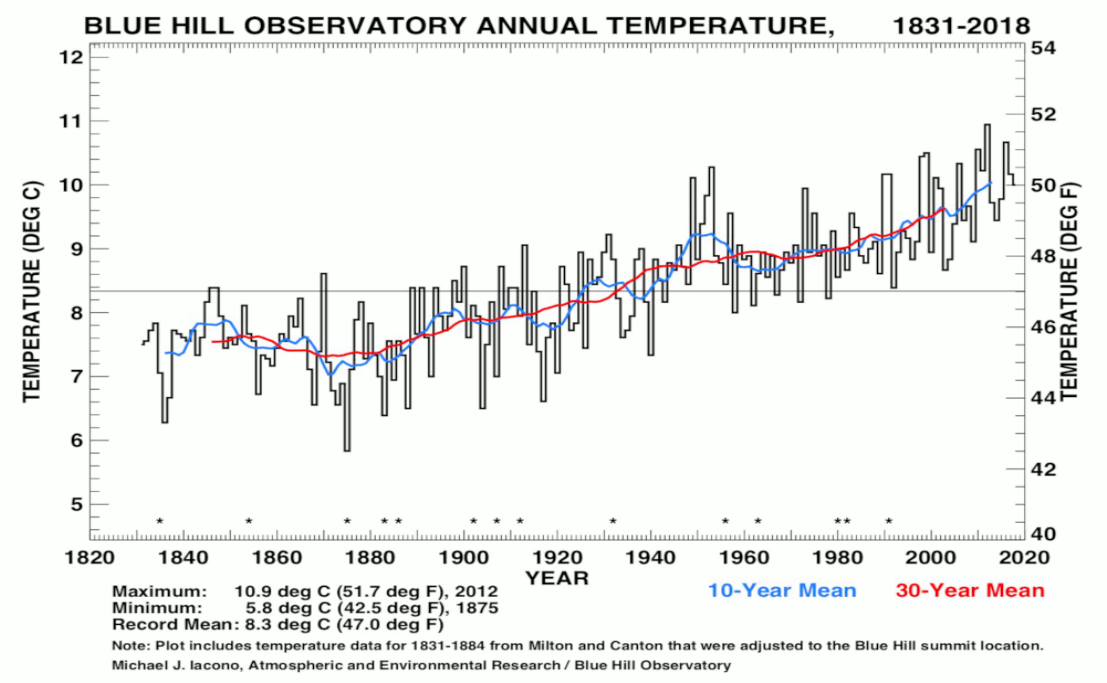
Climate change observations come from a variety of data sources that have measured and recorded changes in recent decades and centuries. Climate change projections, however, predict future climate impacts and by their nature cannot be observed or measured. As a result of the inherent uncertainty in predicting future conditions, climate projections are generally expressed as a range of possible impacts.

Temperature

Our climate has always been regulated by gases, including carbon dioxide, methane, and nitrous oxide, that blanket the earth. These gases trap heat that would otherwise be reflected out to space; without them our planet would be too cold to support life. We refer to these gases as "greenhouse gases" (GHGs) for their heat trapping capacity. The combustion of fossil fuels, our primary energy source in the age of industrialization, releases GHGs into the atmosphere. In the past century, human activity associated with industrialization has contributed to a growing concentration of GHGs in our atmosphere.

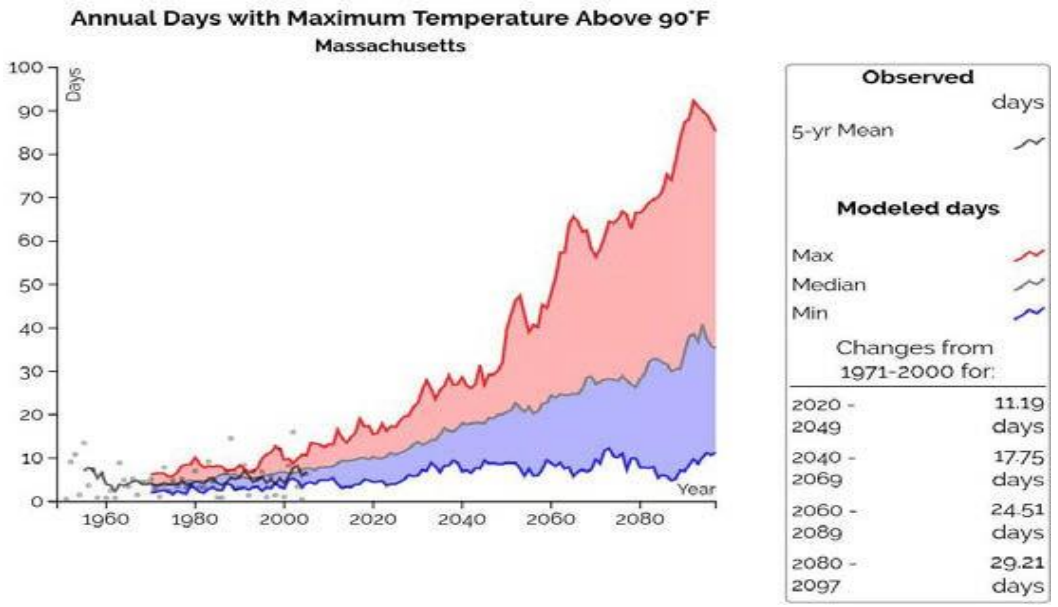
Records from the Blue Hill Observatory in Milton, MA show that average temperatures (30-year mean) have risen approximately 3 degrees (F) in the almost 200 years since record keeping began in 1831(Figure 2).

Figure 2: Observed Increase in Temperature



Climate projections include an increase in average temperature and in the number of extreme heat days. Extreme cold days are projected to decrease in number. The Northeast Climate Adaptation Science Center (NECASC) projects average temperatures in Massachusetts will increase by 5 degrees F by mid-century and nearly 7 degrees F by the end of the century. Figure 3 shows the NECASC projections for increases in the number of days over 90 degrees annually.

Figure 3: Projected Increase in Annual Days Over 90 Degrees F

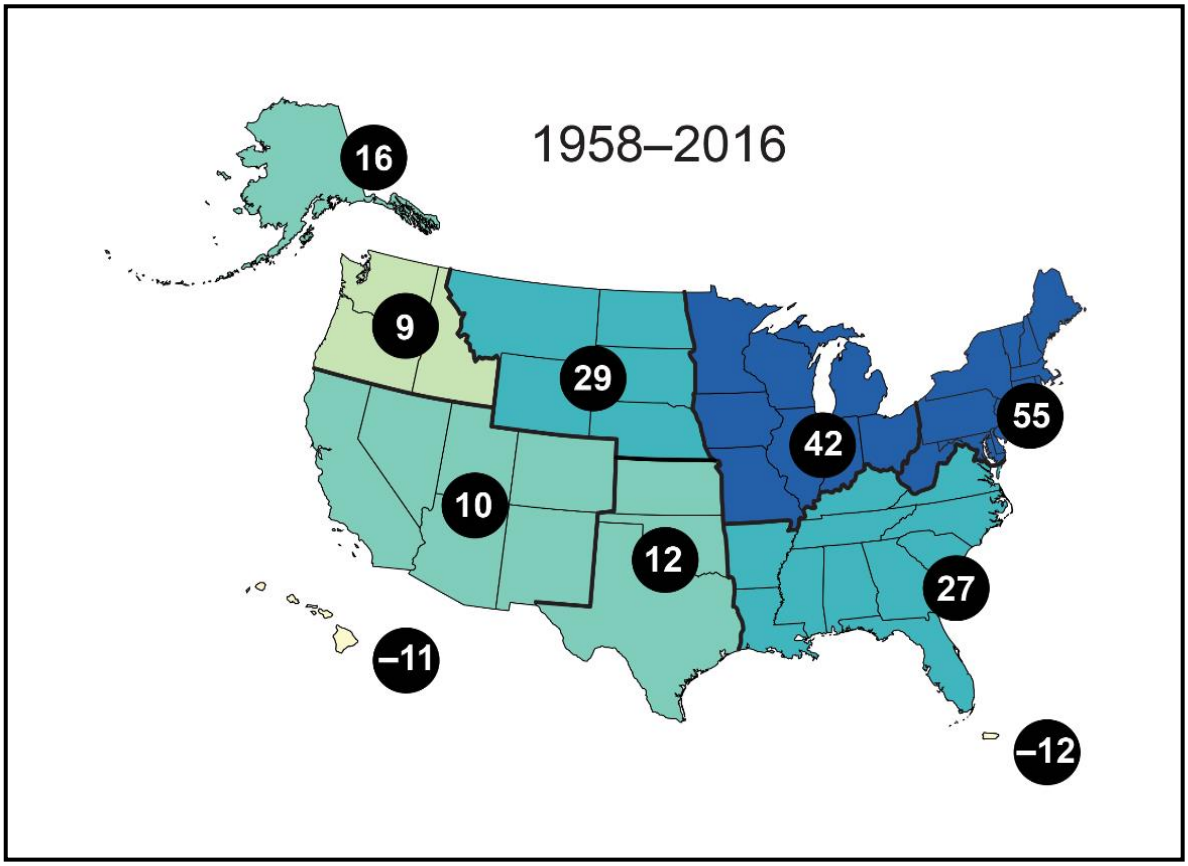


Source: Northeast Climate Adaptation Science Center

Precipitation Patterns

Annual precipitation in Massachusetts has increased by approximately 10% in the fifty-year period from 1960 to 2010 (MA Climate Adaptation Report, 2011). Moreover, there has been a significant increase in the frequency and intensity of large rain events. For the Northeast US, according to the Fourth National Climate Assessment 2018, in the past sixty years there has been a 55% increase in the amount of annual precipitation that falls in the top 1% of storm events (Figure 4). Changes in precipitation are fueled by warming temperatures which increase evaporation and, therefore, the amount of water vapor in the air.

Figure 4:Observed Change in Total Annual Precipitation Falling in the Heaviest 1% of Events



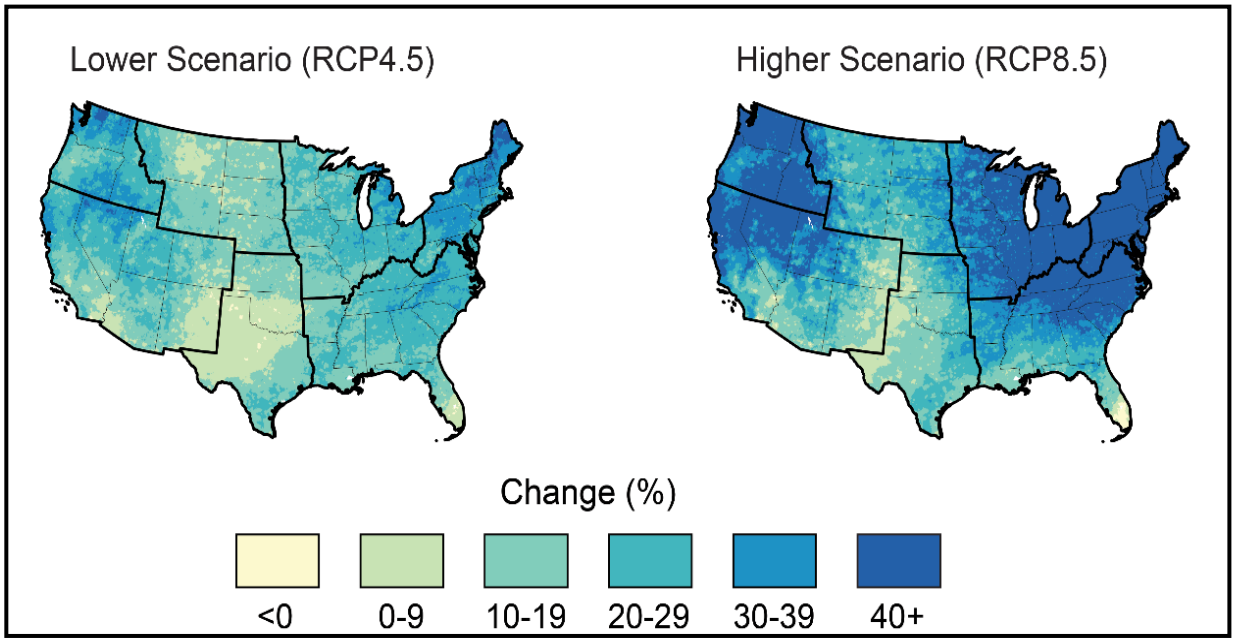
Circled numbers indicate % change.

Source: Fourth National Climate Assessment, 2018

Total annual precipitation in Massachusetts is projected to increase by 1 to 6 inches by mid-century, and by 1.2 to 7.3 inches by the end of this century (SHMCAP p. 2-22). The Fourth National Climate Assessment predicts that the pattern of increasing frequency and intensity of extreme rain events will continue. They project by 2070 to 2099, (relative to 1986 to 2015) a 30-40% increase in total annual precipitation falling in the heaviest 1% of rain events (Figure 5).

Despite overall increasing precipitation, more frequent and significant summer droughts are also a projected consequence of climate change. This is due to projections that precipitation will increase in winter and spring and decrease slightly in the summer and, a result of earlier snow melt, and higher temperatures that will reduce soil moisture.

Figure 5: Projected Change in Total Annual Precipitation Falling in the Heaviest of 1% of Events for 2070-2099



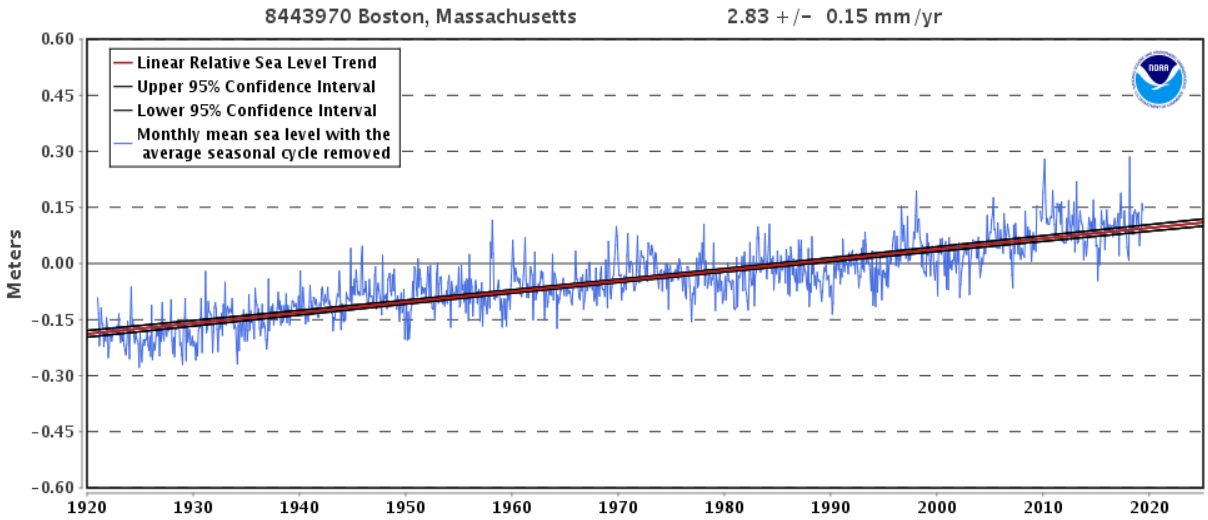
Source: Fourth National Climate Assessment, 2018

Sea Level Rise

Records from the Boston Tide Station show nearly one foot of sea level rise in the past century (Figure 6). Warming temperatures contribute to sea level rise in two ways. First, warm water expands to take up more space. Second, rising temperatures are melting land-based ice which enters the oceans as melt water. A third, quite minor, contributor to sea level rise in New England is not related to climate change. New England is still experiencing a small amount of land subsidence (drop in elevation) in response to the last glacial period.

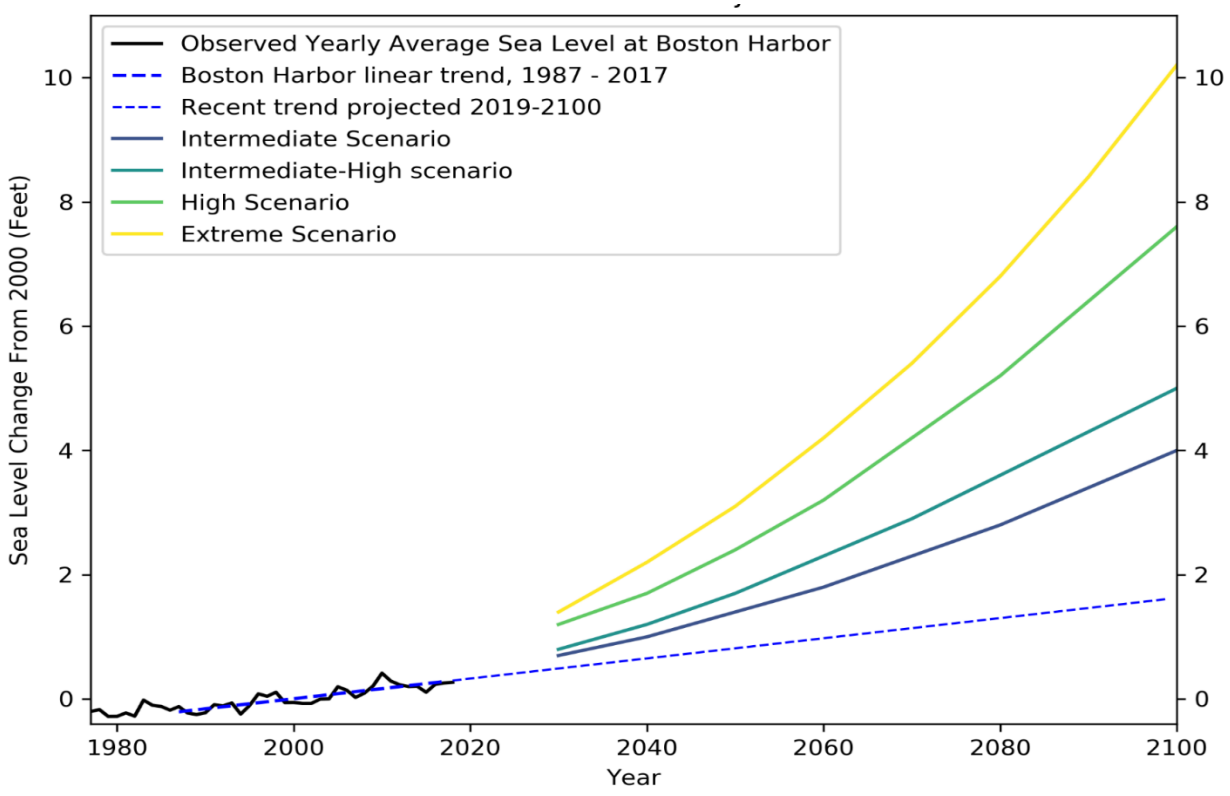
Projections of sea level rise through 2100 vary significantly depending on future greenhouse gas emissions and melting of land-based glaciers. Currently sea levels are rising at an increasing rate. Figure 7 shows projections for the current rate of sea level rise, as well as for lower and higher greenhouse gas emission scenarios and a higher scenario with greater ice melt. Projections for 2100 range from 2 feet to 5 feet, to almost 9 feet for the most extreme scenario. However, by 2050 all of the scenarios suggest roughly one foot of sea level rise above the year 2000.

Figure 6:Observed Increase in Sea Level Rise



Source: NOAA

Figure 7: Recent and Projected Increase in Sea Level Rise

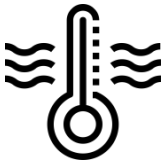


Source: Adapted from the Northeast Climate Adaptation Center data

Following the general outline of the Massachusetts State Hazard Mitigation and Climate Adaptation Plan, this local hazard mitigation plan organizes consideration of natural hazards based on their relationship to projected climate changes. The one exception is that where coastal

and inland flooding are interrelated, they will be considered together. Table 6 below, from the SHMCAP, summarizes the natural hazards reviewed in this plan, climate interactions, and expected impacts.

Table 6:Climate Change and Natural Hazards

Primary Climate Change Interaction	Natural Hazard	Other Climate Change Interactions	Representative Climate Change Impacts
 **Changes in Precipitation**	Inland Flooding	Extreme Weather	Flash flooding, urban flooding, drainage system impacts (natural and human-made), lack of groundwater recharge, impacts to drinking water supply, public health impacts from mold and worsened indoor air quality, vector-borne diseases from stagnant water, episodic drought, changes in snow-rain ratios, changes in extent and duration of snow cover, degradation of stream channels and wetland
	Drought	Rising Temperatures, Extreme Weather	
	Landslide	Rising Temperatures, Extreme Weather	
 **Sea Level Rise**	Coastal Flooding	Extreme Weather	Increase in tidal and coastal floods, storm surge, coastal erosion, marsh migration, inundation of coastal and marine ecosystems, loss and subsidence of wetlands
	Coastal Erosion	Changes in Precipitation, Extreme Precipitation	
	Tsunami	Rising Temperatures	
 **Rising Temperatures**	Average/Extreme Temperatures	N/A	Shifting in seasons (longer summer, early spring, including earlier timing of spring peak flow), increase in length of growing season, increase of invasive species, ecosystem stress, energy brownouts from higher energy demands, more intense heat waves, public health impacts from high heat exposure and poor outdoor air quality, drying of streams and wetlands, eutrophication of lakes and ponds
	Wildfires	Changes in Precipitation	
	Invasive Species	Changes in Precipitation, Extreme Weather	
 **Extreme Weather**	Hurricanes/Tropical Storms	Rising Temperatures, Changes in Precipitation	Increase in frequency and intensity of extreme weather events, resulting in greater damage to natural resources, property, and infrastructure, as well as increased potential for loss of life
	Severe Winter Storm / Nor'easter	Rising Temperatures, Changes in Precipitation	
	Tornadoes	Rising Temperatures, Changes in Precipitation	
	Other Severe Weather (Including Strong Wind and Extreme Precipitation)	Rising Temperatures, Changes in Precipitation	
Non-Climate-Influenced Hazards	Earthquake	Not Applicable	There is no established correlation between climate change and this hazard

OVERVIEW OF HAZARDS AND IMPACTS

Table 7 summarizes the hazard risks for the state and the Town of Saugus. This evaluation takes into account the frequency of the hazard, historical records such as the National Climatic Data Center data for Essex County, the Saugus HMP/MVP Core Team, and variations in geography. The statewide assessment was modified to reflect local conditions in Wayland using the definitions for hazard frequency and severity listed below.

Table 7:Hazards Risk Summary

Hazard	Frequency		Severity	
	Massachusetts	Saugus	Massachusetts	Saugus
Inland Flooding	High	High	Serious	Serious
Drought	Medium	Medium	Minor	Minor
Landslides	Low	Very Low	Minor	Minor
Coastal Flooding	High	High	Serious	Serious
Coastal Erosion	Highly variable	Medium	Serious	Minor
Tsunami	Very Low	Very Low	Extensive	Extensive
Extreme Temperatures	High	High	Minor	Minor
Brush Fires	High	Medium	Minor	Minor
Hurricane/Tropical Storm	Medium	Medium	Serious	Extensive
Severe Winter Storms/Nor'easters	High	High	Extensive	Extensive
Tornadoes	Medium	Very Low	Serious	Serious
Severe Weather Thunderstorms/Winds	High	High	Minor	Minor
Earthquake	Very Low	Very Low	Extensive	Extensive

Frequency

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

It should be noted that several of the hazards listed in the 2018 Massachusetts State Hazard Mitigation plan are not applicable to the Town of Franklin, as follows:

- **Ice jams** are not a hazard in Saugus. The US Army Corps Ice Jam Database shows no record of ice jams in Franklin.
- **Major Urban Fires,** due to the lack of significant wildfire areas in close proximity to urban development that could pose a significant threat of major urban fire.

FLOOD-RELATED HAZARDS

Flooding was the most prevalent serious natural hazard identified by local officials in Saugus. The town is subject to two kinds of flooding; coastal flooding (discussed further under Sea Level Rise) and inland flooding.

Inland or riverine flooding can be associated with overflowing rivers and streams, stormwater flooding associated with impervious surfaces and stormwater infrastructure. Inland flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms.

These two types of flooding may reinforce each other as inland flooding is prevented from draining by the push of wind and tide driven water. Both types of flooding can be caused by major storms such as northeasters and hurricanes. Northeasters can occur at any time of the year, but they are most common in winter. Hurricanes are most common in the summer and early fall.

Regionally Significant Storms

There have been a number of major rainstorms that have resulted in significant flooding in northeastern Massachusetts over the last fifty years. Significant storms include:

- March 1968
- January 1979
- April 1987
- October 1991
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010
- March 2013
- January 2018
- March 2018

The best available local data on previous flooding events are for Essex County through the National Centers for Environmental Information. Essex County, which includes the Town of Saugus, experienced 43 flood events from 2006 to 2020 (see Table 8).

Two deaths and three injuries were reported and the total reported property damage in the county was almost $21 million dollars.

Table 8: Essex County Flood Events, 2006- 2020

Date	Deaths	Injuries	Property Damage $
05/13/2006	2	0	7.000M
07/11/2006	0	0	10.00K
07/28/2006	0	0	20.00K
03/02/2007	0	0	20.00K
04/16/2007	0	0	45.00K
02/13/2008	0	0	30.00K
08/08/2008	0	0	25.00K
09/06/2008	0	0	5.00K
03/14/2010	0	1	9.800M
03/30/2010	0	2	3.270M
04/01/2010	0	0	0.00K
08/05/2010	0	0	7.00K
08/25/2010	0	0	0.00K
10/04/2011	0	0	305.00K
06/23/2012	0	0	0.00K
08/10/2012	0	0	0.00K
06/24/2013	0	0	5.00K
07/01/2013	0	0	0.00K
07/27/2014	0	0	0.00K
10/23/2014	0	0	30.00K
12/09/2014	0	0	0.00K
08/18/2015	0	0	0.00K
09/30/2015	0	0	0.00K
06/29/2016	0	0	0.00K
04/06/2017	0	0	0.00K
06/27/2017	0	0	2.00K
07/08/2017	0	0	0.00K
07/18/2017	0	0	0.00K
09/06/2017	0	0	0.00K
09/15/2017	0	0	10.00K
09/30/2017	0	0	4.00K
10/25/2017	0	0	0.00K
01/13/2018	0	0	5.00K
08/11/2018	0	0	10.00K
11/03/2018	0	0	0.00K
04/15/2019	0	0	0.00K
07/31/2019	0	0	3.00K
09/02/2019	0	0	10.50K
7/13/20	0	0	1.00K

Date	Deaths	Injuries	Property Damage $
7/23/20	0	0	0.00K
9/10/20	0	0	1.00K
TOTAL	2	3	**20.62 M**

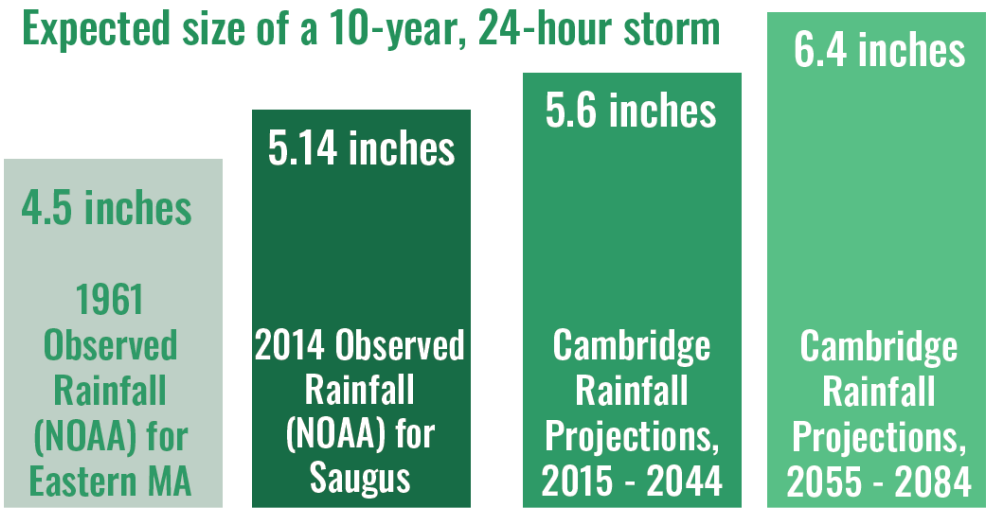
Source: NOAA, National Centers for Environmental Information

Flooding and Climate Change

Due to climate change, scientists project an increase in severity and frequency of precipitation events. Because of its location in the urbanized Saugus River watershed, extreme precipitation events and changing precipitation patterns could increase the frequency and severity of flooding in Saugus. Annual precipitation in Massachusetts has already increased by approximately 10% in the fifty- year period from 1960 to 2010 (MA Climate Change Adaptation Report 2011). Moreover, for the Northeast US, according to the U.S. National Climate Assessment, 2014, there was a 71% increase in the amount of rain that falls in the top 1% of storm events for the period 1958-2012.

Precipitation frequency estimates, which are used to derive stormwater design standards, were published in 196l by the U.S. Commerce Department in a document known as TP-40 (Technical Paper 40). The 10-year, 24-hour storm for eastern Massachusetts was calculated as a 4.5-inch event. Recently the National Oceanic and Atmospheric Administration published updated estimates (NOAA Atlas 14), which increased this design storm to 5.14 inches. In the future, based on projections developed for the City of Cambridge, the region will likely experience more frequent and intense precipitation events, including an increase in the standard "design storm" from historic levels of 4.5 inches to 6.4 inches by the late 21st century (Figure 8). According to data on ResilientMA.org, by mid- to late century, the region can anticipate 9-108 days with precipitation events with greater than one inch of rain, and an increase in total annual precipitation from 46 to 50 inches.

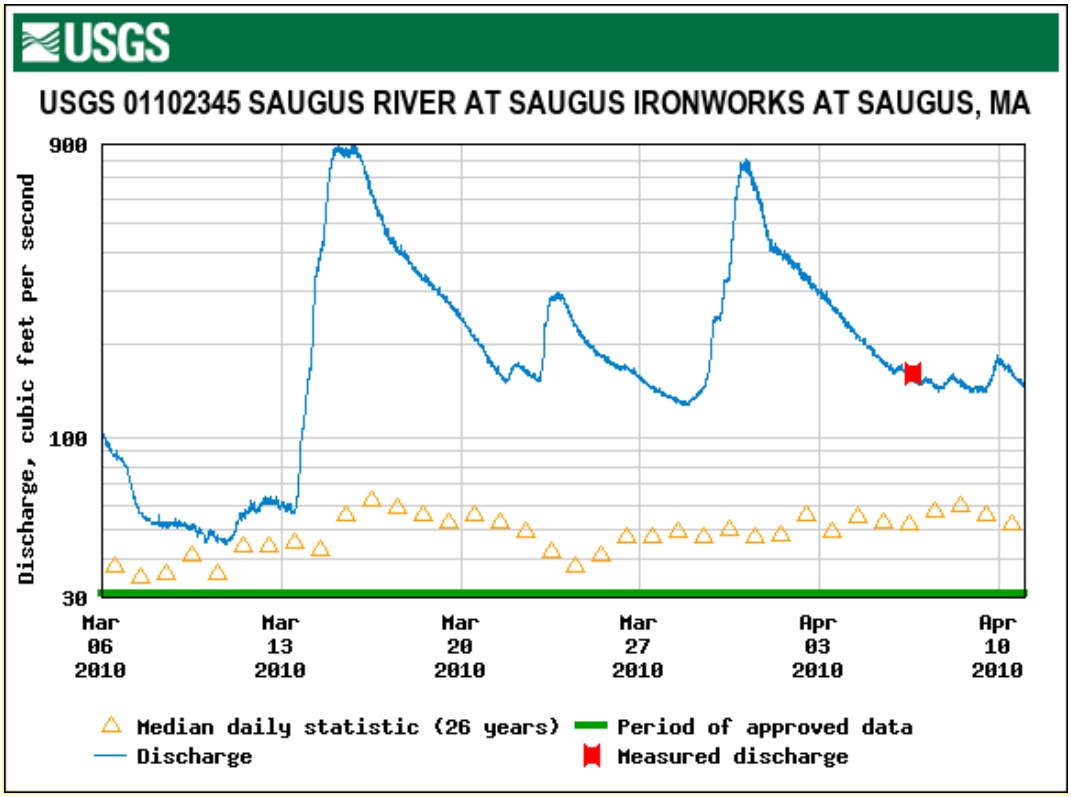
Figure 8: Design Storm Trends and Projections for the 10-year, 24-hour Storm



Sources: NOAA; Cambridge Climate Vulnerability Assessment. Part 1. April 2017

The March 2010 rainstorms in Massachusetts fit the profile of a type of event expected to increase in frequency as the climate warms. That is, significant precipitation, falling in late winter, on frozen ground, as rain rather than snow. The Blue Hill Observatory in Milton recorded 17.7 inches of rain from three storms in the 19 days from March 13 to 31. As shown in the USGS Saugus River gage at Saugus Ironworks, river levels surged with each storm (Figure 9). The river's flow peaked at 900 cubic feet per second (cfs) after the first storm on March 13, and again at 890 cfs after the March 29 storm. By comparison, the median discharge at this time of year is 20 to 30 cfs based on 26 years of record.

Figure 9: March 2010 USGS Saugus River Gage



The March 2010 storms were a federally declared disaster making federal assistance available to property owners who did not carry flood insurance. Based on the flood damage claims, Saugus experienced extensive flood damage, with 24 flood insurance claim and 210 disaster claims, 15.7% of which were located outside of FEMA Special Flood Hazard Areas. The claims were most concentrated in relatively low-lying areas of town east of the Route 1 corridor (see Map 3 in Appendix A).

LOCALLY IDENTIFIED AREAS OF FLOODING

Information on potential flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3 in Appendix A.

The "Locally Identified Areas of Flooding" described below were identified by the Saugus HMP/MVP Core Team as areas where flooding is known to occur. These areas do not necessarily coincide with the flood zones from the FIRM maps. Flood sources include inadequate drainage systems, high groundwater, coastal storms, or other local conditions.

The town had the firm Arcadis Design and Consultancy conduct a thorough town-wide assessment of local flooding and drainage problem sites. The report identified 19 high priority sites. These are shown in Table 9, sites numbered 14 and higher. The site numbers correspond to the numbers on Map 8, "Local Hazard Areas."

Table 9: Saugus Locally Identified Areas of Flooding

Map ID	Name	Comments
1	East Saugus Coastal Flooding	Flooding has closed residential streets and cellars have flooded in this area. Tides can impede the outflow of stormwater. Maintenance of swales and drainage channels is needed in this area. The Town will replace a culvert and install new tide gate in 2021.
2	Elm Street at Saville Street Bridge Flooding	A 52-inch new culvert was installed in 2018 which discharges downstream to address backup at bridge ($1.6 million project)
3	Route 1 Highway: Essex Street to Walnut Street Flooding	A section of the Route 1 corridor has been subject to flooding, in the area of the Extended Stay Hotel, trailer park and Walmart.
4	Spring Street Area Flooding	This area is downstream from Hawkes Pond Reservoir. There is a 48-inch culvert that is 100 years old. The state may be considering a drainage project in this area.
5	Intervale Avenue and Stone Street	Several neighborhood streets have flooded in this area
14	127 Central St. (22)	Flows from Mt Pleasant St & Central Ave enter residence
20	57/59 Essex St. (32)	Drainage ditch under capacity
23	32 Denver St./Maple Rd. (35)	Residents' yards flood from roads
24	Beachview Ave / Belair St. (1)	Area floods, consider installing CD to TG. Maybe a Dry Well or BMP.
26	Bristow St./ Barressi Lane (4)	Drainage for new playground area
27	Spring St. culvert (6)	Culvert is structurally inept. Has high consequence of failure
32	Crystal Pond Brook (East of Main St) (7)	Sediment and vegetative overgrowth in brook flood residents' parcels
33	Crystal Pond Brook (West of Main St) (8)	Brook flows are retarded by beaver dams and vegetative overgrowth
44	Creek from Main St to Heritage Dr (24)	Has had drainage issues in the past resulting in flooding of residential yards.
47	Vine St. / Talbot St. (16)	Brook crossing. 8 Highland Ave
49	Auburn St. / Jasper St. (18)	MS4 from Jasper St flows to an open channel to a culvert under the rail trail
50	Arcadia Ave. (19)	Ponding on road surface, work requires easements.

52	Venice Ave culvert (Seagirt Ave/Harlow St/Lewis Ln) (11)	Drainage Channel requires frequent cleaning, drains to Pines River Marshes
62	PLEASANT AVE (31)	Drainage Channel from Pleasant Ave to Essex Street
63	Fiske Brook/Meadow Brook Road (14)	Dumping in drainage swales results in residents' yards flooding.
64	Altamount Ave. (36)	
66	Houston Ave at Sachem St (5)	Known Flooding Area. No storm drain system in local.
67	Howard St. (9)	Culvert needs to be replaced.
82	Fairmount Ave. (15)	Collapsed drainpipe

Source: Town of Saugus DPW; Arcadis Design and Consultancy

Repetitive Loss Structures

As defined by FEMA, a repetitive loss property is a NFIP-insured structure that has had two or more paid flood losses of $1,000 or more in any given 10-year period since 1978.

There are 83 repetitive loss structures in Saugus, an increase from the 27 structures identified in the 2015 plan (Table 10). Over three-quarters of the repetitive loss properties (63 properties) are located in the A, AE, AO, and AH flood zones, while 20 are located in zones B, C, or X. The vast majority of the repetitive loss properties in Saugus are single family residences, although three multi-family residences can be found in the FEMA flood zone.

These repetitive loss properties had a total of 114 losses, totaling $1,316,882.73 in payments by the NFIP. Building payments accounted for 91% of the payments, and contents losses were 9% of the total losses. For more information on repetitive losses see https://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt and https://www.fema.gov/repetitive-flood-claims-grant-program-fact-sheet.

Table 10: Summary of Repetitive Properties, Losses, and Claims

	A, AE, AO, AH Zones	VE Zone	B, C, X Zones	Total
RL Buildings (Total)	63	0	20	83
RL Losses (Total)	82	0	32	114
RL Payments (Total)	$843,343.51	$.00	$473,539.22	$1,316,882.73
Building Payments	$783,639.72	$.00	$409,485.81	$1,193,125.53
Contents Payments	$59,703.79	$.00	$64,053.41	$123,757.20

Source: Department of Conservation and Recreation, FEMA Repetitive Loss data

DAM FAILURE

Dam failure can arise from two types of situations. Dams can fail because of structural problems or age, independent of any storm event. Dam failure can follow an earthquake by causing

structural damage. Dams can fail structurally because of flooding arising from a storm or they can overspill due to flooding.

In the event of a dam failure, the energy of the water stored behind a 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.

An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight. In addition, some dams have not been properly maintained. The increasing intensity of precipitation is the primary climate concern for dams, as 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. According to the Association of State Dam Safety Officials, three dams have failed in Massachusetts since 1984, one of which resulted in a death.

The Department of Conservation and Recreation (DCR) Office of Dam Safety lists 10 dams in Saugus (Table 11). DCR classifies dam hazards as shown below. One of the dams is rated as non-jurisdictional, one is rated Low Hazard, and six of these dams are rated as Significant Hazard and two rated as High Hazard.

DCR Dam Hazard Classification

The Massachusetts DCR has three hazard classifications for dams:

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

Table 11: Inventory of Dams in Saugus

Dam Name	River	Impoundment Name	Owner	Owner Type	Hazard Potential Classification
Hawkes Pond Outlet Dam	Saugus River	Hawkes Pond	Lynn Water and Sewer Comm.	Municipality	High
Walden Pond Outlet Dam	Saugus River, Ipswich River	Walden Pond	Lynn Water and Sewer Comm	Municipality	High

Dam Name	River	Impoundment Name	Owner	Owner Type	Hazard Potential Classification
John Leo Silver Lake Dam	Tributary of To Lower Pond	Upper Pond	Dept. of Conservation & Recreation	State	Significant
John A. W. Pearce Lake Dam	Tributary of Saugus River	Lower Pond	Dept. of Conservation & Recreation	State	Significant
Griswold Pond Dam	Bennetts Pond Bk/Crystal Bk	Griswold Pond	Town of Saugus	Municipality	Significant
Prankers Pond Dam	Saugus River	Prankers Pond	Town of Saugus	Municipality	N/A
Griswold Lower Pond Dam	Crystal Brook	Griswold Lower Pond	Town of Saugus	Municipality	Significant
Spring Pond Dam	Bennetts Brook	Spring Pond	Town of Saugus	Municipality	Significant
Stevens Pond East Dam	None	Stevens Pond	Residents at Stevens Pond	Private	Significant
Stevens Pond West Dam	None	Stevens Pond	Lisa M. Cinella	Private	Low

Source: DCR, Office of Dam Safety

Two of the dams, Hawkes Pond Outlet Dam and Walden Pond Outlet Dam, are on the Saugus River and are owned and operated by the Lynn Water and Sewer Commission as part of the City's public water supply system. Two others are state-owned dams operated by the MA Department of Conservation and Recreation, John Leo Silver Lake Dam and John A. W. Pearce Like Dam. Two dams are privately owned, the Stevens Pond East and West Dams. The Town of Saugus owns and operates four dams, including

- ***Griswold Lower Pond Dam***- Griswold Lower Pond Dam is of earthen construction, a gravity dam. Its length is 137 feet. Its capacity is 25.2 acre feet. Normal storage is 16.5 acre feet. It is on Crystal Brook and drains an area of 0.29 square miles.

- ***Griswold Pond Dam*** – Griswold Pond Dam is a 500 foot long, 9.5 foot high earth fill embankment. It is located on Crystal Brook.

- **Spring Pond Dam** – This dam is located on a smaller tributary, Bennetts Brook. The town recently had an evaluation of this dam performed by Weston and Sampson.

- **Prankers Pond Dam** – this dam is located on the Saugus River and is a small dam not classified by DCR.

DCR requires that dams that are rated as low hazard be inspected every ten years while dams that are rated as significant hazards must be inspected every five years. All dams within the

community are inspected by Saugus Emergency Managements as part of its CEMP updating process. Both of the Town's Griswold Pond dams are inspected annually.

There have been no recorded dam failures in Saugus. Based on the record of previous occurrences dam failure in Saugus is considered to be a Very Low frequency event. This hazard may occur less frequently than once in 100 years (less than 1% chance per year).

Dams and Climate Change

Climate change could further increase the risk of dam failure in several ways. More intense or frequent precipitation events could alter the river discharge rates, creating greater structural stress to the dam, increasing scouring and erosion, and causing loss of flood storage capacity in nearby spillways or floodplain wetlands.

ICE JAMS

Ice jams occur in cold weather when normally flowing water begins to freeze effectively damming the waterway and causing localized flooding in the area. Flooding may also occur when ice jams break up and ice may pile up at culverts or around bridges. There is no history of ice jams leading to flooding in Saugus and Town staff did not identify this hazard as an issue for the Town. As coastal Massachusetts experiences somewhat warmer winters than the western part of the state and tidal waters are less subject to freezing, this hazard is unlikely to be an issue in the Saugus River.

SEA LEVEL RISE

COASTAL FLOODING

Coastal flooding is most often associated with severe coastal storms that, through the combination of winds and tides, drive tidal waters to higher levels than normally experienced, leading to the inundation of low-lying land areas and the overtopping of sea walls. In low-lying areas coastal flooding can also be associated with routine tidal flooding or higher astronomic tides. Fueled by the warming climate, coastal flooding will become more frequent and severe due to the combination of sea level rise and more frequent and intense storms.

Saugus is not located directly on the coast. However, the Saugus River is tidal from Hamilton Street up to the Saugus Iron Works, as a result this section of town is affected by basement flooding and other problems during heavy rains and storms.

Local data for previous coastal flooding occurrences is not collected by the Town of Saugus. The best available data is for Essex County through the National Centers for Environmental Information. Essex County, which includes the Town of Saugus, experienced 35 coastal flood events from 2006 to 2020 (see Table 12). No deaths or injuries were reported and the total

reported property damage in the county was $7.10 million dollars. Damages from the February and March 2013 coastal floods in Essex County accounted for $6.8 million of that total.

Table 12: Essex County Coastal Flood Events, 2006-2020

Date	Deaths	Injuries	Property Damage
1/31/2006	0	0	60.00K
4/15/2007	0	0	5.00K
4/16/2007	0	0	5.00K
4/17/2007	0	0	20.00K
11/3/2007	0	0	10.00K
11/25/2008	0	0	0.00K
6/21/2009	0	0	0.00K
1/2/2010	0	0	0.00K
2/25/2010	0	0	0.00K
3/1/2010	0	0	0.00K
3/4/2010	0	0	0.00K
3/15/2010	0	0	0.00K
12/27/2010	0	0	75.00K
10/30/2011	0	0	10.00K
6/2/2012	0	0	0.00K
6/3/2012	0	0	30.00K
6/4/2012	0	0	0.00K
12/27/2012	0	0	0.00K
2/9/2013	0	0	5.800M
3/7/2013	0	0	1.000M
1/2/2014	0	0	0.00K
1/3/2014	0	0	0.00K
1/27/2015	0	0	50.00K
1/24/2016	0	0	0.00K
2/8/2016	0	0	0.00K
5/25/2017	0	0	40.00K
1/4/2019	0	0	0.00K
1/30/2018	0	0	0.00K
3/2/2018	0	0	0.00K
10/27/18	0	0	0.00K
11/25/18	0	0	0.00K
10/28/19	0	0	0.00K
4/9/20	0	0	0.00K
9/22/20	0	0	0.00K
Total	**0**	**0**	**7.105M**

Source: NOAA, National Centers for Environmental Information

The NOAA records for Essex County show a total of $7.1 million in damages from coastal flooding from 2006 to 20 Based on the record of previous occurrences coastal flooding in Saugus is a high frequency event as defined by the Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% chance per year).

COASTAL EROSION

Coastal shorelines change constantly in response to storms, seasons, sea level, and human alterations. Coastal erosion is measured as a rate of change over time. According to the SHMCAP frequency of erosion cannot be measured. Rising seas and more frequent and intense storms will tend to increase erosion, although some areas may actually accrete material. Erosion may be exacerbated by efforts to protect shoreline as engineered structures can reduce sediment sources to downdrift areas or, increase erosion seaward of structures due to interaction with waves.

The Massachusetts Office of Coastal Zone Management (CZM) in cooperation with USGS provides shoreline change data for the Massachusetts coast. While the Saugus River is tidal along portions of Saugus, and may experience erosion, CZM data does not extend inland from the coast. Saugus HMP/MVP Core Team members indicated that coastal erosion is often associated with the flooding that occurs in East Saugus. FEMA has indicated in their latest rules post hazard event reconstruction or repair funding for coastal protection structures will only be made available where the damage can be directly attributed to the storm event. Therefore, in order to receive this funding, the Town must maintain records of maintenance and repair activities that demonstrate the status of each structure.

RUMNEY MARSH

Rumney marsh is the principal regional coastal resource in Saugus and parts of neighboring Revere and Lynn. The 2,274 acre area includes significant salt marsh and tidal flat resources in two principal wetland systems along the Saugus River and Pines River (Figure 10). The Rumney Marsh has been characterized by the U.S. Fish and Wildlife Service as one of the most biologically significant estuaries in Massachusetts north of Boston.

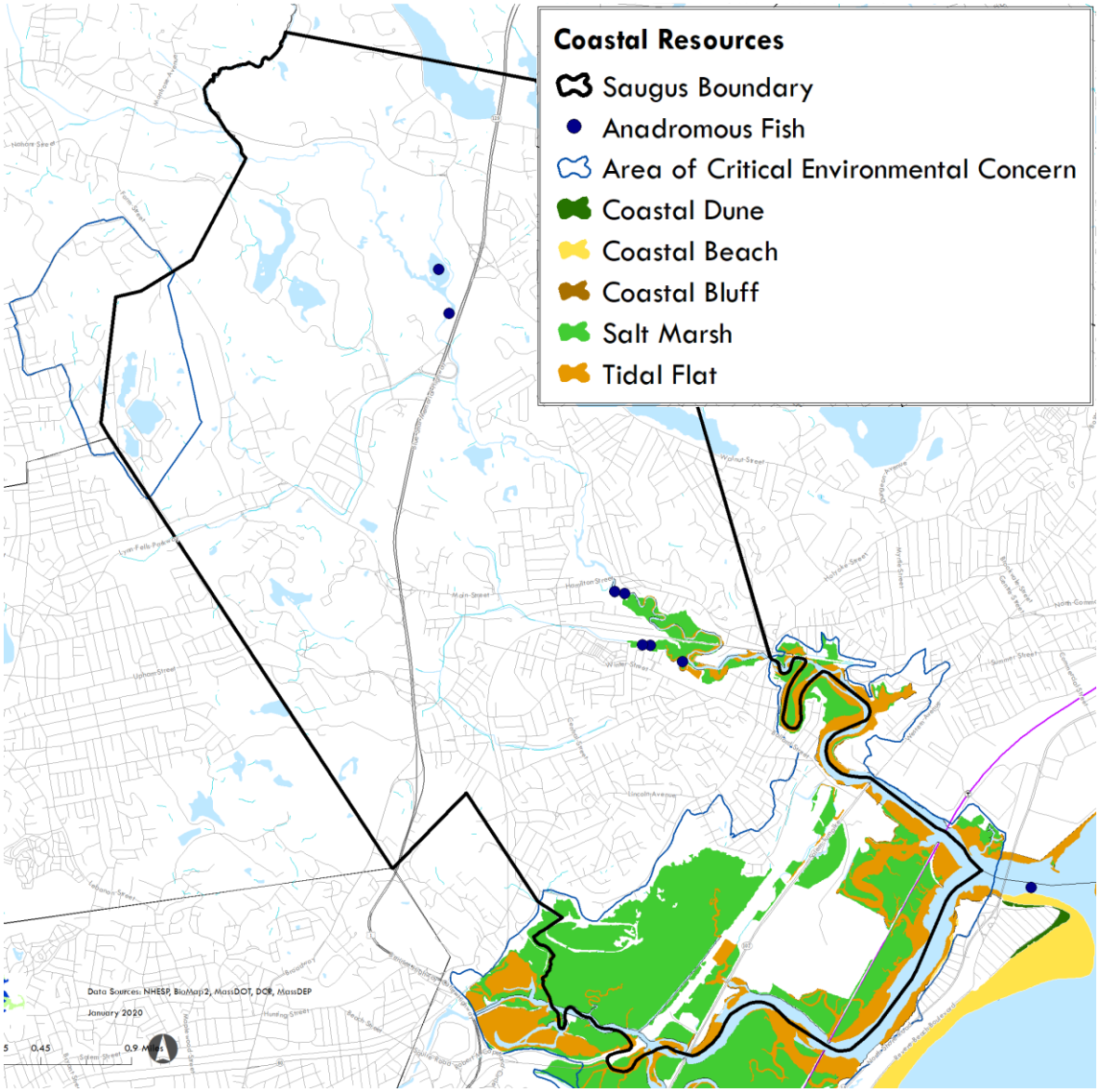
In 1988 Rumney Marsh was designated as an Area of Critical Environmental Concern (ACEC) by the Commonwealth of Massachusetts (along with nearby Belle Isle Marsh in Boston and Revere). Following that designation, the state prepared the *Rumney Marsh Salt Marsh Restoration Plan* in 2002. The plan identified 30 restoration projects, some of which have been completed. In 1992, the MDC acquired and dedicated over 500 acres of the marshes as the Rumney Marsh Reservation. The *Rumney Marsh Salt Marsh Restoration Plan* lists flooding as a key concern:

> Despite the tremendous ecological value of Rumney Marsh and its uniqueness as large natural areas within a highly developed and urbanized region, the ACEC suffers from a host of problems which diminishes values and impairs vital ecological functions. Threats include:

• loss of habitats,
• increase in invasive plant species and loss of native salt marsh plants,
• impaired water quality,
• flooding,
• increase in mosquitoes,
• increased risk of fire, and
• loss of recreational and educational opportunities, open space, and scenic quality.

Disturbances to the ACEC wetlands impact both the marshes themselves, through loss of fish and wildlife habitat, and the surrounding communities, demonstrated by flooding in residential areas."

Figure 10: Coastal Resources in Saugus



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The *Rumney Marsh Salt Marsh Restoration Plan* also addresses the filling of the I-95 embankment:

> One of the most profound impacts to Rumney Marsh was the partial construction of what was intended to be an extension of Interstate Route 95 in the 1960s. Several million cubic yards of sand were placed on approximately 200 acres in the heart of Rumney Marsh. The passage of the National Environmental Policy Act led to the abandonment of the highway project in 1972. By 1978, state and federal regulations preventing the filling of wetlands were instituted and marsh destruction was slowed.
>
> By 1990, plans for reuse of the embankment were developed, which included removal of approximately one million cubic yards of sand for renourishment of Revere Beach, and development of the land into a passive linear park. Several of the projects identified by the *Rumney Marsh Salt Marsh Restoration Plan* directly address portions of the embankment. However, large scale removal of the embankment is complicated by the flood protection it now provides for residential neighborhoods in East Saugus."

The plan concludes that, "Beyond protection of existing flood storage areas, restoration of historic flood storage areas by fill removal and elimination of tidal restrictions is the only feasible method to gain more flood capacity and avoid the recurrence of catastrophic damage."

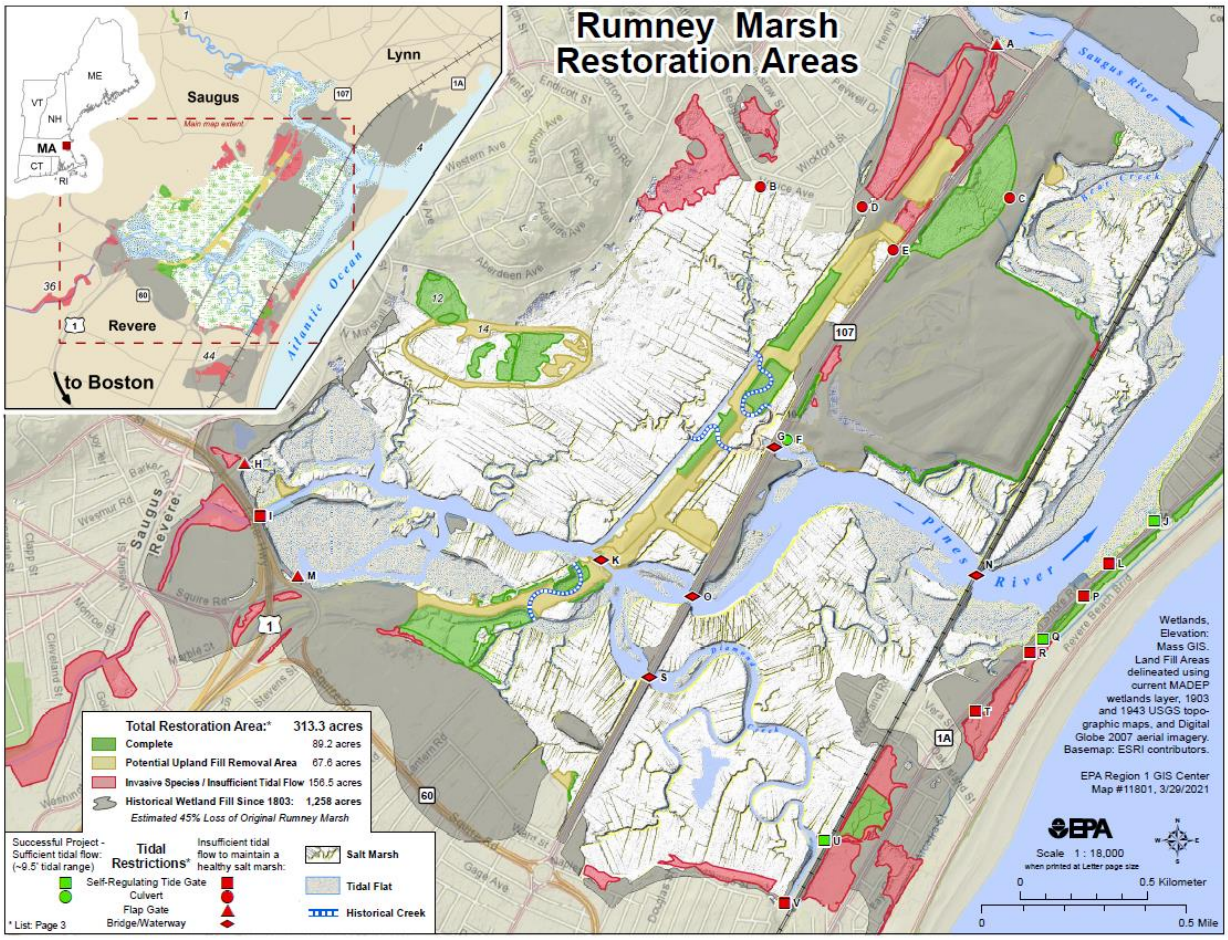
Another key study of the area, the *Saugus River and Tributaries Flood Damage Reduction Study* prepared by the Army Corps of Engineers in 1989, documents the extent and importance of the flood storage capacity of Rumney Marsh. According to the study, damages from coastal storms occur on an annual basis, with significant flooding on an average of every four to five years. Because of the particular topography and tidal hydrology of the study area, floodwaters become trapped from waves pushed inland from the ocean. Resulting interior flood levels are often significantly higher than high tide levels offshore. Only when the storm abates can the floodwaters slowly drain back out through the estuary, the single outlet to the sea (USACE, 1989).

Since the *Rumney Marsh Salt Marsh Restoration Plan was completed,* the US Environmental Protection Agency, Region 1 has been tracking implementation of restoration projects in Rumney Marsh. According to the EPA website, "EPA has used GIS mapping tools for nearly two decades to monitor and track Rumney Marsh protection and restoration efforts. This technology helps depict where the marsh has been historically filled (almost 50% has been filled since 1803), track the status of ongoing restoration projects, and illuminate areas in need of further protection and restoration. Rumney Marsh has come a long way but there is more work to be done." EPA published a comprehensive map displaying the status of restoration projects (Figure 11), and a current list of ongoing and completed projects (Table 13).

In 2019 EPA undertook a tidal water level study to evaluate whether restoring drainage patterns cut off by the embankment would adversely affect tidal flooding of low lying residential and commercial areas. The study made measurements of water levels in seven key locations in Rumney Marsh over a period of 142 days. Although the study has not yet been published, it indicates that Route 107 is causing increased tides in East Saugus rather than the embankment. The EPA

research is expected to be presented in a forthcoming publication, which should help to inform the Town on the most effective long-term strategies for marsh restoration and flood mitigation in Rumney Marsh.

Figure 11: Rumney Marsh Restoration Projects



Source: EPA Region 1

Climate change and future Sea Level Rise

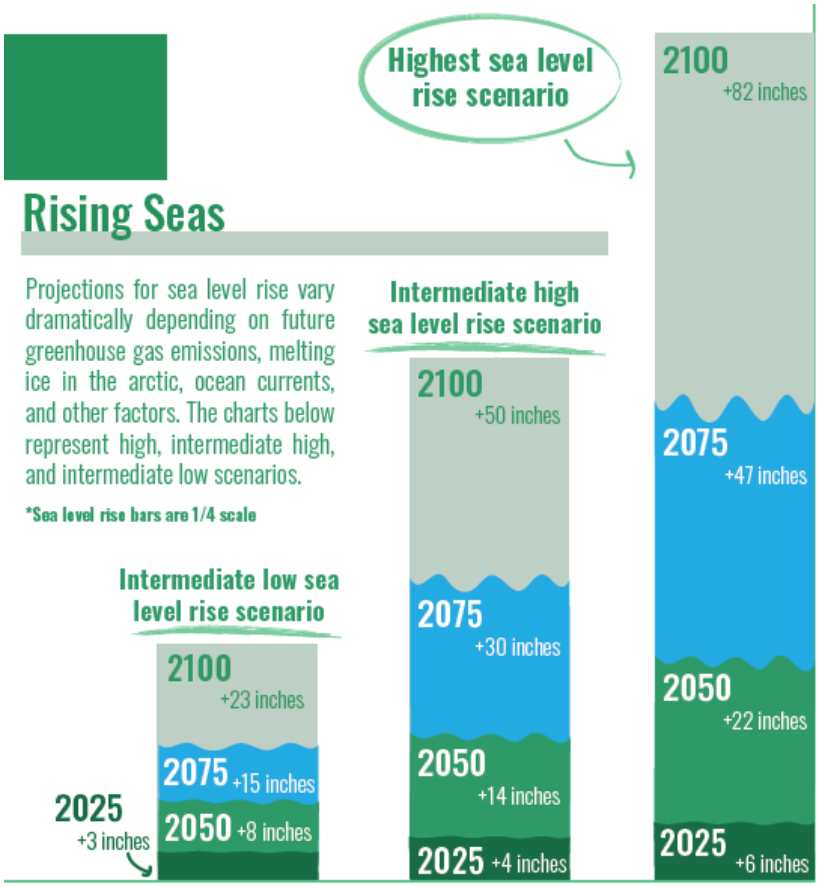
As shown in Figure 6, observed sea level rise at the Boston tide gauge has been nearly one foot over the last century. Projections of sea level rise through the year 2100 vary significantly depending on future greenhouse gas emissions and melting of land-based glaciers. Currently sea levels are rising at an increasing rate. Figure 12 shows three projections for future sea level rise scenarios. Intermediate/Low and Intermediate/High, are based on lower and higher greenhouse gas emission scenarios and the High scenario is based on a scenario with greater ice melt. The Intermediate projections for 2100 range from 2 feet to 4 feet, while the High scenario is nearly 8 feet of sea level rise by the end of the century.

Table 13: Rumney Marsh Restoration Projects

ID	Name	Acres	Phragmites	Status
1	National Park Service	2.9		Complete
2	Seagirt Ave Marsh	3.4	Yes	Insufficient Tidal Flow
3	Ballard St Restoration	34.5	Yes	Insufficient Tidal Flow
4	Potential Lynn South Harbor Shoreline Restoration	2.0		Potential Upland Fill Removal Area
5	GE Salt Marsh Mitigation	0.2		Complete
6	Saugus Ave Marsh	16.4	Yes	Insufficient Tidal Flow
7	I-95 Salt Marsh Restoration Area 6	7.0		Potential Upland Fill Removal Area
8	RESCO Salt Marsh Restoration Area	1.0		Potential Upland Fill Removal Area
9	Crescent Marsh	22.8	Yes	Complete
10	I-95 Salt Marsh Restoration Area 5	1.3		Potential Upland Fill Removal Area
11	I-95 Salt Marsh Restoration Area 4	3.6		Potential Upland Fill Removal Area
12	Park Street Marsh Restoration Area	6.1		Complete
13	Massport Logan Airport Mitigation	4.7		Complete
14	Saugus Racetrack	10.3		Potential Upland Fill Removal Area
15	Saugus Racetrack Open Marsh Water Mgmt (OMWM)	8.6		Complete
16	Landfill Salt Marsh Restoration Area	0.1	Yes	Insufficient Tidal Flow
17	Route 107 Wetland	1.2	Yes	Insufficient Tidal Flow
18	Saugus River Navigation Project Mitigation	5.1		Complete
19	DOT Route 107 Bridges Mitigation	0.6		Complete
20	Saugus Landfill Wetland	0.1	Yes	Complete
21	I-95 Salt Marsh Restoration North	24.0		Potential Upland Fill Removal Area
22	Landfill Salt Marsh Restoration Area	2.9		Complete
23	DCR Nahant Causeway Mitigation	4.2		Complete
24	Linden Brook Restoration	0.8	Yes	Insufficient Tidal Flow
25	Dewey Daggett Landfill Shoreline Stabilization	0.2		Potential Upland Fill Removal Area
26	Pines River Channelization Upland Fill	0.6		Potential Upland Fill Removal Area
27	DCR Salt Marsh Restoration Area	3.5		Potential Upland Fill Removal Area
28	I-95 Salt Marsh Restoration Area 1	3.5		Potential Upland Fill Removal Area
29	Corps Roughan's Point Mitigation Area	2.2		Complete
30	Route 1A Tidegates #1-4 Marsh	5.4		Complete
31	I-95 Salt Marsh Restoration South	9.9		Potential Upland Fill Removal Area
32	Copeland Circle Wetlands	2.4	Yes	Insufficient Tidal Flow
33	Central Artery Marsh Restoration	16.0		Complete
34	Caruso Marsh Restoration Phragmites Zone	0.7	Yes	Insufficient Tidal Flow
35	Caruso Marsh Restoration	1.7		Complete
36	Townline Brook Marsh Restoration	39.0	Yes	Insufficient tidal flow
37	Route 1A Tidegates #5-6 Marsh	9.5	Yes	Insufficient Tidal Flow
38	DCR Salt Marsh Restoration Area 2	0.8	Yes	Potential Upland Fill Removal Area
39	BJ's Salt Marsh Restoration	0.3		Complete
40	Oak Island Marsh Restoration	5.5		Complete
41	Oak Island Marsh Restoration & Eastern County Ditch	20.7	Yes	Insufficient Tidal Flow
42	Hastings Street Salt Marsh	6.5	Yes	Invasive species
43	Naples Road Marsh	1.3	Yes	Invasive species
44	Central County Ditch Marsh Restoration	22.9	Yes	Insufficient Tidal Flow

Source: Environmental Protection Agency, Region 1

Figure 12 Projected Future Sea Level Rise Scenarios



Source: Adapted from the Northeast Climate Adaptation Center data

TSUNAMI

A tsunami is a surge of water typically caused by an offshore earthquake. Tsunamis can cause wave heights of 100 feet or more. According to the SHMCAP, Massachusetts has never experienced a significant tsunami, although two smaller tsunamis have occurred with no deaths or damages recorded. Damage from a tsunami could occur, but it is a very low likelihood event that has not occurred previously in Saugus. The town does not have coastal shoreline, but a tsunami could cause flooding along the Saugus River due to surging tidal waters.

Based on previous occurrences, Tsunami is considered to be a Very Low Frequency event in Saugus. This hazard may occur less frequently than once in 100 years (less than 1% chance per 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.

Average annual precipitation in Massachusetts is 44 inches per year, with approximately three to four-inch average amounts for each month of the year. In Massachusetts, droughts are caused by the prevalence of dry northern continental air and a decrease in coastal- and tropical-cyclone activity. During the 1960s, a cool drought occurred because dry air from the north caused lower temperatures in the springs and summers of 1962 through 1965. The northerly winds drove frontal systems to sea along the southeast coast and prevented the northeastern states from receiving the normal amount of moisture (U.S. Geological Survey). In the driest year (1965), the statewide precipitation total of 30 inches was only 68% of the average total.

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 2019 Massachusetts Drought Management Plan divides the state into seven regions: Western, Central, Connecticut River Valley, Northeast, Southeast, and Cape Cod, and Islands. Saugus is located in the Northeast region. Drought is a potential town-wide hazard in Saugus.

The MA Drought Management Plan was revised in 2019 to change the state's classification of droughts by establishing four levels to characterize drought severity: Mild Drought, Significant Drought, Critical Drought, and Emergency. These levels are based on conditions of natural resources and provide information on the current status of water resources. The levels provide a framework from which to take actions to assess, communicate, and respond to drought conditions. The Massachusetts drought levels are shown in comparison to the U.S. Drought Monitor levels in Figure 13. The two sets of drought indices are similar, but Massachusetts combines the USDM's level D2 and D3 into one category, Critical Drought.

Figure 13: MA Statewide Drought Levels Compared to US Drought Monitor

USDM Names	Recurrence	Percentile Ranges	MA DMP Levels	MA Percentile Ranges	MA DMP Names
D0: Abnormally Dry	once per 3 to 5 years	21 to 30	1	>20 and ≤30%	Mild Drought
D1: Moderate	once per 5 to 10 years	11 to 20	2	>10 and ≤20%	Significant Drought
D2: Severe Drought	once per 10 to 20 years	6 to 10	3	>2 and ≤10%	Critical Drought
D3: Extreme Drought	once per 20 to 50 years	3 to 5			
D4: Exceptional Drought	once per 50 to 100 years	0 to 2	4	≤2%	Emergency

Source: Massachusetts Drought Management Plan, 2019

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 the seven regions in Massachusetts. County by county or watershed-specific determinations may also be made. A determination of drought level is based on six indices:

1. Standardized Precipitation Index (SPI) reflects soil moisture and precipitation.
2. The Stream flow Index is based on the number of consecutive months that stream flow levels are below normal.
3. The Lakes and Impoundments Index is based on the water levels of small, medium, and large index reservoirs across the state, relative to normal conditions for each month.
4. The Groundwater Level Index is based on the number of consecutive month's groundwater levels below normal.
5. Keetch Byram Drought Index (KBDI) is designed for fire-potential assessment.
6. Crop Moisture Index (CMI) reflects soil moisture conditions for agriculture.

Table 14 shows the range of values for each of the indices associated with the drought levels.

Table 14: Indices Values Corresponding to Drought Index Severity Levels

Index Severity Level	Standardized Precipitation Index	Streamflow	Lakes and Impoundments	Groundwater	Keetch-Byram Drought Index	Crop Moisture Index
0	>30th percentile				< 200	> -1.0
1	≤30 and >20				200-400	≤-1.0 and > -2.0
2	≤20 and >10				400-600	≤-2.0 and < -3.0
3	≤10 and >2				600-700	≤ -3.0 and > -4.0
4	≤2				700-800	≤-4.0

Source: MA Drought Management Plan, 2019

Because drought tends to be a regional natural hazard, this plan references state data as the best available data for previous drought occurrences.

Drought Emergencies have been declared infrequently, with five events occurring in the period between 1850 and 2020: 1883, 1911, 1941, 1957, and 1965 to 1966. The drought period between 1965 and 1966 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 1% chance of being in a drought emergency.

Drought Warning levels not associated with drought emergencies have occurred six times, in 1894, 1915, 1930, 1985, and 2016, and 2020. On a monthly basis over the 162-year period of record, there is a 2% chance of being in a Drought Warning.

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 between 1980 and 1981, followed by a drought warning in 1985. The overall frequency of being in a Drought Watch level is 8% on a monthly basis over the 162-year period of record.

Based on the record since 1850, the SHMCAP calculates that statewide there is a 1% chance of being in a drought emergency in any given month. For drought warning and watch levels, the chance is 2% and 8% respectively in any given month (Table 15.

Table 15: Frequency of Massachusetts Drought Levels

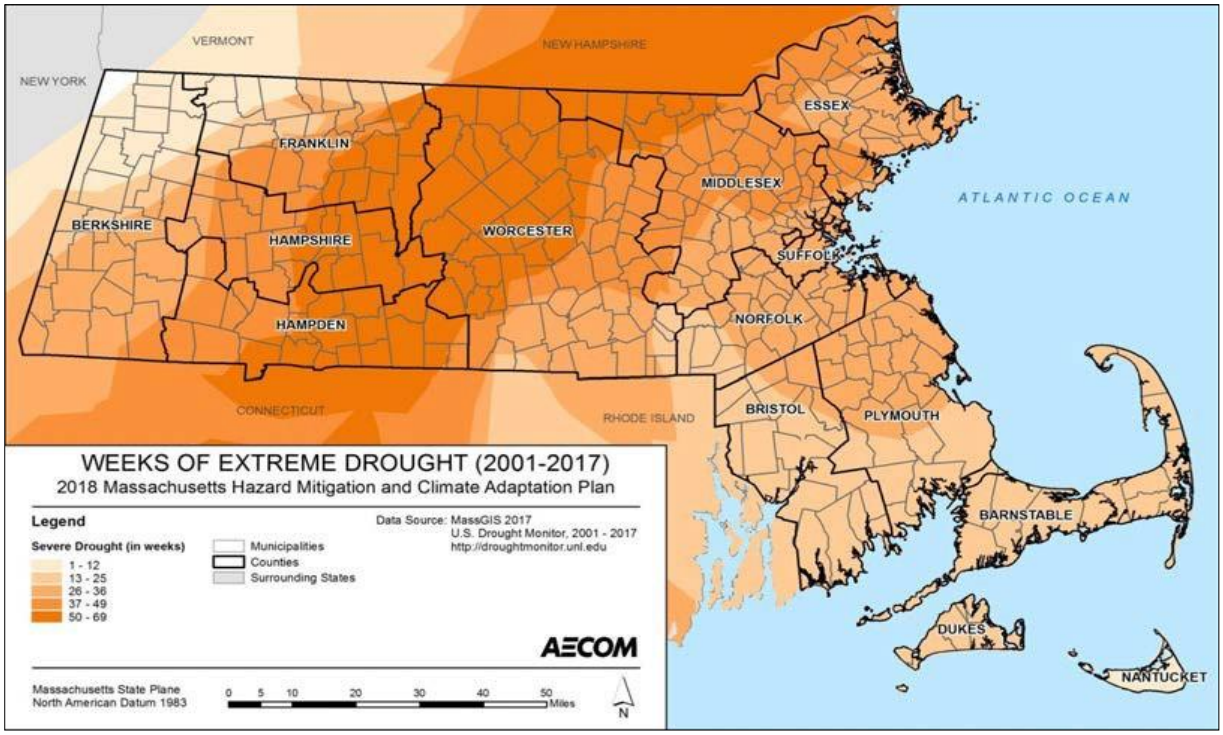
Drought Level	Frequency Since 1850	Probability of Occurrence in a Given Month
Drought Emergency	5 occurrences	1% chance
Drought Warning	5 occurrences	2% chance
Drought Watch	46 occurrences	8% chance

Source: SHMCAP

The U.S. Drought Monitor characterizes droughts as abnormally dry, moderate, severe, extreme, or exceptional. As shown in Figure 14, Saugus experienced between 26 and 36 weeks of severe drought between 2001 and 2017.

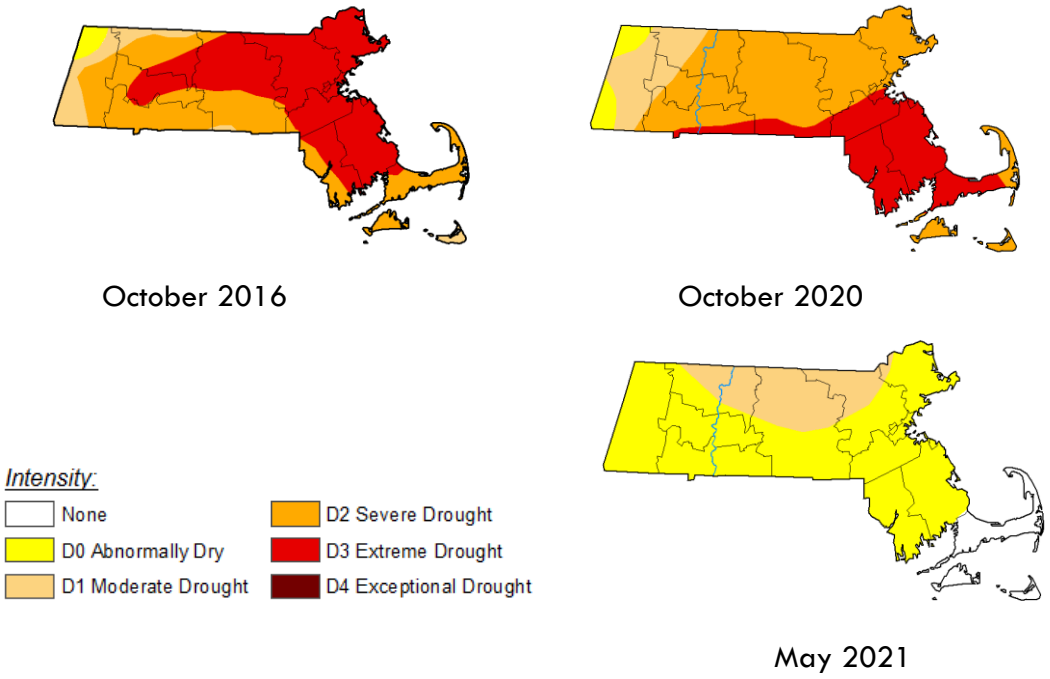
Since the 2015 Saugus Hazard Mitigation Plan there have been three droughts in Massachusetts. The drought of 2016 was the worst one since 1985, with more than half of the state reaching the Extreme Drought stage for several months (Figure 15). This was followed by another drought just four years later in 2020, which was most server in Southeastern Massachusetts and somewhat less so in Saugus and the North Shore. Finally, in the spring of 2021 a third, milder drought was declared across the state.

Figure 14: Weeks of Severe Drought (2001-2017)



Source: MA SHMCAP

Figure 15: Recent Drought Events (2016-2021)



Source: US Drought Monitor

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.

Drought impacts can include reduced groundwater and surface water levels, affecting water quality and quantity, streamflow, and wetlands levels, and negatively impacting aquatic organisms that rely on riverine and wetland habitats. Drought also increases stress on plant communities, weakening trees, and increasing the likelihood of forest and brush fires.

Potential damages of a severe long-term 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. Economic sectors impacted could potentially include commercial and industrial water users, recreation facilities, agriculture, landscaping, and forestry.

As this hazard has never occurred to such a severe degree in Saugus, 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 of several million dollars.

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).

Drought and Climate Change

Changing precipitation patterns and the number of extreme weather events per year is difficult to project into the future. The Northeast Climate Science Center does report an anticipated increase in rainfall for Massachusetts in the spring and winter months and slightly decreased summer rainfall. Consequently, warming temperatures can cause greater evaporation in the summer and fall, as well as earlier snow melt. This, combined with projected higher summer temperatures, could increase the frequency of episodic droughts in the future.

EXTREME TEMPERATURES

AVERAGE AND EXTREME TEMPERATURES

Saugus has four well-defined seasons, characterized mainly by seasonal temperatures. Extreme temperatures can be defined as those that are far outside of the normal seasonal ranges for Massachusetts. The average temperature for Winter (December to February) in Massachusetts is 31.8 degrees Fahrenheit. The average temperature for Summer (June to August) is 71 degrees F.

Extreme temperatures can occur for brief periods of time and be acute, or they can occur over longer periods of time when there is a long stretch of excessively hot or cold weather.

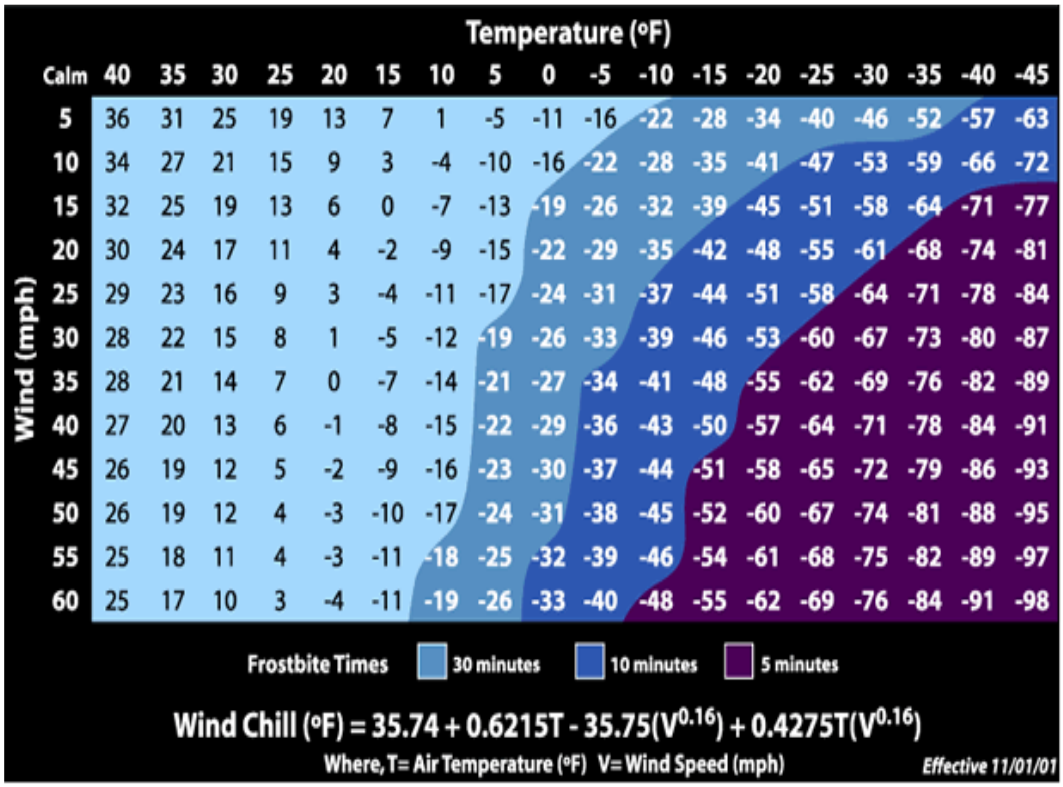
EXTREME COLD

For extreme cold, temperature is typically measured using the Wind Chill Temperature Index, which is provided by the National Weather Service (NWS). Wind chill is the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed and is meant to show how cold conditions feel on unexposed skin and can lead to frostbite. The index is provided in Figure 16 below.

Extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter, those who are stranded, or those who live in homes that are poorly insulated or without heat.

The best available local data on past occurrences of extreme cold in Saugus are for Essex County, through the National Centers for Environmental Information (NCEI). There have been three extreme cold events in the past ten years, which caused no deaths, no injuries, or property damage (see Table 16).

Figure 16: Wind Chill Temperature Index and Frostbite Risk



Source: National Weather Service

Table 16: Essex County Extreme Cold and Wind Chill Occurrences

Date	Deaths	Injuries	Damage
2/15/2015	0	0	0
2/16/2015	0	0	0
2/13/2016	0	0	0

Source: 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 National Weather Service (NWS). These advisories are issued when the heat index (Figure 17) is forecast to exceed 100°F for two or more hours; an excessive heat advisory is issued if the forecast predicts the temperature to rise above 105°F.

Figure17: Heat Index Chart

Relative Humidity (%) \ Temperature (°F)	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										

Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke or Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Source: National Weather Service

The best available local data on past occurrences of extreme heat in Saugus are for Essex County, through the National Centers for Environmental Information. From 1995 - 2020, there have been a total of three excessive heat events recorded, with no reported deaths, no injuries, and no property damage resulting from excessive heat (see Table 17).

Table 17: Essex County Extreme Heat Occurrences 1995 to 2020

Date	Deaths	Injuries	Damage
7/22/2011	0	0	0
7/1/2018	0	0	0
7/3/2018	0	0	0

Source: NOAA, National Centers for Environmental Information

Prolonged exposure to high temperatures can cause heat-related illnesses, such as heat cramps, heat exhaustion, heat stroke, and death. Heat exhaustion is the most common heat-related illness and if untreated, it may progress to heat stroke. People who perform manual labor, particularly those who work outdoors, are at increased risk for heat-related illnesses. Prolonged heat exposure and the poor air quality and high humidity that often accompany heat waves can also exacerbate pre-existing conditions, including respiratory illnesses, cardiovascular disease, and mental illnesses.

Older adults are often at elevated risk due to a high prevalence of pre-existing and chronic conditions. In Saugus, 20.6 percent of the population is over the age of 65. People who live in older housing stock and in housing without air conditioning have increased vulnerability to heat-related illnesses. Power failures are more likely to occur during heat waves, affecting the ability of residents to remain cool during extreme heat. Individuals with pre-existing conditions and those who require electric medical equipment may be at increased risk during a power outage.

The Heat Island Effect and Hot Spots

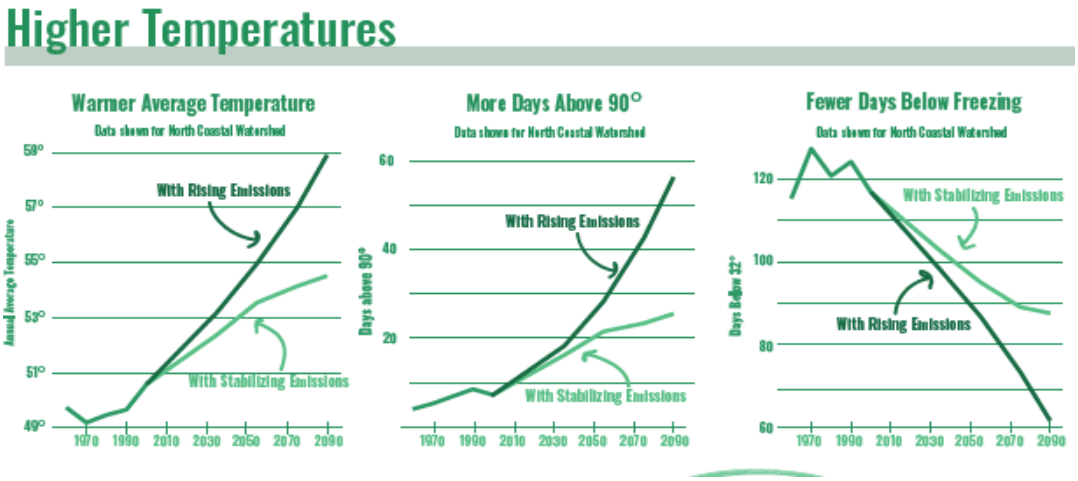
Due to what is termed the "heat island effect", areas with less shade and more dark surfaces (pavement and roofs) will experience even hotter temperatures; these surfaces absorb heat during the day and release it in the evening, keeping nighttime temperatures warmer as well. Map 9 in Appendix A displays areas in Saugus that are among the hottest 5% of land in the MAPC region based on land surface temperature derived from satellite imagery on July 13, 2016, when the high temperature at Logan Airport was 92°F.

The hottest 5% areas, or "hot spots," in Saugus generally follow the Route 1 commercial corridor. Heat impacts are more likely to be felt by residents without air conditioning and by those who work outdoors. Increased average temperatures will have impacts on natural resources as species may need to migrate to stay within temperature range. Map 9 also shows the range of tree cover across the Town. Areas with higher tree coverage are the coolest areas on the map, showing the clear benefits of trees to mitigate extreme heat. The greatest amount of tree cover is in the area of Breakheart Reservation and in the northeastern part of Saugus in the Lynn Woods Reservation along the municipal border with Lynn.

Extreme Temperatures and Climate Change

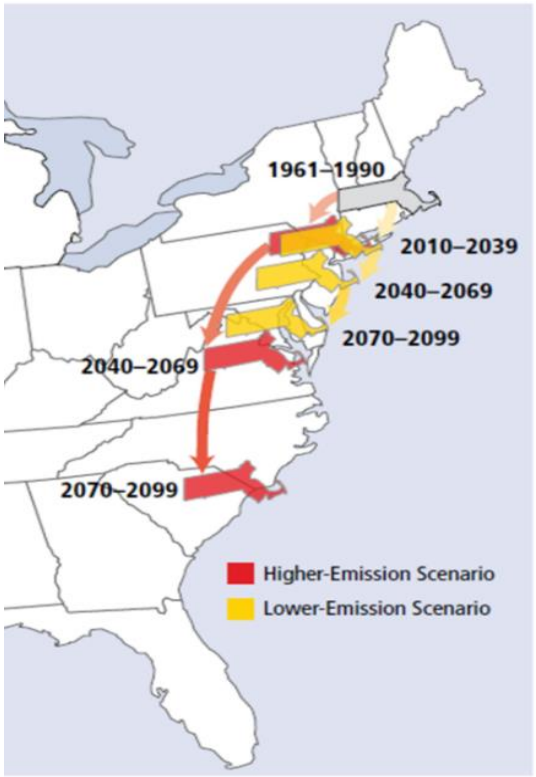
Extreme cold events are predicted to decrease in the future, while extreme heat, as well as average temperatures, are projected to increase. Global temperatures have increased by nearly 2 degrees in the last century and even small changes in temperature have widespread and significant changes to our climatic system. For example, the northeast has experienced a 10-day increase in the growing season in since 1980.

Figure 18: Projected Temperatures for Climate Scenarios to 2100



Source: ResilientMA.org

Figure 19 Temperature Scenarios Map



Source: Union of Concerned Scientists

Future temperature projections for the North Coastal watershed, which includes Saugus, are shown in Figure 18. The projections are based on two future climate scenarios, with stabilizing and rising greenhouse gas emissions to the end of the century. The projections show an increase in average temperatures in the range of 4 to 8 degrees from the current 51 degrees to a range of 55 to 59 degrees. The number of days over 90 degrees is projected to increase from the current 10 days to a range of 25 to 55 days per year. This change represents the present-day climate from Virginia to South Carolina (Figure 19). The projected increase in extreme heat and heat waves is one of the key health concerns related to climate change.

WILDFIRE HAZARDS

A wildfire is a non-structure fire occurring in a forested, shrub 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. A more likely occurrence is brush fires that typically burn no more than the underbrush of a forested area. There are three different classes of wildfires:

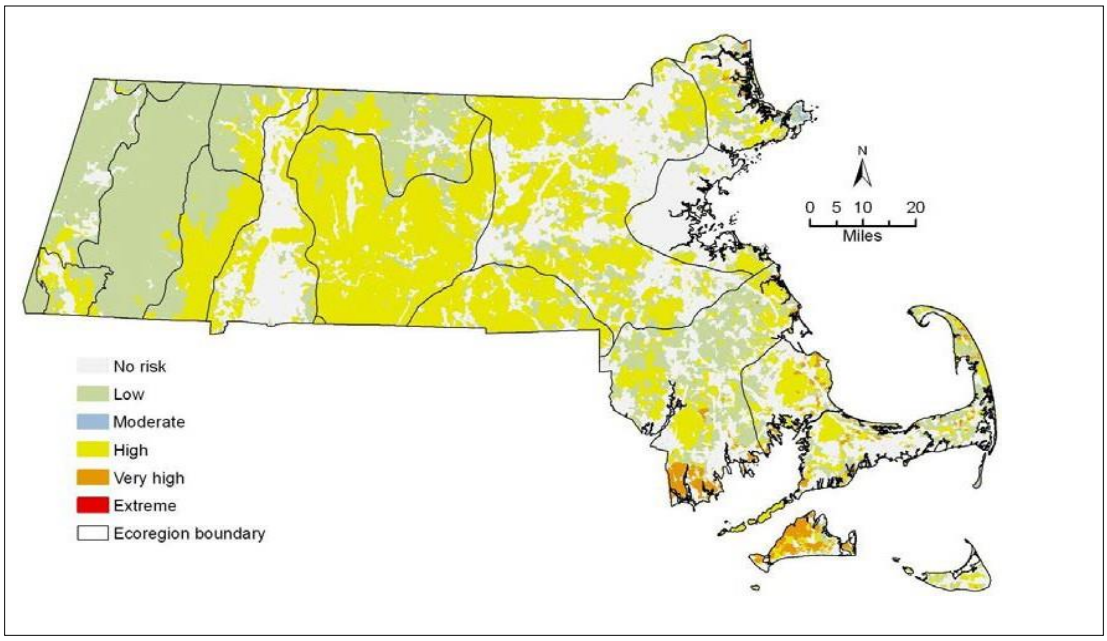
- **Surface fires** are the most common type and burn along the floor of a forest, moving slowly and killing or damaging trees
- **Ground fires** are usually started by lightning and burn on or below the forest floor
- **Crown fires** spread rapidly by wind, jumping along the tops of trees

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. 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. As the climate warms, drought and warmer temperatures may increase the risk of wildfire as vegetation dries out and becomes more flammable.

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 wildfire destroys the ground cover, then erosion becomes one of several potential problems.

The SCHMCAP depicts statewide fire risk incorporating three risk components: fuel, wildland-urban interface, and topography (Figure 20). The wildland-urban interface reflects communities where housing and vegetation intermingle and fire can spread from structures to vegetated areas. The most susceptible fuels are pitch pine, scrub oak and oak forests. Topography can affect the behavior of fires, as fire spreads more easily uphill. Much of Saugus is shown in a no risk category, with part of the northern area, representing the more wooded areas such as Breakheart Reservation and the Lynn watershed lands, in a low-risk zone.

Figure20: Wildfire Risk Areas



Source: Mass SHMCAP

Brush fires are not considered a serious hazard in Saugus. Since the 2015 Hazard Mitigation Plan there were no wildfires that resulted in significant property damage and overall impacts. The Town's wildfires tend to be in the more remote wooded areas. Most fires are inadvertently caused by pedestrian recreational use, careless disposal of cigarettes, and by weather conditions such as lack of rainfall and lightning. These fires typically result in minimal damage and there have been no reports of significant property damage, injuries, or deaths as the result of brush fires. The Saugus HMP/MVP Core Team identified the following areas of town as having the highest potential for brush fires (Table 18). The numbers correspond to the numbers on Map 8, "Hazard Areas."

Table 18: Potential Brushfire Hazard Areas

Map ID	Potential Brushfire Hazard Areas
6	Land located off end of Gianna Drive and power line Right of Way
7	Lynn Water and Sewer Commission Property
8	Pranker's Pond Area
9	3 Dams Golden Hills area
10	Cliff Heights

The Town does not allow open burning and the Fire Department participates in the review of new development and subdivision projects.

Based on the previous record of occurrences, significant brushfires are a medium frequency event in Saugus, occurring from once in 5 years to once in 50 years (2% to 20% chance per year).

Wildfires and Climate Change

Warmer temperatures, more extended heat waves, and increasing drought due to climate change could increase the risk of wildfires in the future. With higher rates of evaporation and potential heat stress impacting vegetation, forests and brush lands could become more flammable, potentially leading to more frequent and/or more severe wildfires. While California and much of the western US have been an extreme example of this in recent years, shifting climate pattens could augment this risk in the northeastern US as well.

EXTREME WEATHER HAZARDS

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. A tropical storm has similar characteristics, but wind speeds are below 74 miles per hour. Climate models suggest that hurricanes and tropical storms will become more intense as warmer ocean waters provide more fuel for the storms. In addition, rainfall amounts associated with hurricanes are predicted to increase because warmer air can hold more water vapor. Hurricanes in Massachusetts since 1938 are shown in Table 19.

Given its location at the coast, the Town of Saugus' entire area is vulnerable to hurricanes, which occur between June and November. A Category 3 hurricane tracked through Saugus in 1944. A recorded tropical storm also tracked through the Town in 1923. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. The town also experiences the impacts of the wind and rain from hurricanes and tropical storms regardless of whether the storm track passed through the town. The hazard mapping indicates that the 100-year wind speed in Saugus is 110 miles per hour.

Table 19: Hurricane Records for Massachusetts, 1938 to 2018

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

*Category 3 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 20 gives an overview of the wind speeds, surges, and range of damage caused by different hurricane categories.

Table 20: Saffir/Simpson Scale

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

Source: NOAA

Hurricanes typically have regional impacts beyond their immediate tracks. Falling trees and branches are a significant problem because they can result in power outages when they fall on power lines or block traffic and emergency routes. Hurricanes are a town-wide hazard in Saugus. Potential hurricane damages to Saugus have been estimated using HAZUS-MH. Total damages are estimated at $17,318.49 for a Category 2 hurricane and $87,541.46 for a Category 4 hurricane. Other potential impacts such as debris disposal and sheltering needs are detailed in Table 38.

Based on records of previous occurrences, hurricanes in Saugus are a Medium frequency event. This hazard occurs from once in 5 years to once in 50 years, or a 2% to 20% chance per year.

NOR'EASTERS

A northeast storm, known as a nor'easter, is typically a large counterclockwise 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 rain or snow, depending on temperatures.

Previous occurrences of nor'easters include the storm events shown on Table 21 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 February 2013, January 2015, and in March 2018 were large nor'easters that caused significant impacts on Massachusetts with heavy snowfall, high winds, and coastal flooding.

Table 21: Nor'easter Events for Massachusetts, 1978 to 2020

Date	Nor'easter Event
February 1978	Blizzard of 1978
October 1991	Severe Coastal Storm ("Perfect Storm")
December 1992	Great Nor'easter of 1992
January 2005	Blizzard/Nor'easter
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	Blizzard of 2013
January 2015	Blizzard of 2015
March 2015	March 2015 Nor'easters
January 2018	January 2018
March 2018	March 2018

Saugus is vulnerable to both the wind and precipitation that accompany 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, and block access for emergency vehicles. Nor'easters are also a cause of coastal flooding. In Saugus, the entire town is potentially at risk from the wind, rain, or snow impacts of a nor'easter, but East Saugus is vulnerable to associated tidal surges, which causes flooding during these storm events.

A blizzard is a winter snowstorm with sustained or frequent wind gusts to 35 mph or more, accompanied by falling or blowing snow which reduces visibility to or below ¼ mile. These conditions must be the predominant condition over a three-hour period. Extremely cold temperatures are often associated with blizzard conditions but are not a formal part of the definition. The hazard related to the combination of snow, wind, and low visibility significantly increases when temperatures drop 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 four inches of snowfall within a 12-hour period. Blizzards and winter storms are often associated with a Nor'easter event, a large counterclockwise 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 (Kocin and Uccellini, 2004), 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 in Table 22.

Table 22: NESIS Categories

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

Source: Massachusetts State Hazard Mitigation Plan, 2013

The most significant winter storm 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 Saugus, blizzards and severe winter storms have occurred in the following years (Table 23):

Table 23: Severe Weather Major Disaster Declarations in Eastern MA

Storm Event	
Severe Winter Storm and Snowstorm	March 2018
Severe Winter Storm, Snowstorm, and Flooding	January 2015
Severe Winter Storm, Snowstorm, and Flooding	February 2013
Hurricane Sandy	October/November 2012
Severe Storm and Snowstorm	October 2011
Tropical Storm Irene	August 2011
Severe Winter Storm and Snowstorm	January 2011
Severe Winter Storm and Flooding	December 2008
Severe Storms and Inland and Coastal Flooding	April 2007
Severe Storm and Flooding	October 2005
Severe Storms & Flooding	March 2001
Blizzard	December 1992
Winter Coastal Storm	October 1991
Severe Coastal Storm	August 1991
Hurricane Bob	September 1985
Hurricane Gloria	February 1978
Coastal Storm, Flood, Ice, Snow	January 1966
Hurricane, floods	August 1955
Hurricanes	September 1954

Based on the record of previous occurrences, nor'easters in Saugus are high frequency events. This hazard may occur more frequently than once in five years (greater than 20% chance per year).

Nor'easters and Climate Change

As with hurricanes, warmer ocean water and air will provide more fuel for storms. According to the SHMCAP it appears that Atlantic coast nor'easters are increasing in frequency and intensity.

SEVERE WINTER STORM/HEAVY SNOW AND BLIZZARDS

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. 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.

Winter storms are a potential town-wide hazard in Saugus. Map 6 in Appendix A indicates that the average annual snowfall for the northern two-thirds of Saugus is 48-72 inches per year while the southern third averages 36 – 48 inches per year.

A number of public safety issues can arise during snowstorms. Impassible streets are a challenge for emergency vehicles and affect residents and employers. Snow-covered sidewalks force people to walk in streets, which are already less safe due to snow, slush, puddles, and ice. Large piles of snow can also block sight lines for drivers, particularly at intersections. Refreezing of melting snow can cause dangerous roadway conditions. In addition, transit operations may be impacted, as they were in the 2015 blizzards which caused the closure of the MBTA system for one day and limited services on the commuter rail for several weeks.

The best available data on previous occurrences and impacts of heavy snow events in Saugus are for Essex County, which includes Saugus. According to National Centers for Environmental Information (NCEI) records, from 2009 to 2020, Essex County experienced 29 days with heavy snowfall events, resulting in no injuries, deaths, and property damage of $65,000. See Table 24 for and heavy snow events and impacts in Essex County.

Heavy snow and blizzards are considered to be high frequency events based on past occurrences. This hazard occurs more than once in five years, with a greater than 20 percent chance of occurring each year.

Table 24: Heavy Snow events and Impacts in Essex County 2009 – 2020

Date	Deaths	Injuries	Damage-$
1/11/2009	0	0	0
1/18/2009	0	0	0
3/1/2009	0	0	0
3/9/2009	0	0	0
12/20/2009	0	0	0
1/18/2010	0	0	0
2/16/2010	0	0	15,000
1/12/2011	0	0	0
1/26/2011	0	0	0
2/8/2013	0	0	0
3/7/2013	0	0	0
3/18/2013	0	0	0
12/14/2013	0	0	0
12/17/2013	0	0	0
1/2/2014	0	0	0
1/18/2014	0	0	10,000
2/5/2014	0	0	0
2/13/2014	0	0	0
2/18/2014	0	0	0
1/24/2015	0	0	0
1/26/2015	0	0	0
2/2/2015	0	0	0
2/8/2015	0	0	0
2/14/2015	0	0	0
2/5/2016	0	0	40,000
3/14/17	0	0	0
11/15/18	0	0	0
12/1/19	0	0	0
1/18/20	0	0	0
12/16/20	0	0	0
TOTAL	**0**	**0**	**$65,000**

Source: NOAA, National Centers for Environmental Information

Severe Winter Storms and Climate Change

As with nor'easters, warmer ocean water and air will provide more fuel for severe winter storms. According to the SHMCAP changing atmospheric patterns favor the development of winter storms.

ICE STORMS AND HAIL EVENTS

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. Ice storm conditions are defined by liquid rain falling and freezing on contact with cold objects, creating ice buildups of **one-fourth of an inch** or more. An ice storm warning, which is now included in the criteria for a winter storm warning, is issued when a **half inch or more** of accretion of freezing rain is expected.

Sleet and hail are other forms of frozen precipitation. Sleet occurs when raindrops fall into subfreezing air thick enough that the raindrops refreeze into ice before hitting the ground. The difference between sleet and hail is that sleet is a wintertime phenomenon whereas hail falls from convective clouds (usually thunderstorms), often during the warm spring and summer months.

Hail size refers to the diameter of the hailstones. Warnings may report hail size through comparisons with real-world objects that correspond to certain diameters shown in Table 25.

Table 25: Hail Size Comparisons

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
Teacup	3.00
Grapefruit	4.00
Softball	4.50

The greatest ice-related 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 causing power outages and blocking roadways. The impacts of winter storms may also include roof collapses and property damage and injuries related to the weight of snow and ice.

The best available local data on previous ice storm and hail occurrences in Saugus are for Essex County through the National Environmental Information Center (NEIC). Essex County, which includes Saugus, had one ice storm event recorded from 2000 to 2020 (see Table 26). No deaths or injuries were reported and the total reported property damage in the county was $2.0 million dollars.

Table 26: Essex County Ice Storm Events, 2000- 2020

Date	Deaths	Injuries	Property Damage
12/11/2008	0	0	$2,000,000

Source: NOAA, National Centers for Environmental Information

Statewide, ice storms are considered to be medium frequency events based on past occurrences. This hazard occurs once in five years to once in 50 years, with a 2% to 20% chance of occurring each year. However, according to the Massachusetts State Hazard Mitigation Plan, ice storms occur more frequently in the higher elevations of Western and Central Massachusetts, therefore coastal communities like Saugus in Eastern Massachusetts are less susceptible to this hazard.

Compared to ice storms, hail events are much more frequent in Essex County. NEIC records show that Essex County experienced 14 hail events from 2010 to 2020, with no recorded property damage, injuries, or deaths (Table 27).

Table 27: Essex County Hail Events, 2010 through 2020

DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE
6/5/2010	1.5	0	0	0
6/20/2010	1	0	0	0
6/1/2011	0.75	0	0	0
6/23/2012	0.88	0	0	0
7/18/2012	0.75	0	0	0
5/21/2013	0.75	0	0	0
9/1/2013	0.75	0	0	0
8/7/2014	0.75	0	0	0
5/12/2015	0.75	0	0	0
6/23/2015	1	0	0	0
8/4/2015	1	0	0	0
6/30/2019	0.75	0	0	0
7/30/20	0.75	0	0	0
8/23/20	0.75	0	0	0
TOTAL		**0**	**0**	**0**

*Magnitude refers to diameter of hail stones in inches

Source: NOAA, National Environmental Information Center

Hail events are considered to be medium frequency events in Saugus based on past occurrences. This hazard occurs once in five years to once in 50 years, with a 2% to 20% chance of occurring each 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 1, 2007, the National Weather Service began rating tornados using the Enhanced Fujita-scale (EF-scale), which allows surveyors to create more precise assessments of tornado severity. The EF-scale is summarized in Table 28.

Table 28: Enhanced Fujita Scale

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

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 (NESEC). 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 in Chelsea just south of Route 16, 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 rendered uninhabitable.

Since 1958, there have been eleven tornadoes in Essex County recorded by the NCEI. No tornados were F3, one was F2, eight were F1 and two were F 0. These 11 tornadoes resulted in no fatalities and four injuries and up to $560,280 in damages, as summarized in Table 29.

Table 29: Tornado Records for Essex County

Date	Fujita Scale	Deaths	Injuries	Property Damage $	Length	Width
6/13/1956	F1	0	0	2500	1	10
11/21/1956	F2	0	0	25000	0.8	17
12/18/1956	F1	0	0	250	0.5	23
7/13/1960	F0	0	0	30	0.1	33
7/21/1962	F1	0	3	25000	2.7	33
5/19/1964	F0	0	0	2500	0.1	300
5/19/1964	F1	0	0	2500	2	300
8/10/1965	F1	0	0	0	3.6	33
7/1/1968	F1	0	1	250000	0.3	100
7/21/1972	F1	0	0	2500	0.3	20
8/15/1991	F1	0	0	250000	0.8	300
		0	**4**	**$560,280**		

Source: National Centers for Environmental Information

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.

Although tornadoes are a potential town-wide hazard in Saugus, tornado impacts are relatively localized compared to severe storms and hurricanes. Damages from any tornado in Saugus would greatly depend on the track of the tornado. The greatest damages would be cause if a tornado passed along the heavily developed Route 1 commercial corridor in Saugus. The Town does maintain American Red Cross certified emergency shelters if they were needed in case of evacuations due to tornadoes.

Based on the record of previous occurrences since 1956, Tornado events in Saugus are a very low frequency event as there is no record of tornado activity in Saugus. This hazard occurs less frequently than once in 100 years (less than 1% per year).

Tornadoes and Climate Change

According to the SHMCAP, it is possible that severe thunderstorms which can include tornadoes may increase in frequency and intensity. However, scientists have less confidence in the models that seek to project future changes in tornado activity.

OTHER SEVERE WEATHER

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. Generally defined as a storm that includes thunder, which always accompanies lightning, a thunderstorm is a storm event featuring 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 Saugus are for Essex County through the National Centers for Environmental Information (NCEI). Between the years 2009 and 2020, NCEI records show 49 thunderstorm events in Essex County communities (Table 30). These storms resulted in a total of $1.88 million in property damages. There were two injuries and no deaths reported.

Table 30: Essex County Thunderstorm Wind Events, 2009-2020

Date	Magnitude-(knots)	Deaths	Injuries	Damage-$
7/26/2009	50	0	0	25000
7/31/2009	50	0	0	50500
6/3/2010	50	0	0	71000
6/5/2010	50	0	0	60000
6/6/2010	52	0	0	79500
6/24/2010	50	0	0	65750
7/12/2010	50	0	0	30000
7/19/2010	50	0	0	25000
6/9/2011	50	0	0	207000
7/4/2011	50	0	0	31000
7/18/2011	39	0	0	20000
8/19/2011	50	0	0	60000
10/4/2011	50	0	0	10000
6/23/2012	50	0	0	75500
6/25/2012	40	0	0	5000

Date	Magnitude-(knots)	Deaths	Injuries	Damage-$
7/4/2012	50	0	0	5000
6/24/2013	50	0	0	25000
7/1/2013	50	0	0	18000
7/3/2014	50	0	0	100000
7/15/2014	50	0	0	15000
7/28/2014	50	0	0	15000
9/2/2014	45	0	0	5000
9/6/2014	50	0	0	2385000
5/28/2015	61	0	0	50000
5/28/2015	50	0	0	81000
6/23/2015	60	0	0	5000
7/27/2015	45	0	0	1000
8/4/2015	50	0	0	65000
2/25/2016	50	0	0	21000
6/29/2016	50	0	0	25000
7/1/2016	50	0	0	15000
7/18/2016	70	0	0	105000
7/23/2016	50	0	0	155000
9/11/2016	50	0	0	10000
05/18/2017	50	0	0	29000
06/23/2017	50	0	0	26500
06/27/2017	50	0	0	10.00K
06/18/2018	50	0	0	46500
09/18/2018	61	0	0	16000
06/30/2019	40	0	0	6000
07/17/2019	50	0	0	1750
07/31/2019	50	0	0	40000
08/21/2019	50	0	0	3.00K
6/6/2020	50	0	0	1500
7/5/2020	50	0	0	1300
7/13/2020	50	0	0	1000
7/23/2020	50	0	0	1800
7/30/2020	50	0	0	8500
8/23/2020	50	0	0	9600
TOTAL		**0**	**2**	**1.88 M**

Source: NOAA, National Centers for Environmental Information
Magnitude refers to maximum wind speed in knots.

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

Based on the record of previous occurrences, severe thunderstorms in Saugus are high frequency events as defined by the 2018 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

Thunderstorms and Climate Change

As noted previously, the intensity of rainfall events has increased significantly, and those trends are expected to continue. The SHMCAP does not specifically address whether climate will affect the intensity or frequency of thunderstorms.

NON-CLIMATE INFLUENCED HAZARDS

Geologic hazards include earthquakes, landslides, sinkholes, subsidence, and unstable soils such as fill, peat, and clay. Town officials did not identify any problems with areas of geologic instability, such as sinkholes or subsidence. Although new construction under recent building codes generally will be built to seismic standards, there are still many structures in town which pre-date building code updates. Information on geologic hazards in Saugus can be found on Map 4 in Appendix A.

EARTHQUAKES

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

Seismologists use a magnitude scale known as the Richter scale to express the seismic energy released by each earthquake. The typical effects of earthquakes in various ranges are summarized in Table 31.

Table 31: Richter Scale and Effects

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. Serious damage in areas several hundred meters across.

Source: Nevada Seismological Library (NSL), 2005

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 2007, 355 earthquakes were recorded in Massachusetts (NESEC). Most have originated from the La Malbaie fault in Quebec or from the Cape Ann fault located off the coast of Rockport. The region has experienced larger earthquakes in the distant past, including a magnitude 5.0 earthquake in 1727 and a 6.0 earthquake that struck in 1755 off the coast of Cape Ann. More recently, a pair of damaging earthquakes occurred near Ossipee, NH in 1940. A 4.0 earthquake centered in Hollis, Maine in October 2012 was felt in the Boston area. Historic records of some of the more significant earthquakes in the region are shown in Table 32.

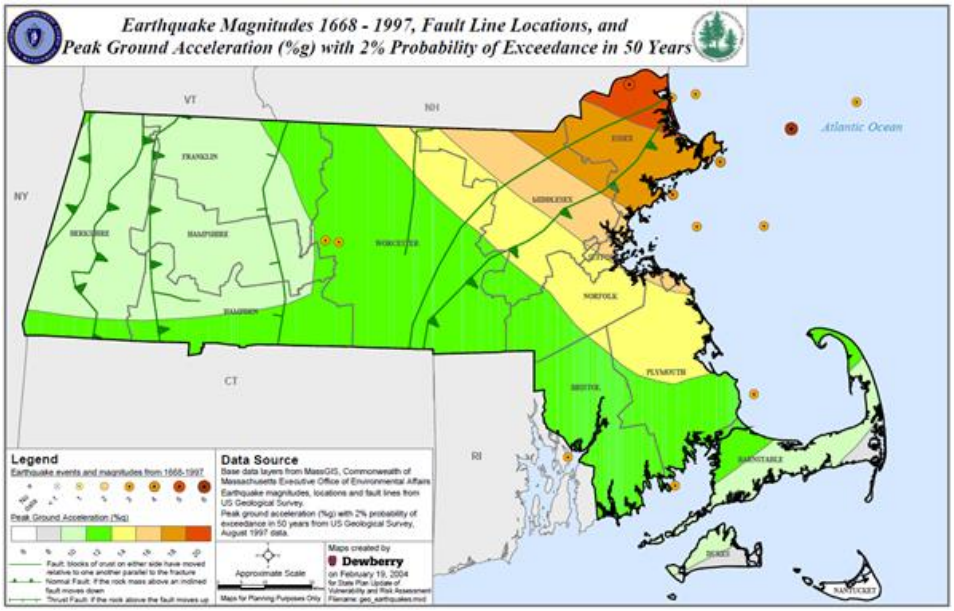
Table 32: Historical Earthquakes in Massachusetts or Surrounding Area

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

Source: Boston HIRA

One measure of earthquake risk is ground motion, which is measured as maximum peak horizontal acceleration, expressed as a percentage of gravity (%g). The range of peak ground acceleration in Massachusetts is from 10 %g to 20 %g, with a 2% probability of exceedance in 50 years. Saugus is in the middle to upper part of the range for Massachusetts, at 16 %g to 18 %g, (Figure 21, making it a relatively moderate area of earthquake risk within the state, although the state as a whole is considered to have a low risk of earthquakes compared to the rest of the country. There have been no recorded earthquake epicenters within Saugus.

Figure 21: State of Massachusetts Earthquake Probability Map



Source: Massachusetts Hazard Mitigation Plan

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. The majority of 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.

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% chance per year.

Earthquakes are a potential town-wide hazard for Saugus. Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the town pre-dates the most recent building code. Potential earthquake damages to Saugus have been estimated using HAZUS-MH. Total building damages are estimated at $516.69 million for a 5.0 magnitude earthquake and $3,841.32 million for a 7.0 magnitude earthquake. Other potential impacts of earthquakes such as sheltering and debris generation, are detailed in Table 39.

LANDSLIDES

According to the U.S. Geological Survey, "The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. 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; earthquake created stresses that make weak slopes fail; excess weight from accumulation of rain or snow; and stockpiling of rock or ore from waste piles or man-made structures.

In Massachusetts, according to the SHMCAP, the most common cause of landslides are geologic conditions combined with steep slopes and/or heavy rains. Landslides associated with heavy rains typically occur on steep slopes with permeable soils underlain by till or bedrock.

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.

Changes in precipitation may increase the chance of landslides, as extreme rain events could result in more frequent saturated soils which are conducive to landslides. Drought may also increase the likelihood of landslides if loss of vegetation decreases soil stability.

There is no universally accepted measure of landslide extent, but it has been represented as a measure of the destructiveness. Table 33 summarizes the estimated intensity for a range of landslides. Fast moving rock falls have the highest intensity while slow moving landslides have the lowest intensity.

Table 33: Landslide Volume and Velocity

Estimated Volume (m^3)	Expected Landslide Velocity		
	Fast moving (rock fall)	**Rapid moving (debris flow)**	**Slow moving (slide)**
<0.001	Slight intensity	--	--
<0.5	Medium intensity	--	--
>0.5	High intensity	---	--
<500	High intensity	Slight intensity	--
500-10,000	High intensity	Medium intensity	Slight intensity
10,000 – 50,000	Very high intensity	High intensity	Medium intensity
>500,000	--	Very high intensity	High intensity
>500,000	--	--	Very high intensity

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

The majority of Saugus is classified as having low susceptibility and a low incidence of landslides (see Map 4, Appendix A). According to State data, there is a moderate landslide risk in about one third of the Town, primarily in East Saugus. Saugus enforces a Hillside Protection Bylaw under its zoning that limits clearing, erosion and runoff, serving to stabilize the land and prevent landslides from occurring. The Town continues to make builders aware of erosion and landslide risks through its Building Department and the Conservation Commission. There is no history of landslides in Saugus.

Local officials did not identify any significant issues related to landslides. Should a landslide occur in the future, the type and degree of impacts would be highly localized. Although unlikely, the Town's vulnerabilities could include damage to structures, transportation and other infrastructure, and localized road closures. Injuries and casualties, while possible, would be unlikely given the low extent and impact of landslides in Saugus.

The SHMCAP, utilizing data from the MA Department of Transportation from 1986 to 2006 to estimates that, on average, roughly one to three known landslides have occurred each year. A slope stability map published by the MA Geological Survey and UMass-Amherst indicates that the most significant risk of landslide is in western Massachusetts.

There is no record of landslides in Saugus. Based on past occurrences, landslides are considered to be a very low frequency events in Saugus, events that occur less frequently than once in 100 years (less than 1% per year)

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. Some change has certainly occurred in Saugus since then, but this data still provides the most detailed town wide description of land use available. Table 34 shows the acreage and percentage of land in 29 categories. If the five residential categories are aggregated,

residential uses make up 34.96% of the area of the town. Commercial and industrial combined make up 7.4% of the town. The highest percentage of undeveloped land is forest, which comprises 1,972.46 acres, or 27.18 % of the town. The thirteen land use categories with less than 1% of land area represent a combined 5.06% of overall land use.

Table 34: Town of Saugus, MA 2005 Land Use

Land Type	Acres	Percent
Crop Land	0.0	0
Pasture	7.7	0.1
Forest	1972.4	27.18
Wetland	184.7	2.55
Mining	39.7	0.58
Open Land	257.9	3.55
Participation Recreation	64.0	0.88
Spectator Recreation	0	0
Water-Based Recreation	1.5	0.02
Multi-Family Residential	259.0	3.57
High Density Residential	1322.8	18.23
Medium Density Residential	863.5	11.9
Low Density Residential	80.2	1.1
Salt Water Wetland	569.3	7.84
Commercial	483.6	6.66
Industrial	53.5	0.74
Urban Open	36.8	0.5
Transportation	138.5	1.9
Waste Disposal	57.5	0.79
Water	332.1	4.58
Cranberry Bog	0.0	0
Power line	95.1	1.31
Saltwater Sandy Beach	8.7	0.12
Marina	2.5	0.03
Golf Course	47.1	0.65
Urban Public	73.7	1.02
Cemetery	21.8	0.3
Orchard	0.0	0
Nursery	5.1	0.07
Forested Wetland	203.1	2.8
Very Low Density Res.	11.0	0.15
Junkyards	0.0	0
Brushland/Successional	62.7	0.87
Total Acres	**7256.8**	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

ECONOMIC ELEMENTS

Saugus has several areas of concentrated economic activity. These are predominantly the commercial and industrial areas located along the Route 1 corridor. More development along Route 1 is anticipated in the next five years. Smaller scale commercial businesses are located in the Cliftondale Square Business District.

NATURAL, CULTURAL, AND HISTORIC RESOURCE AREAS

Saugus Town Hall was built in 1875 and added to the National Register of Historic Places in 1985. Saugus has two sites that are designated as National Historic Landmarks: the Saugus Iron Works and Boardman House; they are also both listed within the National Register of Historic Places. According to the National Park Service's website, "National Historic Landmarks (NHLs) are nationally significant historic places designated by the Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States."[1]

The Boardman House, located on Howard Street, was built in 1692 for the family of William Boardman. Over 300 years later, it remains remarkably intact. Though it has had some minor structural repairs, the house has been unaltered since the early 18th century. Descendants of William Boardman owned and occupied the home until 1914, when William Sumner Appleton, founder of Historic New England, purchased it because of its remarkable state of preservation.2 In order to help finance and maintain the Boardman House, it was actually rented for a number of years.

The Saugus Iron Works was one of the first successful ironworks in North America. Now owned and managed by the National Parks Service, the site includes a reconstructed blast furnace, forge, rolling mill, and a restored 17th century house. Set on the Saugus River, the original manufacturing site was a training ground for skilled ironworkers and what would become of America's iron and steel industry. The Iron Works provides a glimpse into the past by showing the critical role that iron-making played in 17th-century settlement and its legacy in shaping the nation's early history.[3]

Designed in 1934 by Charles Eliot, the Breakheart Reservation offers birding, fishing, hiking, access to Pearce and Silver Lakes and the Saugus River as well as views of Boston and southern

[1] "National Historic Landmarks Program," National Parks Service, www.nps.gov/nhl/
[2] "Boardman House," Historic New England, www.historicnewengland.org/property/boardman-house/
[3] "Saugus Iron Works," National Park Service, www.nps.gov/sair/index.htm

New Hampshire from its seven hills. The Reservation, managed by the MA Department of Conservation and Recreation, was added to the National Register of Historic Places in 2003.

Located in the Lynnhurst area of Saugus, Vinegar Hill it is significant for both historic and prehistoric purposes. Native Americans are known to have used Vinegar Hill as a quarry for "Saugus Jasper" and other volcanic materials used for making stone tools. Prehistoric stone artifacts have been found at the site dating back 6,000. In 1640, early European settlers built a fort and lookout to provide protection from pending dangers. By the 1650s, pirates were known to hide out in the area and trade silver for goods at Hammersmith, the original name for the Saugus Iron Works. Since this time, several many artifacts and tool manufacturing sites in the area have been found.

Round Hill is another area of Saugus known for its rich Native American history. The 150-foot Round Hill, located behind the Town's Public Safety Building, is the focal point of the Saugus Town Seal; the hill is located behind Motowampate, the Saugus sachem who is holding a bow and arrow. Native American artifacts, including arrowheads, have been found at Round Hill. The Town of Saugus is working to create a historic site at the base of Round Hill that will honor the town's Native American history. Once completed, the site will feature an interpretive sign, granite pavers, a site identification obelisk, benches, and professional landscaping.[4]

DEVELOPMENT TRENDS

Development trends throughout the metropolitan region are tracked by MassBuilds, 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 four projects in the Town of Saugus since 2015 (Table 35). The database also includes several attributes of the new development, including housing units, and commercial space. The four developments include a total of 628 housing units and 124,000 square feet of commercial space.

Table 35: Summary of Saugus Developments, 2014-2020

Name	Status	Year	Housing Units	Commercial Square Feet	Project Type
Avalon at Hilltop	Completed	2020	280	24,000	Residential
Bellevue Heights	Completed	2017	28	0	Residential
Essex Landing	Completed	2018	256	100,000	Residential
Lynnfield Village	Completed	2020	64	0	Residential
720 – 770 Broadway	Completed	2018	0	135,000	Commercial

[4] Mike Gaffney (2014), "Round Hill site recognized in Saugus for its history," *Saugus Advertiser*, http://saugus.wickedlocal.com/article/20140508/NEWS/140507429

The Business Highway Sustainable Development Zoning District along the Route 1 Corridor was adopted in 2015 and seeks to foster mixed use sustainable development centers including new housing. Recently, the Town has experienced an unanticipated increase in the construction of multi-family dwellings. As a result, in 2019, Town Meeting members unanimously approved a two-year moratorium on the construction of multi-family dwellings of three or more units. With the assistance of MAPC, the town is currently in the process of updating its Comprehensive Master Plan. Once completed, the plan will guide current and future growth and development in Saugus.

The MassBuilds database includes a GIS analysis of the location of development sites with respect to hazard areas such a flooding, landslide risk, annual snowfall, and maximum wind speed. None of the new development sites are located within a FEMA flood hazard area or a locally identified flood area of concern. All of the sites are within the area classified as "Low Incidence" for landslide, within the area of 48 to 72 inches of average annual snowfall, and within the zone of maximum wind speed of 110 miles per hour. The new development does not significantly increase the Town's vulnerability to natural hazards.

POTENTIAL FUTURE DEVELOPMENT

MAPC consulted with the Saugus HMP/MVP Core Team to determine areas that may be developed in the future, based on the Town's comprehensive planning efforts and current development trends and projects. A total of 4 sites were identified and mapped. These areas are listed below in Table 36 and shown on Map 8 in Appendix A.

Table 36 Potential future development projects:

Map ID	Name	Description
D	Twin Springs Subdivision	20 houses, 80% constructed
F	Aggregate Industries	Possible mixed-use development, Master Planning for 60 acres
E	Saugus Ridge	300 apartment units (40B)
G	860 Broadway	300 residential units

As with the recent new development, a GIS analysis was conducted on the potential future development sites with respect to hazard areas such a flooding, landslide risk, annual snowfall, and maximum wind speed. None of the potential future development sites are located within a FEMA flood hazard area or a locally identified flood area of concern. All of the sites are within the area classified as "Low Incidence" for landslide, within the area of 48 to 72 inches of average annual snowfall, and all are within the zone of maximum wind speed of 110 miles per hour. The new development does not significantly increase the Town's vulnerability to natural hazards.

CRITICAL INFRASTRUCTURE IN HAZARD AREAS

Critical 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 94 facilities identified in Saugus. These are listed in Table 37 and are shown on the maps in Appendix A.

Five of the sites are located in a flood hazard area, aside from several dams, bridges, piers, and reservoirs, which by definition are sited within these areas. These sites include the Big Y Market, the Fox Hill Yacht Club, and three sewage pumping stations.

Concern was also expressed at the public meeting that the unlined ash landfill at the Wheelabrator Waste to Energy Plant could be vulnerable to future sea level rise. Inundation of this waste disposal facility could mobilize contaminants from the landfill over a wide area.

Explanation of Columns in Table 37

- ***Column 1: ID #:*** The first column in Table 37 is an ID number which appears on the maps that are part of this plan. See Appendix A.
- ***Column 2: Name****:* The second column is the name of the site.
- ***Column 3: Type*****:** The third column indicates what type of site it is.
- ***Column 4: FEMA Flood Zone*****:** The fourth 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. as follows: **Zone AE** (1% annual chance) **-** Zones AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the FIS by detailed methods. Mandatory flood insurance purchase requirements apply.

  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.

  Zone X (.2% annual chance) - Zones X is the flood insurance rate zone that corresponds to the 500-year floodplains.
- ***Column 5: Brush Fire Area:*** The sixth column indicates the risk of brush fire in local hazard areas. A "No" entry in this column means that the site is not within any of the mapped brush fire hazard zones. If there is an entry in this column, it indicates the local hazard area.
- ***Column 6:*** **Hot spots** indicates areas that are within the 5% of hottest areas in the MAPC region based on satellite data from 2016.
- ***Colum 7:*** **Landslides**: Infrastructure in areas of Low Incidence (Low) or Moderate Susceptibility/Low Incidence (Mod/Low)

Table 37: Critical Facilities and Relationship to Hazard Areas

MAP #	FACILITY NAME	FACILITY TYPE	FEMA FLOOD ZONE	BRUSH FIRE	HOT SPOT	LANDSLIDE
1	Lynnhurst School	School	No	No	No	Low
2	Oaklandvale School	School	No	No	No	Low
3	Saugus Police Emergency/EOC	Police Station	No	No	No	Low
4	Saugus Fire Dept Dispatch	Fire Station	No	No	No	Low
5	Blessed Sacrament Church	Church	No	No	No	Low
6	Greater Grace Cristian Academy	School	No	No	No	Low
7	Christian Learning Center	School	No	No	No	Low
8	Medical Treatment Center	Medical Facility	No	No	No	Low
9	Douglas Waybright	School	No	No	No	Low
10	Saugus High/Middle School	School	No	No	Yes	Low
11	Veteran's Elementary School	School	No	No	No	Mod/Low
12	Facility Building Maintenance	Town Facility	No	No	No	Low
13	Saugus Elks Club	Place of Assembly	No	No	No	Low
14	Knights Of Columbus	Church	No	No	No	Low
15	Evans Elementary School	School	No	No	No	Low
16	Belmonte Saugus Middle School	School	No	No	Yes	Low
17	Veterans Memorial	School	No	No	No	Mod/Low
18	Hammersmith House Nursing Home	Nursing Home	No	No	No	Mod/Low
20	Former Ballard Elementary School	Surplus Town building	No	No	No	Mod/Low
21	Saugus Fire Station	Fire Station	No	No	No	Mod/Low
22	Harbor Side Health Care	Medical Facility	No	No	No	Mod/Low
23	Saint Margaret's Church	Church	No	No	No	Mod/Low

MAP #	FACILITY NAME	FACILITY TYPE	FEMA FLOOD ZONE	BRUSH FIRE	HOT SPOT	LANDSLIDE
24	Methodist Church	Church	No	No	Yes	Mod/Low
25	Heliport At Blessed Sacrament Church	Heliport	No	No	No	Low
26	Department of Public Works	Municipal Office	No	No	No	Low
27	Fuel Depot at DPW	Fuel Depot	No	No	No	Low
28	Heliport At Saugus High School	Heliport	No	No	No	Low
29	Stop & Shop # 16	Food	No	No	No	Low
30	Heliport at Belmonte Saugus Middle School	Heliport	No	No	No	Moderate
31	East Saugus Methodist Church	Place of Worship	No	No	No	Mod/Low
32	Town Boat Landing	Boat Landing	AE: 1% Annual Chance	No	No	
33	Heliport Across from Fox Hill Yacht Club	Heliport	AE: 1% Annual Chance	No	No	Mod/Low
34	Wheelabrator Waste Disposal Plant	Waste-to-energy facility	No	No	No	Mod/Low
35	Heliport Anna Parker Play Ground	Heliport	No	No	No	Mod/Low
36	Post Office	Federal Office	No	No	No	Mod/Low
37	Sweetser Corner Housing Authority	Elderly housing	No	No	No	Mod/Low
38	Town Hall	Municipal Office	No	No	No	Low
39	Center Congregation	Place of Worship	No	No	No	Low
40	Public Library	Municipal Office	No	No	No	Low
41	Summer Street Church	Place of Worship	No	No	No	Low
42	Synagogue	Place of Worship	No	No	No	Low
43	Youth & Rec Dep.	Day Care	No	No	No	Mod/Low
44	Saugus Assembly Of God	Place of Worship	No	No	No	Mod/Low
45	Saugus Senior Center	Senior Center	No	No	No	Mod/Low

MAP #	FACILITY NAME	FACILITY TYPE	FEMA FLOOD ZONE	BRUSH FIRE	HOT SPOT	LANDSLIDE
46	Verizon	Switching Station	No	No	No	Mod/Low
47	Church Of Nazarene	Place of Worship	No	No	No	Mod/Low
48	Jehovah Witness	Place of Worship	No	No	No	Low
49	Walgreens Pharmacy	Pharmacy	No	No	No	Low
50	Stanly W Day Pump Station	Sewer Pump Station	AE: 1% Annual Chance	No	No	Mod/Low
51	Lincoln Ave Bridge	Bridge	AE: 1% Annual Chance	No	No	Mod/Low
53	Kasabuski Skating Rink	Skating Rink	No	No	No	Low
54	Target	Retail Store	No	No	Yes	Low
55	Hockey Town USA Skating Rink	Skating Rink	No	No	No	Low
56	Cell Towers on Days Inn	Cell Tower	No	No	No	Low
57	Cell Towers on Stone Hill Corporation	Cell Tower	No	No	No	Low
58	Cell Tower	Cell Tower	No	No	No	Low
59	Radio tower Police/ Fire	Communication Tower	No	Lynn Water and Sewer Commission Property	No	Low
60	Walnut Street Gospel Hall	Place of Worship	No	No	No	Low
62	Walgreens Pharmacy	Pharmacy	No	No	No	Low
63	Fox Hill Yacht Club	Yacht Club	AE: 1% Annual Chance	No	No	Mod/Low
64	Lobstermans Landing	Pier	AE: 1% Annual Chance	No	No	Mod/Low
65	Birch Pond Reservoir	Reservoir, Lynn Water System	A: 1% Annual Chance	Lynn Water and Sewer Commission Property	No	Low
66	Walden Pond Dam	Dam, Lynn Water System	No	No	No	Low
67	Walden Pond Reservoir	Reservoir, Lynn Water System	A: 1% Annual Chance	No	No	Low

MAP #	FACILITY NAME	FACILITY TYPE	FEMA FLOOD ZONE	BRUSH FIRE	HOT SPOT	LANDSLIDE
68	Hawke's Pond	Reservoir, Lynn Water System	A: 1% Annual Chance	No	No	Low
69	Hawke's Pond Dam	Dam, Lynn Water System	No	No	No	Low
70	Radio tower Police	Communication Tower	No	No	No	Low
71	Heritage Heights Elder Housing	Elderly Housing	No	No	No	Low
72	Laure Gardens/Towers Elder Housing	Elderly Housing	No	No	No	Low
73	Electrical Sub Station	Electric Sub Station	No	No	No	Low
74	Radio Tower At Square 1 Mall	Radio Tower	No	No	Yes	Low
75	National Grid Power Station	Electric Station	No	No	No	Low
76	Cell Tower	Cell Tower	No	No	No	Low
78	Saugus Animal Hospital	Animal Services	No	No	No	Low
80	Saugus High School	Emergency Dispensing Station	No	No	Yes	Low
81	School Administration	Municipal Office	No	No	No	Low
83	Bristow Street Sewer Pumping Substation	Sewer Pumping Substation	AE: 1% Annual Chance	No	No	Mod/Low
83	Laurel Street Sewer Pumping Substation	Sewer Pumping Substation	AE: 1% Annual Chance	No	No	Mod/Low
84	Lynnhurst Street Sewer Pumping Substation	Sewer Pumping Substation	No	No	No	Low
85	Route 1N Sewer Pumping Substation	Sewer Pumping Substation	No	No	No	Low
86	MBTA Drawbridge	Bridge	AE: 1% Annual Chance	No	No	
87	MBTA Bridge	Bridge	AE: 1% Annual Chance	No	No	Mod/Low
88	Spillway for Reservoir	Lynn Water System	No	No	No	Low
89	Spillway for Hawke's Pond	Lynn Water System	No	No	No	Low

MAP #	FACILITY NAME	FACILITY TYPE	FEMA FLOOD ZONE	BRUSH FIRE	HOT SPOT	LANDSLIDE
61	Big Y World Class Market	Supermarket	AE: 1% Annual Chance	No	Yes	Low
77	Sachem Manor- Janet M. Leuci Residence	Elderly Housing	No	No	No	Low
79	Animal Medical Center	Animal Services	No	Pranker's Pond area	No	Low
90	Walmart Supercenter	Supermarket	No	No	No	Low
91	Spring Pond Dam	Dam	No	3 Dams Golden Hills area	No	Low
92	Upper Griswold Dam	Dam	No	3 Dams Golden Hills area	No	Low
93	Lower Griswold Dam	Dam	No	3 Dams Golden Hills area	No	Low
94	John Leo Silver Lake Dam	Dam	No	No	No	Low
95	John A. W. Pearce Lake Dam	Dam	No	No	No	Low
96	Stevens Pond East Dam	Dam	X: 0.2% Annual Chance	Pranker's Pond area	No	Low

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 through the HAZUS-MH software.

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. For more information on the HAZUS-MH software, go to http://www.fema.gov/plan/prevent/hazus/index.shtm

> "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."

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 Saugus, 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.

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 38: Estimated Damages from Hurricanes

	100 Year	500 Year
Building Characteristics		
Estimated total number of buildings	9,000	
Estimated total building replacement value (2014 $)	$3,773,000,000	
Building Damages		
# of buildings sustaining minor damage	347.21	1,835
# of buildings sustaining moderate damage	28.39	360.75
# of buildings sustaining severe damage	0.91	25.19
# of buildings destroyed	0.06	14.87
Population Needs		
# of households displaced	0	14
# of people seeking public shelter	0	6
Debris		
Building debris generated (tons)	1,262	6,606
Tree debris generated (tons)	2,834	8,041
Total	**4,096**	**14,647**
# of truckloads to clear building debris	50	264
Value of Damages		
Total property damage (buildings and content) (Thousands of dollars)	$16,489.72	$80,199.88
Total losses due to business interruption (Thousands of dollars)	$828.77	$7,341.58
Total	**$17,318.49**	**$87,541.46**

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 39: Estimated Damages from Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	9,000	
Estimated total building replacement value (2014 $) (Millions of dollars	$3,773	
Building Damages		
# of buildings sustaining slight damage	2,772	232
# of buildings sustaining moderate damage	1,523	1,741
# of buildings sustaining extensive damage	439	2,635
# of buildings completely damaged	112	4,883
Population Needs		
# of households displaced	437	6,231
# of people seeking public shelter	241	3,437
Debris		
Building debris generated (tons)	0.09	0.72
# of truckloads to clear debris (@ 25 tons/truck)	3,520	28,600
Value of Damages (Millions of dollars)		
Total property damage	$516.69	$3,841.32
Total losses due to business interruption	$86.15	$498.00
Total Losses	$602.84	$4,239.32

Estimated Damages from Flooding

The HAZUS flood risk module was used to estimate damages to the municipality at the 100 and 500 return periods. These return periods correspond to flooding events that have a 1% and a 0.2% likelihood of occurring in any given year.

Table 4010: Estimated Damages from Flooding

	100 Year	500 Year
Building Characteristics		
Estimated total number of buildings	9,000	
Estimated total building replacement value (2014 $) (Millions of dollars)	$3,773,000,000	
Building Damages		
# of buildings sustaining slight damage (1-10%)	40	68
# of buildings sustaining moderate damage (11-50%)	115	355
# of buildings sustaining substantial damage (>50%)	0	4
Population Needs		
# of households displaced	786	1,117
# of people seeking public shelter	112	177
Value of Damages (Millions of dollars)		
Total property damage (buildings and content)	$89.83	$180.01
Total losses due to business interruption	$74.74	$298.05
Total	**$164.57**	**$478.06**

SECTION 5: HAZARD MITIGATION GOALS

The Saugus Local Hazard Mitigation Planning Team reviewed and discussed the goals from the 2015 Hazard Mitigation Plan for the Town of Saugus. All of the goals are considered critical for the Town and they are not listed in order of importance.

GOAL 1: Ensure that critical infrastructure sites are protected from natural hazards.

GOAL 2: Protect existing residential and business areas from flooding

GOAL 3: Maintain and improve existing infrastructure in good condition; utility for public funds for mitigation.

GOAL 4: Continue to enforce existing zoning and building regulations.

GOAL 5: Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.

GOAL 6: Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities.

GOAL 7: Encourage future development and redevelopment in areas that are not prone to natural hazards.

GOAL 8: Educate the public about natural hazards, climate change, and mitigation measures.

GOAL 9: Make efficient use of public funds for hazard mitigation.

GOAL 10: Ensure that hazard mitigation measures are in place to keep major roads open with a particular emphasis on Route 1.

GOAL 11: Consider the potential impacts of future climate change. Incorporate climate sustainability and resiliency in hazard mitigation planning.

SECTION 6: EXISTING MITIGATION MEASURES

The existing protections in the Town of Saugus 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. The Town's existing mitigation measures are listed by hazard type here and are summarized in Table 42 below.

EXISTING TOWN-WIDE MITIGATION FOR FLOOD-RELATED HAZARDS

Saugus 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) – Saugus participates in the NFIP with 425 policies in force as of May 20, 2020. As shown in Table 41, all but 19 of the 425 policies are for residential properties, with about three-quarters of those for single family residences. There is a total of $117,890,900 in coverage in place. The NFIP has paid 350 losses in Saugus totaling $2,244,222.

Table 41: Saugus Flood Insurance Policy Data

	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses
Single Family	296	$351,922	$81,415,700	291	$1,589,803.28
2-4 Family	101	$112,192	$24,097,300	51	$413,534.78
All Other Residential	9	$3,212	$1,958,000	2	$25,064.39
Non Residential	19	$106,220	$10,419,900	6	$215,820.54
Total	425	$573,546	$117,890,900	350	$2,244,222.99

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.

Public Works Operations/Maintenance Activities – The Public Works Department actively maintains the Town's storm drain system. The following specific activities serve to maintain the capability of the drainage system through the reduction of sediment and litter build up and proper maintenance and repair.

- Street sweeping – All streets are swept two times annually in the spring and fall.
- Catch basin cleaning – Catch basins are cleaned when on-third full with sediments.
- Roadway treatments – Streets are primarily treated with road salt.

Open Space and Recreation Plan – The Town of Saugus Open Space and Recreation Plan is listed as being current the MA Division of Conservation Services through October of 2024. The plan identifies a number of open space parcels prioritized for acquisition that would also benefit hazard mitigation efforts.

Floodplain Zoning District – Section 4.6: Lands in Saugus that are subject to seasonable and periodic flooding that must be developed, preserved, and maintained to assure the natural flow of watercourses. These are made up of the following categories:

A. Flood Plain District- Lands that are shown on the FEMA Flood Boundary and Floodway Map dated January 19, 1983, as amended; and lands shown as Flood Plain on the official Zoning Map of the Town of Saugus.

B. Flood Plain-Fringe- Lands in Saugus shown as Zones A, A-2, A-3,A-4, A-7, and A-9 on the Town of Saugus Flood Rate Insurance Map dated January 19, 1983, as amended, except for those that are included in the Flood Plain District as defined in Section 4.6A.

Section 6.5.3 - Base flood elevation is required for proposals or other developments greater than 10 lots or 1 acre, whichever is less, within unnumbered A zones.

Section 6.5.4- Neighboring communities must be notified of, using the NFIP State Coordinator, of any proposed alteration or relocation of a watercourse.

Section 12.4- Special permit applications within the Flood Plain Districts must also meet the following conditions, in addition to the Town's general special permit conditions:

1. The application must have been referred to and reported on, within 35 days, by the Board of Health, Conservation Commission and Planning Board;
2. The proposed use must not be detrimental to the public health, safety and welfare;
3. The proposed use must comply with all requirements of the underlying zoning district.

Subdivision Rules and Regulations 4.E.1 – The Subdivision Rules and Regulations contains provisions that require that lots shall be prepared in such a manner that development of one shall not cause detrimental drainage on another and that drainage easements must be provided as needed.

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

Wetlands Protection By-Law – The purpose of the Wetlands Protection By-Law is to further protect the Town's shores, ponds, rivers, and wetlands for, among other reasons, flood control, erosion and sedimentation control, and public safety. In addition to requiring review of all development,

excavation, or fill activities in or within 100 feet of any wetland, shoreline, coastal feature, etc., and also any land subject to tidal action, coastal storm flowage, or flooding, the Bylaw also allows for a 50-foot no-disturb provision within the 100-foot buffer zone.

EXISTING DAM FAILURE MITIGATION MEASURES

The Comprehensive Emergency Management Plan (CEMP) - The CEMP addresses dam safety, shows inundation areas and the number of homes and people that might be affected.

Permits required for construction – State law requires a permit for the construction of any dam.

DCR dam safety regulations – The state has enacted dam safety regulations mandating inspections and emergency action plans. The Emergency Management Agency is required to inspect dams as part of the CEMP updating process. The Lynn Water and Sewer Commission are also required to inspect their dams.

EXISTING TOWN-WIDE MITIGATION FOR WIND-RELATED HAZARDS

Tree management - The Department of Public Works has an effective tree maintenance program and uses its own equipment to trim and remove trees in public areas and along Rights-of-Ways as needed. In addition, Saugus has a Tree Committee, which works with and advises the Tree Warden on matters pertaining to tree and landscape planning, as well as maintenance of shade and other public trees in Saugus.

Tree management– The Town conducts tree maintenance and also uses its own equipment to trim and remove trees as needed.

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

EXISTING TOWN-WIDE MITIGATION FOR WINTER-RELATED HAZARDS

Snow disposal - The Department of Public Works using staff and outside contractors provides standard snow plowing operations, including salting and sanding. Approximately 30% of snow removal is done by the DPW and 70% by local contractors.

Public education – The town provides education on the website and via social media.

EXISTING TOWN-WIDE MITIGATION FOR FIRE-RELATED HAZARDS

Burn Permits – The Town does not issue permits for outdoor burning.

Subdivision/Development Review - The Fire department reviews all new subdivisions and development projects for compliance with site access, water supply needs, and all other applicable regulations.

Public education - The town provides public education and notices for fire risk.

EXISTING TOWN-WIDE MITIGATION FOR EARTHQUAKE HAZARDS

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 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.

EXISTING TOWN-WIDE MITIGATION FOR MULTIPLE HAZARDS

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.

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.

Communications--Incident command units are available through MA State Police, MA Department of Fire Services and MEMA.

COMPILATION OF EXISTING MITIGATION

Table 42 summarizes the many existing natural hazard mitigation measures already in place in Saugus.

Table 42: Summary of Saugus Existing Mitigation Measures

Type of Existing Mitigation	Description/Area Covered	Effectiveness Enforcement	2021 Updates/ Changes Needed
MULTI-HAZARD			
Comprehensive Emergency Management Plan (CEMP)	Town-wide	Effective; emphasis is on emergency response.	Ongoing CEMP updates
Communications Equipment	Town-wide	Effective	Ongoing equipment upgrades
Massachusetts State Building Code	Town-wide	Effective for new construction.	Building Code amendments, Chapter 9, done in 2019
Emergency Power Generators	Town-wide	Effective.	Generators installed at Saugus High School, Junior High School, Veterans School, Town Hall. Upgrade generators as needed; provide generators at additional locations; provide alternative fuel sources and generator power source flexibility.
Participation in the Local Emergency Planning Committee (LEPC)	Town-wide	A forum for inter-departmental cooperation on natural and manmade disasters.	Saugus participates in the Mystic Valley Emergency Planning Committee; monthly meetings; mandatory reporting

Type of Existing Mitigation	Description/Area Covered	Effectiveness Enforcement	2021 Updates/ Changes Needed
FLOOD HAZARDS			
Participation in the National Flood Insurance Program (NFIP)	Areas identified on the FIRM maps.	There are 425 Flood Insurance policies in force.	Encourage all eligible homeowners to obtain insurance.
Public Works Operations/Maintenance Activities	Town-wide.	The DPW cleans catch basins once a year and sweeps all streets twice per year. Somewhat Effective.	More employee hours needed for preventive maintenance; consider Stormwater Utility.
Open Space Plan		Somewhat Effective.	Open Space Plan updated in 2018
Zoning – Floodplain District	• Development in Floodplain districts must be in compliance with MGL Ch. 131, Sec. 40, Article 24, the Saugus Wetlands Protection Bylaw, Mass. State Building Code regulations for flood resistant construction, DEP wetlands regulations. • In the floodway, all encroachments and development are prohibited unless a registered engineer certifies that there will not be any increase in base flood water surface elevations or velocities.	Effective for new construction.	None

Type of Existing Mitigation	Description/Area Covered	Effectiveness Enforcement	2021 Updates/ Changes Needed
	• In Zone A, A1-30 and AE, along watercourses that have not had a regulatory floodway designated, the best available Federal, state or local data shall be used to prohibit encroachments in floodways that would result in any increase in flood levels during the occurrence of the base flood discharge. • Base flood elevation data is required for subdivision proposals or other developments greater than 10 lots or 1 acre within unnumbered A zones. • In a Flood Plain District, if a special permit is required for a use, the reviewing and permit granting authorities shall base their decision on the following criteria: danger to life and property due to increased flood heights or velocities; the danger of damage downstream, the susceptibility of the proposed facility and its contents to flood damage; the availability of alternative locations not subject to flooding; the relationship of the proposed use to the comprehensive plan and flood plain management plan for the area; the safety of access of emergency		

Type of Existing Mitigation	Description/Area Covered	Effectiveness Enforcement	2021 Updates/ Changes Needed
	vehicles to the property in times of flood; the expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters expected at the site..		
Salt Water Marsh and River Basin Planning Committee	Town Manager appoints a committee of 7 to review, investigate, and recommend plans to realize the greatest potential usage of the Saugus Salt Marshes.	Effective	No longer active
Waterways Commission	• Commission established to develop policies for the planning, development and management of Saugus' waterways. • Commission is charged with developing a Saugus Waterways Plan for approval by Town Meeting	Effective	No longer active. Harbormaster oversees waterway activities
Subdivision Rules & Regulations	Town-wide	Effective for new construction.	After new MA Stormwater Performance Standards are established by DEP (2021-22), update subdivision drainage regulations to match the state standards.
Stormwater By-Law	Town-wide	Effective	Update bylaw for consistency with the MS4 stormwater permit
Wetlands Protection By-Law	Resource Areas	Effective	None

Type of Existing Mitigation	Description/Area Covered	Effectiveness Enforcement	2021 Updates/ Changes Needed
Hillside Protection Bylaw	One of the purposes of this bylaw is to minimize water run-off and soil erosion problems as a result of grading of steep slopes. Applies to R-1, R-2, B-e, R-4, B-1, B-2, B-3, I-I and I-2 zoning districts	Effective	None
WIND HAZARDS			
The Massachusetts State Building Code	Town-wide	Effective for most situations except severe storms	None
Tree trimming program	Town-wide	Satisfactory	Enhance the tree trimming program to mitigate utility interruptions in storms
WINTER HAZARDS			
Snow Disposal Site	As necessary	As necessary	None
BRUSH FIRE HAZARDS			
Development Review	Town-wide	Town-wide	None
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	Town-wide	Town-wide	None

MITIGATION CAPABILITIES AND LOCAL CAPACITY FOR IMPLEMENTATION

Under the Massachusetts system of "Home Rule," the Town of Saugus is authorized to adopt and from time to time amend 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, Stormwater Bylaws, Health Regulations, Public Works regulations, and local enforcement of the State Building Code.

Local Bylaws may be amended by the Town Meeting to improve the town's capabilities, and changes to most regulations require a public hearing and a vote of the authorized board or commission. The Town of Saugus has recognized several existing mitigation measures that require implementation or improvements and has the capacity within its local boards and departments to address these.

Several departments including Public Works, Planning, and Conservation will address the many planning and infrastructure projects. The Public Works Department has commissioned a consultant to conduct a comprehensive assessment of the stormwater drainage system, and 19 priority mitigation projects have been identified which the DPW will pursue implementation over the next several years. The Town is currently working on an updated Master Plan, which will incorporate climate impact considerations for the first time. The updated 2018 Open Space and Recreation Plan identifies priorities that the Conservation Commission will implement. Many projects, including public education.

SECTION 7: MITIGATION MEASURES FROM PREVIOUS PLAN

IMPLEMENTATION PROGRESS ON THE PREVIOUS PLAN

The Town of Saugus has taken steps to incorporate issues raised in the 2015 Hazard Mitigation Plan into several of its ongoing planning and policy initiatives. To address stormwater issues, the town engaged the services of Arcadis xx to conduct a comprehensive field assessment of stormwater drainage problems throughout the town. This resulted in the identification of 19 priority drainage improvement projects, which are integrated into this 2021 update of the Hazard Mitigation Plan. The town is currently engaged in preparing a new Comprehensive Plan, and MAPC is contributing to a section that integrates climate resilience issues into the new plan. The town is also conducting a Municipal Vulnerability Preparedness (MVP) in conjunction with the 2021 Hazard Mitigation Plan update. Other ways in which the town has integrated the previous plan include the implementation of a major drainage improvement project on Elm Street, and improved GIS mapping capabilities.

At a meeting of the Saugus Hazard Mitigation Planning Committee, Town staff reviewed the mitigation measures identified in the 2015 Saugus Hazard Mitigation Plan and determined whether each measure had been implemented, partially completed, 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 2021 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. Table 43 summarizes the status of mitigation measures from the 2015 plan.

Table 43: Mitigation Measures from the 2015 Plan

#	Hazard Area/ Issue	Mitigation Action Recommended in the 2015 Plan	Hazard Type	Priority in 2015 plan	Current Status *(Complete, In Progress, Not Complete, Notes)*	Include in 2021 Plan?
1.	Flood Hazard	Complete design and construction of Route One drainage system replacement.	Structural Projects	High	In Progress: Spot improvements have been made. Pumping installed at Walmart site.	Yes
2.	Flood Hazard	Complete design and reconstruction or removal of the Elm Street Bridge.	Structural Projects	High	Completed: The Town did other improvements. A 52-inch culvert was installed in 2018 which discharges downstream to address backup at bridge ($1.6 million project)	No
3.	Flood Hazard	Update East Saugus drainage system	Structural Projects	High	In progress: Ongoing work by the Town, replacing culvert and putting in new tide gate in 2021; Mass	Yes

#	Hazard Area/ Issue	Mitigation Action Recommended in the 2015 Plan	Hazard Type	Priority in 2015 plan	Current Status *(Complete, In Progress, Not Complete, Notes)*	Include in 2021 Plan?
					DOT did some work on Route 107	
4.	Flood Hazard	Consider adopting a Stormwater Utility mechanism.	Prevention	High	In progress	Yes
5.	Flood Hazard	Additional manpower resources for storm preparation and response	Prevention	High	In progress	Yes
6.	Flood Hazard	Replace the Spring Street 48-inch culvert with a larger, pre-cast concrete culvert.	Structural	High	Not completed-assessed in Drainage Master Plan	Yes
7.	Flood Hazard	Upgrade drainage lines along Lynnhurst Street from Stockade Road to Elm Street.	Structural Projects	High	Not completed-assessed in Drainage Master Plan	Yes
8.	Flood Hazard	Replace undersized drainage line along Intervale Avenue.	Structural Projects	High		
9.	Flood and Hurricanes	Continue active public education programs related to flood and hurricane awareness and mitigation measures	Public Education	High	Not completed	No
10.	Flood Hazard	Repetitive Loss Area Property Owner Outreach	Public Education	High	Not completed	No
11.	Flood Hazard	FEMA Community Rating System Program	Prevention	High	Not completed	No
12.	Flood Hazard	Acquisition of Vacant Flood Prone Lands	Prevention	High	In progress	Yes
13.	Flood Hazard	Floodplain District Management	Prevention	High	In progress	Yes
14.	Flood Hazard	Floodplain Mapping	Prevention	High	In progress	Yes
15.	Winter Storms	Continue to enforce MA Building Code to ensure adequate snow loads for new and reconstruction	Prevention	High	In Progress	No
16.	Winter Storms	Partnership with DPW and utilities to document known hazards	Prevention	High	Completed	No
17.	Winter Storms	Partner with MEMA and FEMA to implement risk reduction programs	Prevention	High	In Progress	No
18.	Winter Storms	Purchase a new sander and 5-ton dump truck.	Emergency Services	High	Completed	No
19.	Winter Storms	Purchase new bucket truck and chipper	Emergency Services	High	Completed	No
20.	Brush Fires	Fire road access system with Lynn Water and Sewer	Prevention	High	Completed	No
21.	Brush Fire	Increase cooperation between the Fire Dept and residents by encouraging the public to evaluate access routes to remote areas for fire-fighting vehicles and to	Prevention	High	Not Completed	No

#	Hazard Area/ Issue	Mitigation Action Recommended in the 2015 Plan	Hazard Type	Priority in 2015 plan	Current Status *(Complete, In Progress, Not Complete, Notes)*	Include in 2021 Plan?
		develop passable routes if they do not exist.				
22.	Brush Fires	High pressure floating water pump	Emergency Services	High	Completed	No
23.	Multi-Hazard/ Communications	Install town-wide Reverse 911 emergency communications system.	Emergency Services.	High	Completed	No
24.	Multi-Hazard/ Communications	Install fixed, natural gas fueled generators at Town Hall and Senior Center.	Emergency Services	High	In progress-Senior Center	Yes
25.	Multi-Hazard/ Communications	Replace Police Station radio repeater.	Emergency Services	High	In progress—planning procurement	Yes
26.	Multi-Hazard/ Communications	Replace Emergency Management Department radio console	Emergency Services	High	In Progress—planning procurement	Yes
27.	Multi-Hazard/ Communications	Update 60 hand held radios at the Police Department	Emergency Services	High	No completed – currently need 125 radios	Yes
28.	Flood Hazard	Key town staff should participate in MEMA or FEMA trainings	Prevention / Property Protection	Medium	In progress - continue	Yes
29.	Flood Hazard	Draft Master Plan update or policy on Climate Preparedness	Prevention	Medium	In progress – Town is conducting an MVP project	Yes
30.	Multi-Hazard	Sea Level Rise Action Work Group	Prevention	Medium	The MVP/HVP Core Team should maintain a focus on Sea Level Rise action in implementing the plan	Yes
31.	Brush Fires	Purchase 500 feet of new 2-inch and 500 feet of 1.5-inch forestry hose	Natural Resource Protections	Medium	Not completed	No
32.	Flood Hazard	GIS wetlands mapping	Natural Resource	Low	Completed	No
33.	Flood Hazard	Stormwater Outfall mapping	Emergency Services	Low	Completed	No
34.	Earthquakes	Municipal building earthquake options	Prevention	Low	Not completed	Yes

As indicated in Table 43, Saugus made significant progress implementing mitigation measures identified in the 2015 Hazard Mitigation Plan. In particular, the Town made a significant improvement to address the drainage near Elm street through a $1.6 million project to install a new 52-inch drainage pipe that discharges below the bridge. A new tide gate will be installed in the summer of 2021. The also town completed GIS mapping of wetlands as well as stormwater outfalls.

Finally, the Town conducted a Municipal Vulnerability Project (MVP) to address climate change impacts and identify resiliency opportunities in conjunction with this Hazard Mitigation Plan Update. The priority actions are summarized in Appendix XX, and the full MVP report accompanies this plan in a separate document.

Several projects that were not completed will be continued into this plan update. While the town has addressed stormwater challenges in several locations, more improvements are needed at key locations throughout the town. To facilitate further improvements, the town engaged a consultant to conduct a town-wide comprehensive assessment of the drainage system, resulting in 19 priority projects being identified, which are included in this plan update.

Overall, 17 mitigation measures from the 2015 plan will be continued in this 2021plan update. Most retain the same priority in this 2021 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. 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.

SECTION 8: 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.

https://www.fema.gov/hazard-mitigation-grant-program
https://www.fema.gov/pre-disaster-mitigation-grant-program
https://www.fema.gov/flood-mitigation-assistance-grant-program

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

- **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.

- **Property Protection:** Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.

- **Public Education & Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.

- **Emergency Services Protection:** Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, and protection of emergency response infrastructure.

(Source: FEMA Local Multi-Hazard Mitigation Planning Guidance)

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 developed urban and suburban communities such as the metropolitan Boston area, mitigating natural hazards, particularly flooding, is often 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 Massachusetts Water Resources Authority (MWRA), 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 Saugus and a discussion of inter-municipal issues.

OVERVIEW OF REGIONAL FACILITIES WITHIN SAUGUS

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

- U.S. Route 1 and State Rt. 107 (MassDOT)
- Saugus Iron Works National Historic Site (National Park Service)
- Breakheart Reservation (Mass DCR)
- Lynn Woods Reservation (Lynn Water and Sewer Commission)
- Rumney Marsh Reservation (Mass DCR)

INTER-COMMUNITY CONSIDERATIONS

Shoreline Environment – The coastal shoreline of the North Shore area is a dynamic environment where forces of erosion and deposition of sand are constantly at work changing the beach profile. This process disregards municipal boundaries as sand and other materials are moved along the coast. Shoreline protection measures such as sea walls, jetties, and others have an impact on this process with the potential of building up sand in some areas while striping it away from others. Municipalities along the North Shore should work to understand how these processes are at work locally and consider mutually beneficial means of protecting their shore side communities from the impacts of storm damage.

Climate Change and Sea Level Rise – The entirety of Massachusetts's coastal environment faces potential risk from Climate Change and associated sea level rise. Models incorporating current trends indicate a gradual rise in global temperature, with a consequent increase in the volume of water in the world's ocean due to thermal expansion as the water warms and the addition of water from melting ice sheets and glaciers. Higher temperatures and higher sea levels will result in a greater frequency and intensity of storms and higher flood levels.

The potential future changes to the State's storm damage profile caused by climate change will likely be well outside of historic trends, making those trends uncertain predictors of future risk and vulnerability at best. Since the 2015 plan, Massachusetts has established a robust program to help communities address climate change through the Municipal Vulnerability Program (MVP). The state also launched a website providing the best available information to map and model climate change and sea level rise data in Massachusetts at www.resilientma.org. Saugus and its neighboring communities on the North Shore have all participated in the MVP program, which raises the possibility of collaboration on issues of joint concern along the coast. A group of communities on the South Shore have formed a regional climate resilience working group to share information and coordinate their local and regional strategies for implementation. Saugus and its neighboring communities could benefit from a similar regional effort on the North Shore.

Massachusetts Department of Transportation (MDOT). The planning, construction, operations, 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 numerous competing priorities. In the sections that follow, the plan includes recommendations for activities where cooperation with these other agencies may be necessary. Implementation of these recommendations will require that all parties work together to develop solutions.

NEW DEVELOPMENT AND INFRASTRUCTURE

As part of the process of developing recommendations for new mitigation measures for this plan update, the Town considered the issues related to new development, redevelopment, and infrastructure needs in order to limit future risks.

Taking into consideration the ongoing update to the town's Comprehensive Plan, the Wetlands Act and bylaw enforced by the Conservation Commission, the floodplain zoning overlay, the

stormwater bylaw, and the recently completed Municipal Vulnerability project, 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 establishing a Stormwater Utility and updating the stormwater bylaw to be consistent with the EPA MS4 Stormwater Permit.

PROCESS FOR SETTING PRIORITIES FOR MITIGATION MEASURES

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

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

Table 44 below demonstrates the prioritization of the Town'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:

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 $250,000
Medium	Estimated costs between $50,000 to $250,000
Low	Estimated costs less than $50,000 and/or staff time

Overall 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 44: Mitigation Measures Prioritization

Mitigation Actions	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
FLOOD (Inland, Coastal, Stormwater, Dams)				
1) Update East Saugus drainage system	East Saugus	HIGH	HIGH	HIGH
2) Design and adopt a Stormwater Utility mechanism	Town wide	MEDIUM	LOW	HIGH
3) Additional manpower resources for storm preparation and response	Town wide	HIGH	LOW	HIGH
4) Replace the Spring Street 48-inch culvert with larger, pre-cast concrete culvert	Spring St.	HIGH	HIGH	HIGH
5) Upgrade drainage lines along Lynnhurst Street from Stockade Road to Elm Street	Lynnhurst St.	HIGH	HIGH	HIGH
6) Acquisition of Vacant Flood Prone Lands	Town wide	HIGH	HIGH	HIGH
7) Floodplain District Management	Town wide	HIGH	LOW	HIGH
8) Floodplain Mapping	Town wide	HIGH	LOW	HIGH
13) Belair and Hewlett Streets, discharge to Pines River Marshes (1)	Belair and Hewlett Sts.	HIGH	HIGH	HIGH
14) Bristow Street Area, discharges to Pines River Marshes and Saugus River at Ballard Street tide gates (4)	Bistrow Street	HIGH	HIGH	HIGH
15) Sachem Street, discharges to Saugus River (5)	Sachem St.	HIGH	HIGH	HIGH
16) Spring Street Culvert, discharges to Saugus R. (6)	Spring St.	HIGH	HIGH	HIGH
17) Bennetts Pond Brook, east of Main Street, discharges to Bennetts Pond Brook (7)	Bennetts Pond Brook	HIGH	HIGH	HIGH
18) Bennetts Pond Brook, west of Main Street, discharges to Bennetts Pond Brook (8)	Bennetts Pond Brook	HIGH	HIGH	HIGH
19) Howard Street Culvert, discharges to unnamed tributary to Bennetts Pond Brook (9)	Howard St.	HIGH	HIGH	HIGH

Mitigation Actions	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
20) Forest Avenue Right-of-Way, discharges to Fish Brook (14)	Forest Ave.	HIGH	HIGH	HIGH
21) Fairmount Avenue, discharges to Saugus River (15)	Fairmount Avenue	HIGH	HIGH	HIGH
22) Shute Brook culverts at Vine Street and Highland Avenue, discharges to Shute Brook (16)	Shute Brook at Vine St. & Highland Av	HIGH	MEDIUM	HIGH
23) Auburn Street wetlands, discharges to wetlands tributary to Shute Brook (18)	Auburn St. wetlands	HIGH	HIGH	HIGH
24) Acadia and Aberdeen Avenues, discharges to Pines River marshes (19)	Acadia & Aberdeen Avenues	HIGH	HIGH	HIGH
25) Central and Mt. Pleasant Streets; discharges to unnamed tributary to Saugus River (22)	Central & Mt. Pleasant Streets	HIGH	MEDIUM	HIGH
26) 8 Sycamore Lane, discharges to unnamed tributary to Bennett's Pond Brook (24)	Sycamore Lane	HIGH	HIGH	HIGH
27) Pleasant Avenue, discharges to unnamed tributary to Fiske Brook (31)	Pleasant Avenue	HIGH	MEDIUM	HIGH
28) Essex Street, discharges to Pines River via Revere (32)	Essex Street	HIGH	HIGH	HIGH
29) Maple Road, discharges to unnamed tributary to Fiske Brook (35)	Maple Road	HIGH	HIGH	HIGH
30) Altamont Avenue, discharges to Penny Brook (36)	Altamont Avenue	HIGH	HIGH	HIGH
31) Key town staff should participate in MEMA or FEMA trainings	Town wide	MEDIUM	LOW	MEDIUM
32) Draft Master Plan update on Climate Preparedness; implement Municipal Vulnerability Preparedness (MVP) and Sea Level Rise actions	Town wide	MEDIUM	MEDIUM	MEDIUM
33) Stormwater outfall mapping (MS4 Permit)	Town wide	MEDIUM	LOW	LOW
EARTHQUAKE				
34) Identify public buildings vulnerable and assess options to make them more resistant to earthquakes	Town wide	LOW	LOW	LOW
WIND HAZSARDS / WINTER HAZARDS				
35) Disseminate information to property owners to reduce risk from tree failure to life, property and utility systems;	Town wide	MEDIUM	LOW	LOW

Mitigation Actions	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
36) Identify potentially hazardous trees in critical areas;	Town wide	MEDIUM	LOW	LOW
37) Increase staff to assist DPW to identify and remove trees within Public Right-of-Way	Town wide	MEDIUM	LOW	LOW
EXTREME HEAT AND COLD				
38) Adopt Site Design guidelines to increase shade tree plantings near buildings, increase trees used in parking areas and along public ways.	Town wide	LOW	LOW	LOW
39) Conduct public outreach on extreme temperatures and resources available to residents; focus on vulnerable populations	Town wide	MEDIUM	LOW	LOW
DROUGHT				
40) Adopt guidelines for development to promote drought tolerant landscaping and low water use site design measures	Town wide	MEDUIM	LOW	LOW
BRUSHFIRE				
41) Public Education on Brush Fire Prevention	Town wide	LOW	LOW	LOW
42) Develop a plan for managing wildfires and brushfires in difficult to access locations	Town wide	MEDIUM	LOW	LOW
MULTIHAZARDS				
9) Install fixed, natural gas fueled generators at Town Hall and Senior Center	Town Hall and Senior Center	HIGH	LOW	HIGH
10) Replace Police Station radio repeater	Police Dept	HIGH	LOW	HIGH
11) Replace Emergency Management Department radio console	Emergency Management	HIGH	LOW	HIGH
12) Update 60 hand-held radios at the Police Department	Police Dept.	HIGH	LOW	HIGH

Introduction to Potential Mitigation Measures (Table 45)

- **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 44, the designation of high, medium, or low priority was done considering area covered by the mitigation measures and their potential benefits and preliminary estimated project costs.

- **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. 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.

Massachusetts Emergency Management Agency (MEMA) – The grants page https://www.mass.gov/hazard-mitigation-assistance-grant-programs describes the various Hazard Mitigation Assistance Program.

Massachusetts Municipal Vulnerability Preparedness Action Grants—Communities designated by the state as MVP certified are eligible to apply for MVP Action Grants. These grants are intended to assist with the implementation of mitigation and resilience actions identified in a community's MVP Report. Since Saugus conducted and MVP project in conjunction with this 2021 Hazard Mitigation Plan Update, it is expected that the town should be eligible for MVP Action Grants in the next grant round of 2022. https://resilientma.org/mvp/

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.

Table 45: Saugus Recommended Mitigation Measures						
Hazard Type	**Mitigation Measure**	**Measure Type**	**Implementation Responsibility**	**Time Frame (2021-2026)**	**Estimated Cost**	**Potential Funding Sources**
High Priority Projects						
Flood Hazard	1) Update East Saugus drainage system	Structural Projects	Public Works	2026	$5 million	Town of Saugus-bond/BRIC
Flood Hazard	2) Design and adopt a Stormwater Utility mechanism	Prevention	Public Works	2022	$25,000	Town of Saugus-DPW budget
Flood Hazard	3) Additional manpower resources for storm preparation and response	Prevention	Public Works	2022	$25,000/year	Town of Saugus-DPW budget
Flood Hazard	4) Replace the Spring Street 48-inch culvert with larger, pre-cast concrete culvert	Structural	Public Works	2025	$500,000	Town of Saugus-DPW/BRIC
Flood Hazard	5) Upgrade drainage lines along Lynnhurst Street from Stockade Road to Elm Street	Structural Projects	Public Works	2023	$5 Million	Town of Saugus-DPW/BRIC
Flood Hazard	6) Acquisition of Vacant Flood Prone Lands	Prevention	Conservation/ Planning	2021-2026	Cost of land TBD	Town of Saugus General Fund/DCR
Flood Hazard	7) Floodplain District Management	Prevention	Conservation/ Building Dept.	2021-2026	LOW Staff Time	Town of Saugus-General Fund
Flood Hazard	8) Floodplain Mapping	Prevention	Conservation/ Building Dept.	2022	LOW Staff Time	Town of Saugus General budget
Multi-Hazard/ Communications	9) Install fixed, natural gas fueled generators at Town Hall and Senior Center	Facilities Engineer	Public Works	2023-2024	$75,000	Town of Saugus DPW budget

Table 45: Saugus Recommended Mitigation Measures						
Hazard Type	**Mitigation Measure**	**Measure Type**	**Implementation Responsibility**	**Time Frame (2021-2026)**	**Estimated Cost**	**Potential Funding Sources**
Multi-Hazard/ Communications	10) Replace Police Station radio repeater	Emergency Services	Police Department	2021-2022	$50,000	Town of Saugus General Fund
Multi-Hazard/ Communications	11) Replace Emergency Management Department radio console	Emergency Services	Emergency Management	2021-2022	$36,000	Town of Saugus General Fund
Multi-Hazard/ Communications	12) Update 60 hand-held radios at the Police Department	Emergency Services	Police Department	2021-2022	$75,000	Town of Saugus General Fund
Flood Hazard	13) Belair and Hewlett Streets, discharge to Pines River Marshes (1)	Structural Projects	Public Works	2022-2026	HIGH $500,000	Town of Saugus-DPW budget
Flood Hazard	14) Bristow Street Area, discharges to Pines River Marshes and Saugus River at Ballard Street tide gates (4)	Structural Projects	Public Works	2022-2026	HIGH TBD	Town of Saugus-DPW budget
Flood Hazard	15) Sachem Street, discharges to Saugus River (5)	Structural Projects	Public Works	2022-2026	HIGH $550,000	Town of Saugus-DPW budget
Flood Hazard	16) Spring Street Culvert, discharges to Saugus R. (6)	Structural Projects	Public Works	2022-2026	HIGH $500,000	Town of Saugus-DPW budget
Flood Hazard	17) Bennetts Pond Brook, east of Main Street, discharges to Bennetts Pond Brook (7)	Structural Projects	Public Works	2022-2026	HIGH TBD	Town of Saugus-DPW budget
Flood Hazard	18) Bennetts Pond Brook, west of Main Street, discharges to Bennetts Pond Brook (8)	Structural Projects	Public Works	2022-2026	HIGH TBD	Town of Saugus-DPW budget

Table 45: Saugus Recommended Mitigation Measures						
Hazard Type	**Mitigation Measure**	**Measure Type**	**Implementation Responsibility**	**Time Frame (2021-2026)**	**Estimated Cost**	**Potential Funding Sources**
Flood Hazard	19) Howard Street Culvert, discharges to unnamed tributary to Bennetts Pond Brook (9)	Structural Projects	Public Works	2022-2026	HIGH $1 Million	Town of Saugus-DPW budget
Flood Hazard	20) Forest Avenue Right-of-Way, discharges to Fish Brook (14)	Structural Projects	Public Works	2022-2026	HIGH $1 Million	Town of Saugus-DPW budget
Flood Hazard	21) Fairmount Avenue, discharges to Saugus River (15)	Structural Projects	Public Works	2022-2026	HIGH $1.8 Million	Town of Saugus-DPW budget
Flood Hazard	22) Shute Brook culverts at Vine Street and Highland Avenue, discharges to Shute Brook (16)	Structural Projects	Public Works	2022-2026	MEDIUM $50,000	Town of Saugus-DPW budget
Flood Hazard	23) Auburn Street wetlands, discharges to wetlands tributary to Shute Brook (18)	Structural Projects	Public Works	2022-2026	HIGH $300,000	Town of Saugus-DPW budget
Flood Hazard	24) Acadia and Aberdeen Avenues, discharges to Pines River marshes (19)	Structural Projects	Public Works	2022-2026	HIGH $1.7 Million	Town of Saugus-DPW budget
Flood Hazard	25) Central and Mt. Pleasant Streets; discharges to unnamed tributary to Saugus River (22)	Structural Projects	Public Works	2022-2026	MEDIUM $150,000	Town of Saugus-DPW budget
Flood Hazard	26) 8 Sycamore Lane, discharges to unnamed tributary to Bennett's Pond Brook (24)	Structural Projects	Public Works	2022-2026	HIGH $1.5 Million	Town of Saugus-DPW budget

Table 45: Saugus Recommended Mitigation Measures						
Hazard Type	**Mitigation Measure**	**Measure Type**	**Implementation Responsibility**	**Time Frame (2021-2026)**	**Estimated Cost**	**Potential Funding Sources**
Flood Hazard	27) Pleasant Avenue, discharges to unnamed tributary to Fiske Brook (31)	Structural Projects	Public Works	2022-2026	MEDIUM $75,000	Town of Saugus-DPW budget
Flood Hazard	28) Essex Street, discharges to Pines River via Revere (32)	Structural Projects	Public Works	2022-2026	HIGH $500,000	Town of Saugus-DPW budget
Flood Hazard	29) Maple Road, discharges to unnamed tributary to Fiske Brook (35)	Structural Projects	Public Works	2022-2026	HIGH $400,000	Town of Saugus-DPW budget
Flood Hazard	30) Altamont Avenue, discharges to Penny Brook (36)	Structural Projects	Public Works	2022-2026	HIGH $800,000	Town of Saugus-DPW budget
Medium Priority Projects						
Flood Hazard	31) Key town staff should participate in MEMA or FEMA trainings	Prevention /Property Protection	Fire, Emergency Management, Police and DPW	2021-2026	LOW Staff Time	Town of Saugus General Fund
Flood Hazard	32) Draft Master Plan update on Climate Preparedness; implement Municipal Vulnerability Preparedness (MVP) and Sea Level Rise actions	Prevention	Conservation/ DPW	2021-2022	MEDIUM & Staff Time	Town of Saugus General Fund
Low Priority Projects						
Flood Hazard	33) Stormwater outfall mapping (MS4 Permit)	Prevention	DPW	2021-2023	$80,000	Town of Saugus General Fund

Table 45: Saugus Recommended Mitigation Measures						
Hazard Type	**Mitigation Measure**	**Measure Type**	**Implementation Responsibility**	**Time Frame (2021-2026)**	**Estimated Cost**	**Potential Funding Sources**
Earthquakes	34) Identify public buildings vulnerable and assess options to make them more resistant to earthquakes	Prevention	Public Buildings	2024-2025	LOW	Town of Saugus General Fund
Wind Hazards Winter Hazards	Implement a program to prevent trees from threatening lives, property, and public infrastructure during high wind events and winter storms: 35) Disseminate information to property owners to reduce risk from tree failure to life, property and utility systems; 36) Identify potentially hazardous trees in critical areas; 37) Increase staff to assist DPW to identify and remove trees within Public Right-of-Way	Prevention	DPW	2022-2026	LOW Staff Time	Town of Saugus General Fund
Extreme Temperatures	38) Adopt Site Design guidelines to increase shade tree plantings near buildings, increase trees used in parking areas and along public ways.	Prevention/Regulations	Planning Board/ Conservation Commission	2022-2023	LOW Staff time	Town of Saugus General Fund
Extreme Temperatures	39) Conduct public outreach on extreme temperatures and resources available to	Prevention/Public Education	Board of Health/ Council on Aging	2022-2026	LOW Staff time	Town of Saugus General Fund

Table 45: Saugus Recommended Mitigation Measures						
Hazard Type	**Mitigation Measure**	**Measure Type**	**Implementation Responsibility**	**Time Frame (2021-2026)**	**Estimated Cost**	**Potential Funding Sources**
	residents; focus on vulnerable populations					
Drought Hazards	40) Adopt guidelines for development to promote drought tolerant landscaping and low water use site design measures	Prevention/Regulations	Planning Board/ Conservation Commission	2022-2023	LOW Staff time	Town of Saugus General Fund
Brushfire Hazards	41) Public Education on Brush Fire Prevention	Prevention/Public Education	Fire Dept.	2022-2023	LOW Staff time	Town of Saugus General Fund
Brushfire Hazards	42) Develop a plan for managing wildfires and brushfires in difficult to access locations	Prevention/Planning	Fire Dept.	2023-2025	LOW Staff time	Town of Saugus General Fund

For COST ESTIMATES, where specific dollar estimates are not available, the following categories were used:

LOW: Less than $50,000

MEDIUM: $50,000 to $250,000

HIGH: More than $250,000

SECTION 9: PLAN ADOPTION & MAINTENANCE

PLAN ADOPTION

The Saugus Hazard Mitigation Plan 2021 Update was adopted by the Saugus Town Manager 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

MAPC worked with the Saugus Hazard Mitigation Planning Team to prepare this plan. After approval of the plan by FEMA, this group will continue to function to coordinate the implementation of the plan. Additional members may be added to the local team from businesses, non-profits and institutions. The Town will encourage public participation during the next 5-year planning cycle. As a mid-term review of the plan 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 Review of 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 the Saugus HMP/MVP Core Team members and other interested stakeholders in the Town. The survey will poll the members Saugus HMP/MVP Core Team on progress and accomplishments for implementation, changes or revisions to the plan that may be needed, 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 Saugus HMP/MVP Core Team, coordinated by the Senior Planner, 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 annual review to identify the needs and priorities for the plan update and seek funding for the plan update process. A potential sources of funding an updated plan is the FEMA Building Resilient

Infrastructure and Communities grant (BRIC), which will 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 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. When it is drafted, the updated Saugus Hazard Mitigation Plan will be forwarded to MEMA and FEMA for review and approval.

INTEGRATION OF THE PLANS WITH OTHER PLANNING INITIATIVES

Upon approval of this Saugus Hazard Mitigation Plan 2021 Update by FEMA, the Saugus HMP/MVP Core 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. At a minimum, the plan will be reviewed and discussed with the following departments:

- Town Administrator's office
- Fire Department
- Emergency Management
- Police Department
- Public Works Department
- Public Buildings
- Planning and Development Department
- Conservation Commission
- Board of Health
- Inspectional Services
- Building Department

Other groups that will be coordinated with include large institutions, Chambers of Commerce, land conservation organizations and watershed groups. The plan will also be posted on the Town's website. The posting of the plan on the website 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 Comprehensive Emergency Management Plan, Master Plan, Open Space and Recreation Plan, and Capital Plan.

SECTION 10: LIST OF REFERENCES

In addition to the specific reports listed below, much of the technical information for this plan came from meetings with Town department heads and staff.

Town of Saugus, Massachusetts, https://www.saugus-ma.gov/

Town of Saugus Open Space and Recreation Plan 2018-2024

General Bylaws for the Town of Saugus

Town of Saugus, Massachusetts. Zoning Bylaws

Town of Saugus Community Resilience Building Workshop Summary of Findings January 2020

Massachusetts State Hazard Mitigation and Climate Adaptation Plan, 2018

FEMA, Local Mitigation Plan Review Guide, October 2011

FEMA, Flood Insurance Rate Maps for Essex 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 (NCEI), http://www.ncdc.noaa.gov/

USGS, National Water Information System, http://nwis.waterdata.usgs.gov/usa/nwis

APPENDIX A: 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 documentation for some of the hazard maps was incomplete as well.

The map series consists of eight panels displaying the following information:

Map 1.	Population Density
Map 2.	Potential Development
Map 3.	Flood Zones
Map 4.	Earthquakes and Landslides
Map 5.	Hurricanes and Tornadoes
Map 6.	Average Snowfall
Map 7.	Composite Natural Hazards
Map 8.	Hazard Areas
Map 9	High Land Surface Temperature and Tree Cover
Map 10	Sea Level Rise
Map 11	Sea Level Rise with Category 1 Hurricane

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: Potential Development – This map shows potential future developments, and critical infrastructure sites. MAPC consulted with town staff to determine areas that were likely to be developed or redeveloped in the future.

Map 3: Flood Zones – The map of flood zones used the FEMA NFIP Flood Zones for Middlesex County as its source. 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 municipally owned and protected open space.

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.

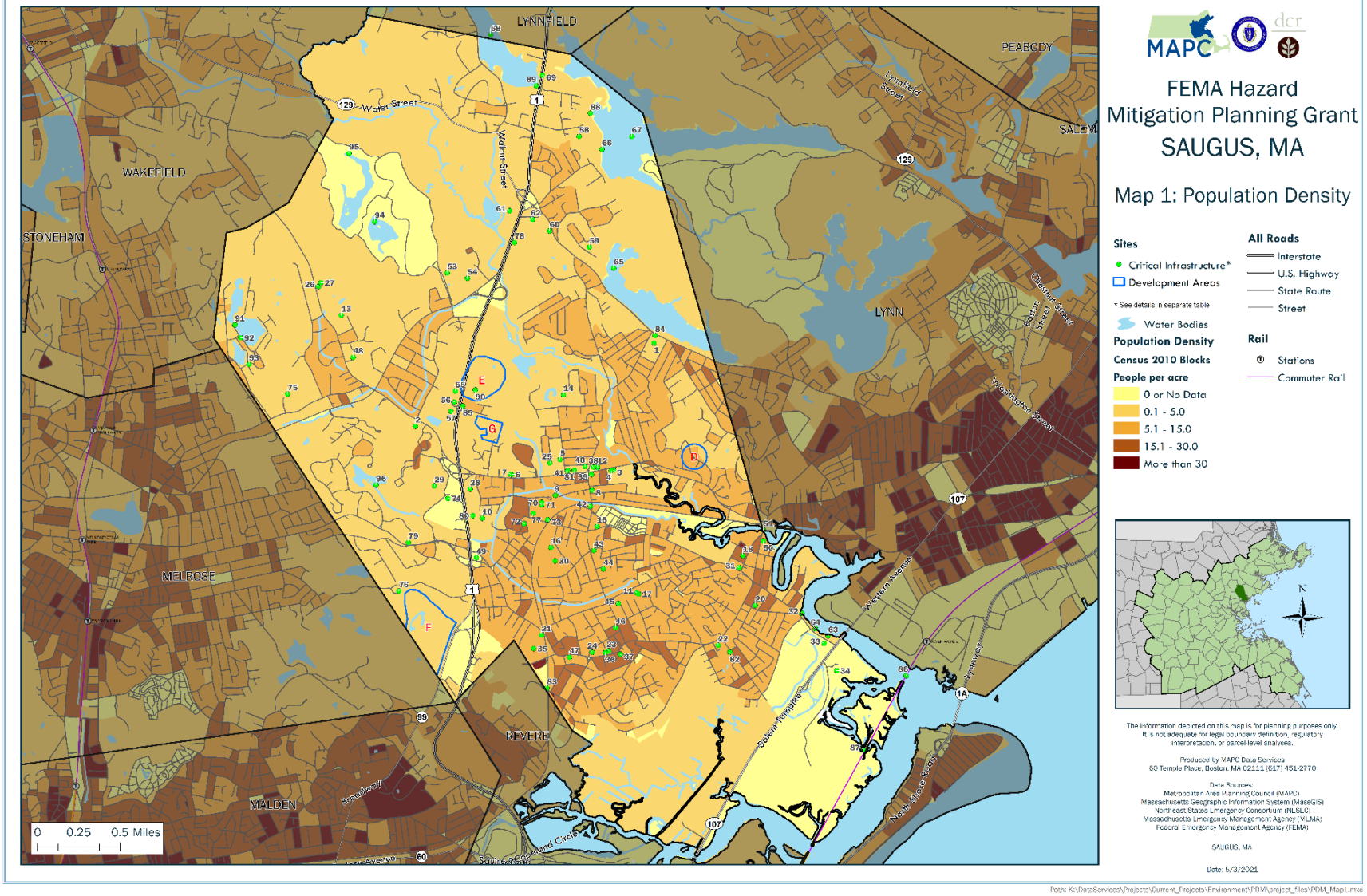
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map

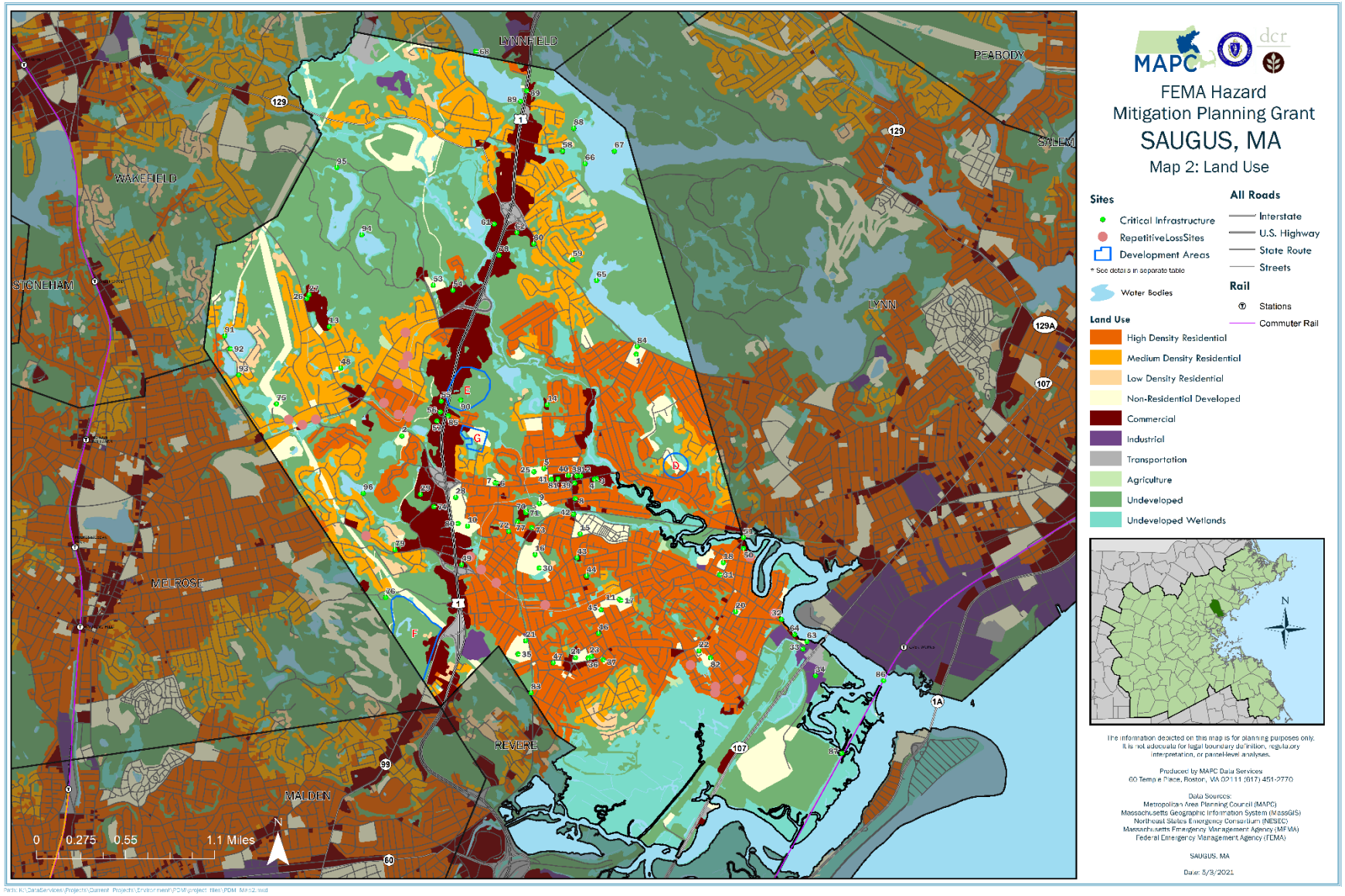
includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind and rain from these storms were felt in other communities even if the track was not 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 and open space. 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. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.


LYNNFIELD
PEABODY
SALEM
WAKEFIELD
STONEHAM
LYNN
MELROSE
REVERE
MALDEN
Water Street
Walnut Street
Lynnfield Street
Broadway
Salem Turnpike
Northern Avenue
Lynnway
Washington Street
Boston Street
Glenmont Street
Copeland Circle
North Shore Mall
0 0.25 0.5 Miles
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
SAUGUS, MA
Map 1: Population Density
Sites
Critical Infrastructure*
Development Areas
* See details in separate table
Water Bodies
Population Density
Census 2010 Blocks
People per acre
0 or No Data
0.1 - 5.0
5.1 - 15.0
15.1 - 30.0
More than 30
All Roads
Interstate
U.S. Highway
State Route
Street
Rail
Stations
Commuter Rail
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)
SAUGUS, MA
Date: 6/3/2021


LYNNFIELD
PEABODY
SALEM
WAKEFIELD
STONEHAM
LYNN
MELROSE
REVERE
MALDEN
0 0.275 0.55 1.1 Miles
N
MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
SAUGUS, MA
Map 2: Land Use
Sites
Critical Infrastructure
RepetitiveLossSites
Development Areas
* See details in separate table
Water Bodies
All Roads
Interstate
U.S. Highway
State Route
Streets
Rail
Stations
Commuter Rail
Land Use
High Density Residential
Medium Density Residential
Low Density Residential
Non-Residential Developed
Commercial
Industrial
Transportation
Agriculture
Undeveloped
Undeveloped Wetlands
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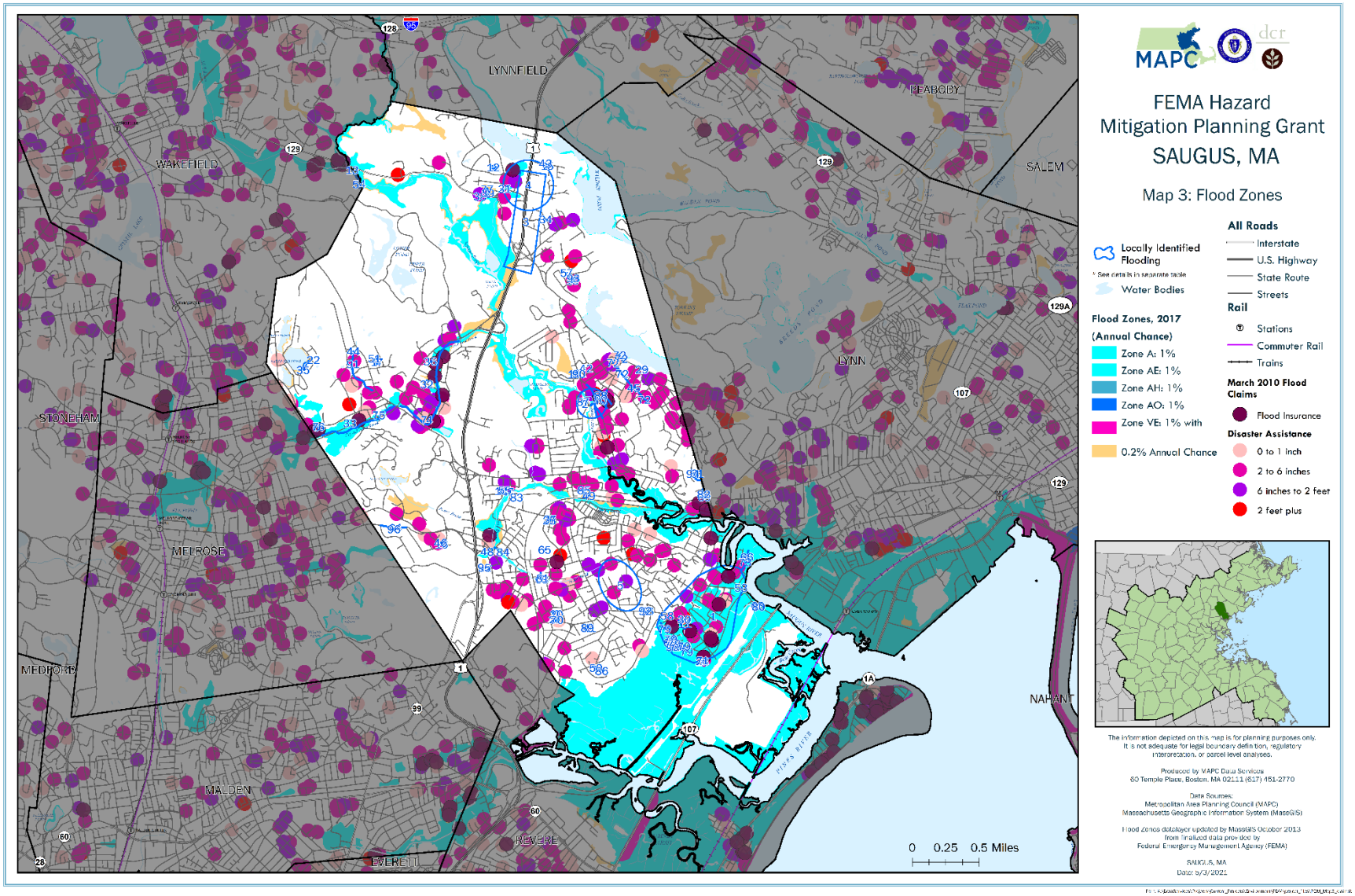
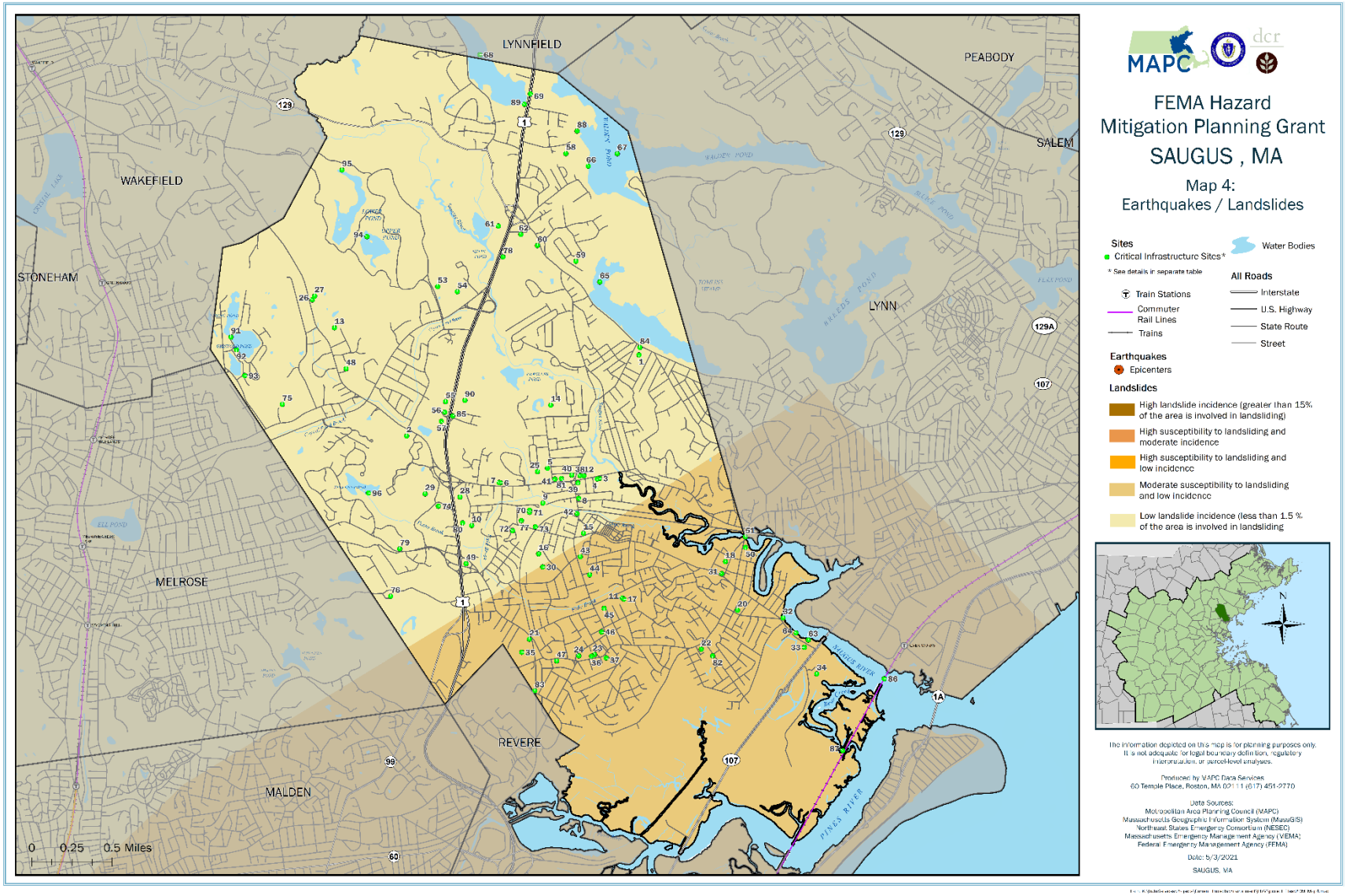
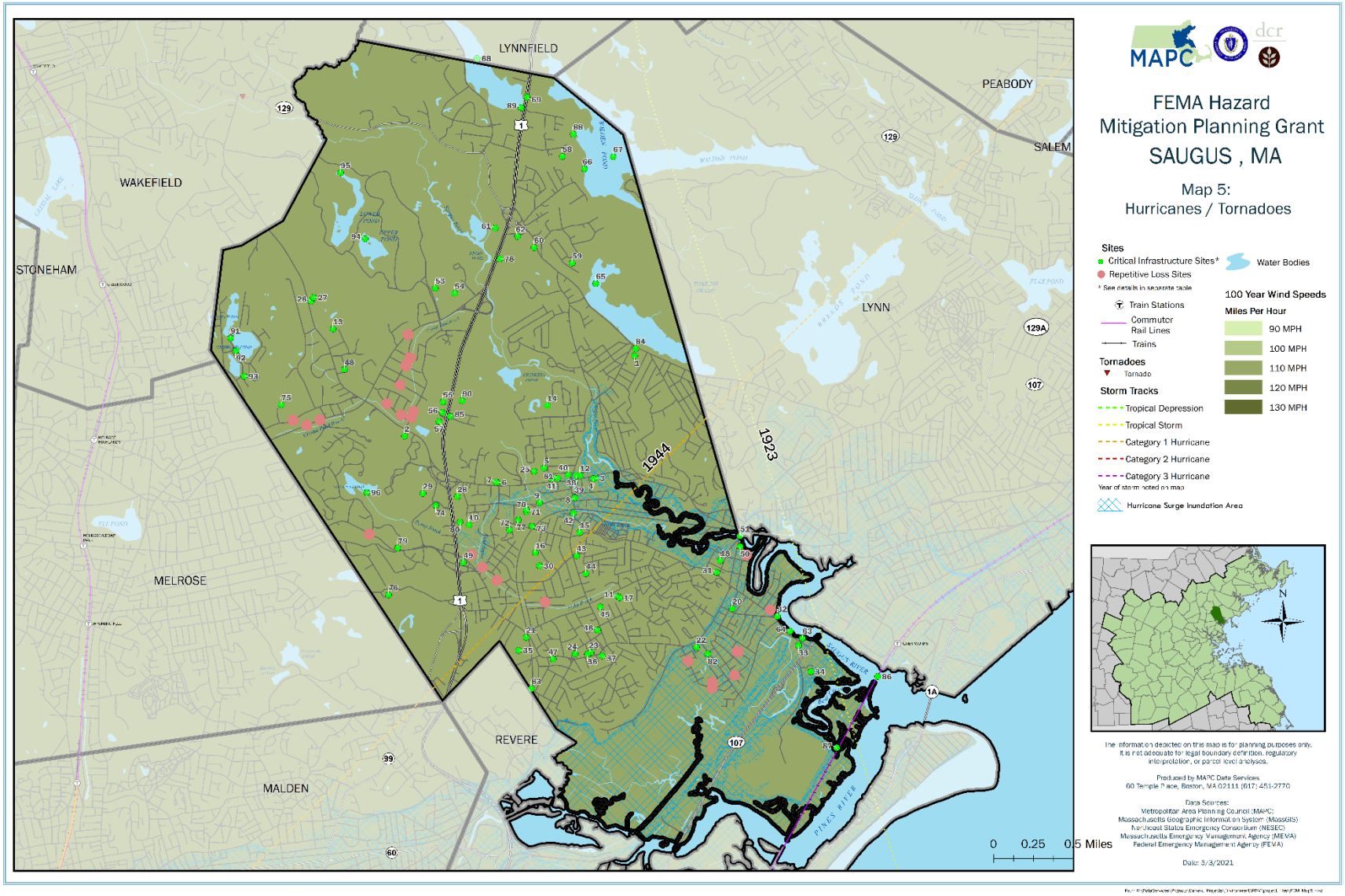
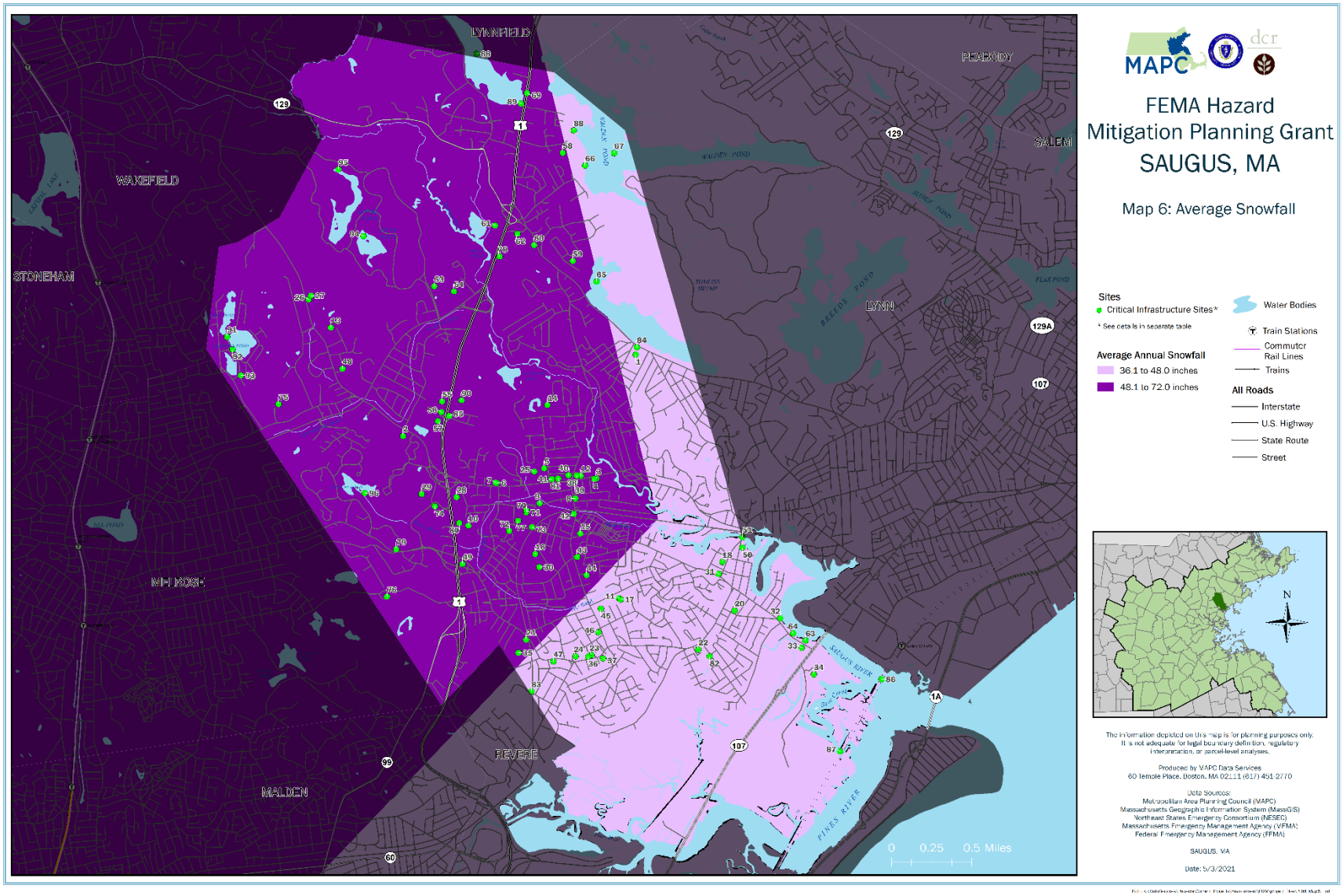
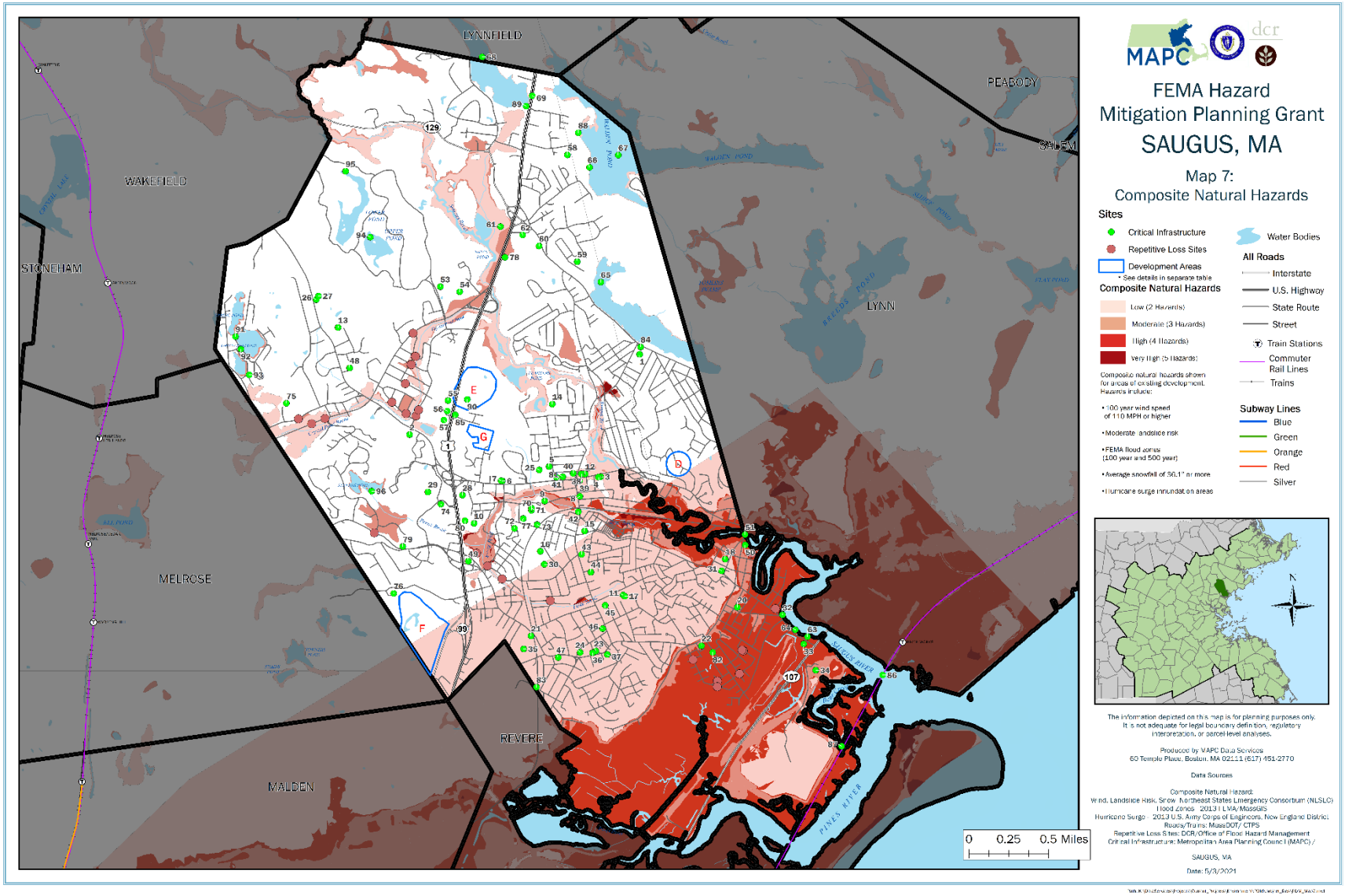
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
SAUGUS, MA
Date: 5/3/2021

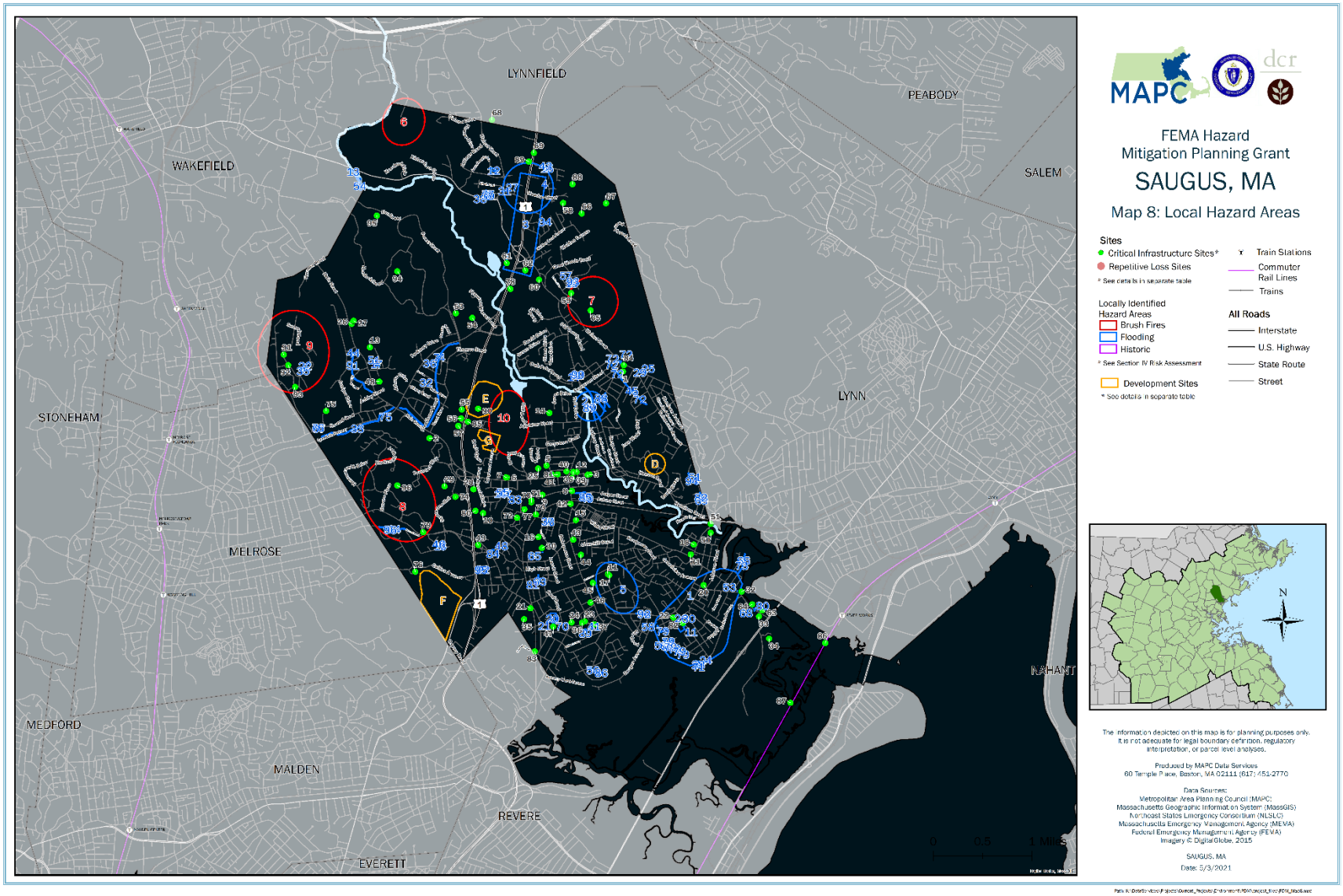

MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
SAUGUS, MA
Map 3: Flood Zones
Locally Identified Flooding
* See data is in separate table
Water Bodies
Flood Zones, 2017
(Annual Chance)
Zone A: 1%
Zone AE: 1%
Zone AH: 1%
Zone AO: 1%
Zone VE: 1% with
0.2% Annual Chance
All Roads
Interstate
U.S. Highway
State Route
Streets
Rail
Stations
Commuter Rail
Trains
March 2010 Flood Claims
Flood Insurance
Disaster Assistance
0 to 1 inch
2 to 6 inches
6 inches to 2 feet
2 feet plus
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)
SAUGUS, MA
Date: 5/3/2021
LYNNFIELD
PEABODY
WAKEFIELD
SALEM
LYNN
STONEHAM
MELROSE
MEDFORD
MALDEN
EVERETT
REVERE
NAHANT
0 0.25 0.5 Miles


LYNNFIELD
PEABODY
SALEM
WAKEFIELD
STONEHAM
LYNN
MELROSE
REVERE
MALDEN
0 0.25 0.5 Miles
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
SAUGUS , MA
Map 4:
Earthquakes / Landslides
Sites
Critical Infrastructure Sites*
* See details in separate table
Water Bodies
All Roads
Train Stations
Commuter Rail Lines
Trains
Interstate
U.S. Highway
State Route
Street
Earthquakes
Epicenters
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
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)
Date: 5/3/2021
SAUGUS, MA


LYNNFIELD
PEABODY
SALEM
WAKEFIELD
STONEHAM
LYNN
MELROSE
REVERE
MALDEN
1944
1923
0 0.25 0.5 Miles
MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
SAUGUS , MA
Map 5:
Hurricanes / Tornadoes
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Train Stations
Commuter Rail Lines
Trains
Tornadoes
Tornado
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Year of storm noted on map
Hurricane Surge Inundation Area
Water Bodies
100 Year Wind Speeds
Miles Per Hour
90 MPH
100 MPH
110 MPH
120 MPH
130 MPH
N
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis.
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)
Date: 3/3/2021


LYNNFIELD
PEABODY
SALEM
WAKEFIELD
STONEHAM
LYNN
MELROSE
REVERE
MALDEN
129
1
129A
107
1A
99
60
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
SAUGUS, MA
Map 6: Average Snowfall
Sites
Critical Infrastructure Sites*
* See details in separate table
Average Annual Snowfall
36.1 to 48.0 inches
48.1 to 72.0 inches
Water Bodies
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
N
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)
SAUGUS, MA
Date: 5/3/2021


LYNNFIELD
PEABODY
SALEM
WAKEFIELD
STONEHAM
LYNN
MELROSE
REVERE
MALDEN
0 0.25 0.5 Miles
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
SAUGUS, MA
Map 7:
Composite Natural Hazards
Sites
Critical Infrastructure
Repetitive Loss Sites
Development Areas
• See details in separate table
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 50.1" or more
• Hurricane surge inundation areas
Water Bodies
All Roads
Interstate
U.S. Highway
State Route
Street
Train Stations
Commuter Rail Lines
Trains
Subway Lines
Blue
Green
Orange
Red
Silver
N
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 | LMA/ 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) /
SAUGUS, MA
Date: 5/3/2021


LYNNFIELD
PEABODY
WAKEFIELD
SALEM
LYNN
STONEHAM
MELROSE
NAHANT
MEDFORD
MALDEN
REVERE
EVERETT
MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
SAUGUS, 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
N
0 0.5 1 MILES
The information depicted on this map is for planning purposes only.
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interpretation, or parcel level analyses.
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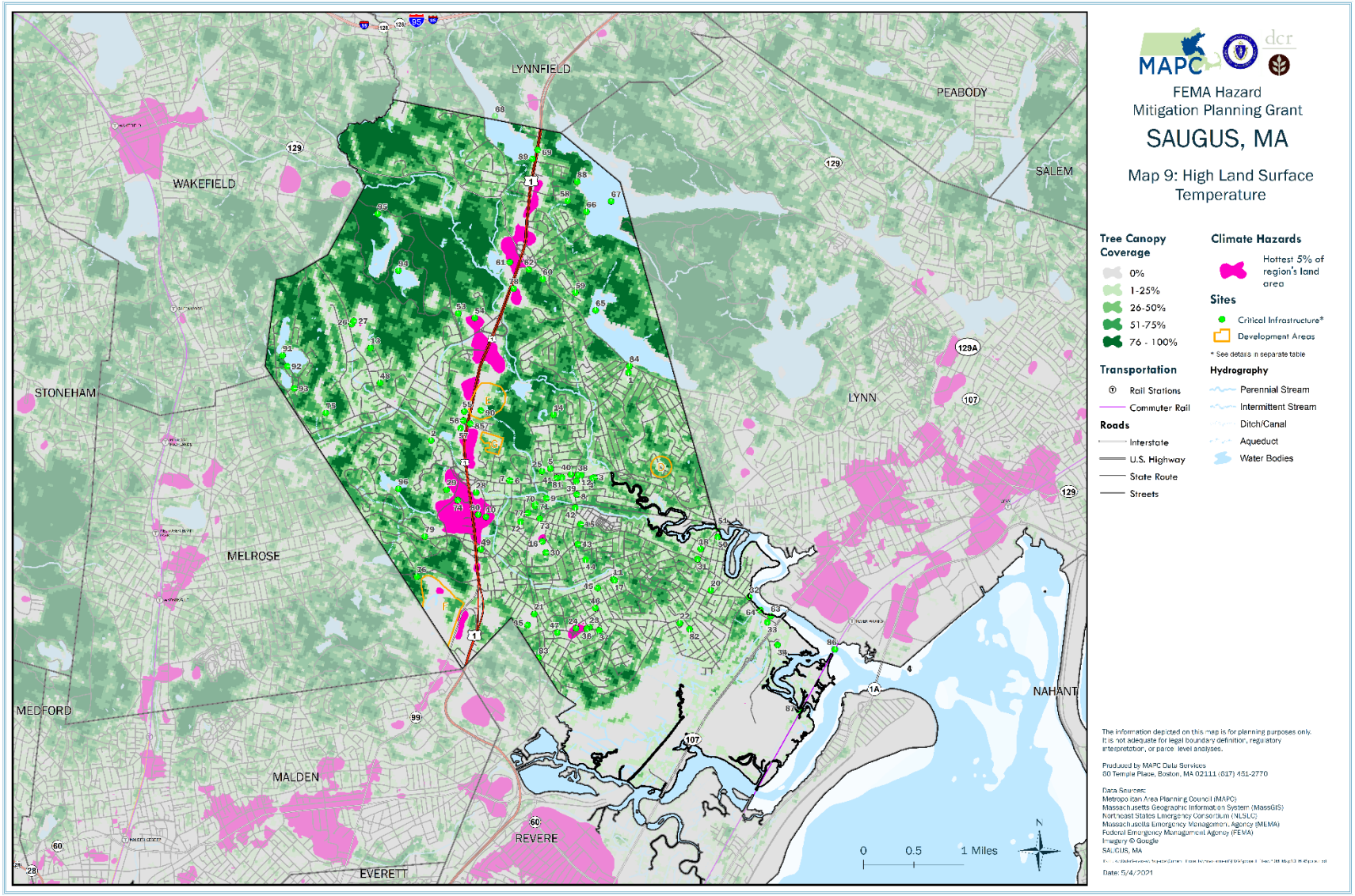
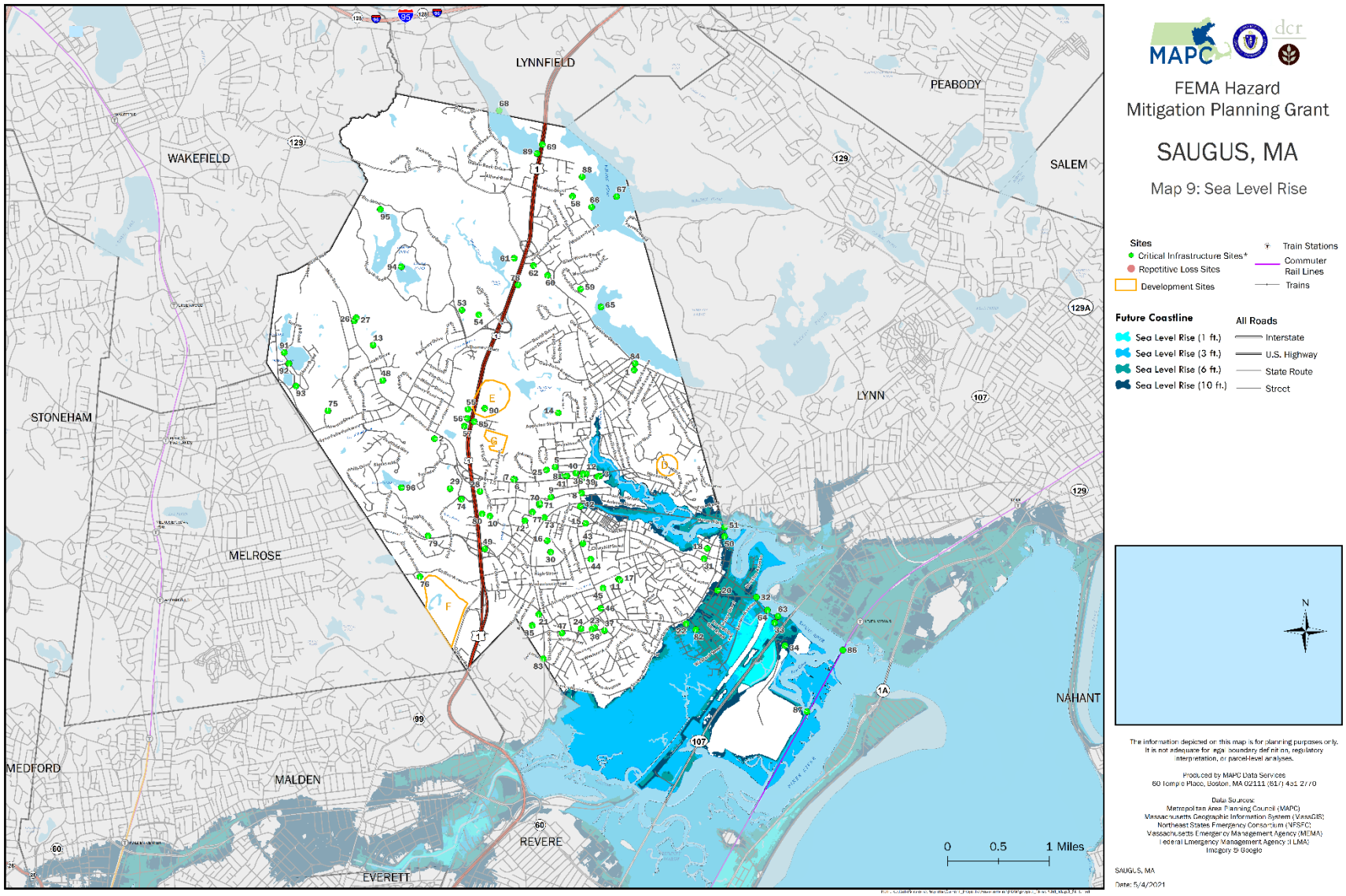
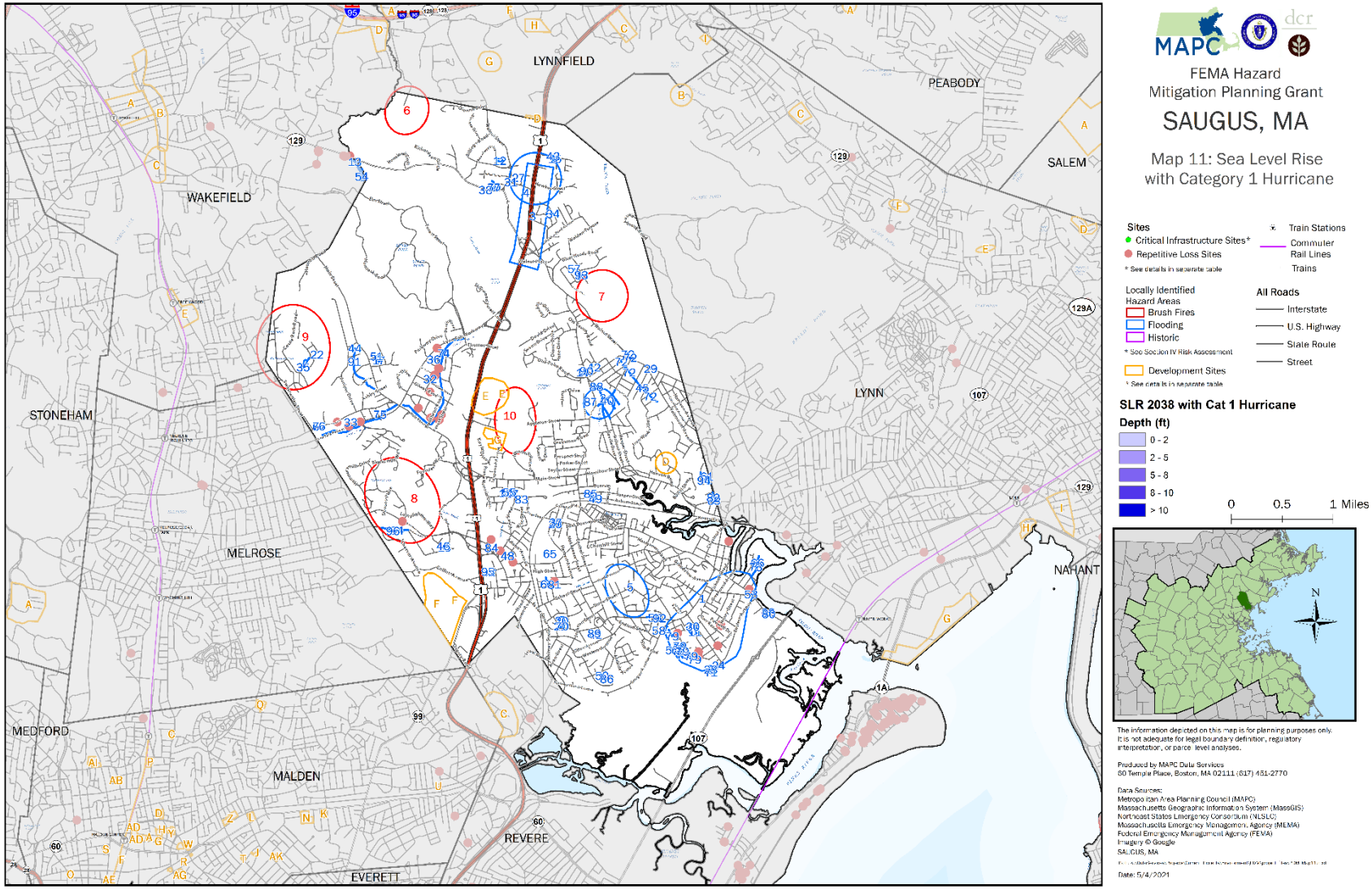
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
Imagery © DigitalGlobe, 2015
SAUGUS, MA
Date: 5/3/2021


LYNNFIELD
PEABODY
WAKEFIELD
SALEM
STONEHAM
LYNN
MELROSE
MEDFORD
MALDEN
REVERE
EVERETT
NAHANT
0 0.5 1 Miles
N
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
SAUGUS, MA
Map 9: High Land Surface Temperature
Tree Canopy Coverage
0%
1-25%
26-50%
51-75%
76 - 100%
Climate Hazards
Hottest 5% of region's land area
Sites
Critical Infrastructure*
Development Areas
* See details in separate table
Transportation
Rail Stations
Commuter Rail
Roads
Interstate
U.S. Highway
State Route
Streets
Hydrography
Perennial Stream
Intermittent Stream
Ditch/Canal
Aqueduct
Water Bodies
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analyses.
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
Imagery © Google
SAUGUS, MA
Date: 5/4/2021


LYNNFIELD
PEABODY
WAKEFIELD
SALEM
STONEHAM
LYNN
MELROSE
NAHANT
MEDFORD
MALDEN
REVERE
EVERETT
0 0.5 1 Miles
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
SAUGUS, MA
Map 9: Sea Level Rise
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
Development Sites
Train Stations
Commuter Rail Lines
Trains
Future Coastline
Sea Level Rise (1 ft.)
Sea Level Rise (3 ft.)
Sea Level Rise (6 ft.)
Sea Level Rise (10 ft.)
All Roads
Interstate
U.S. Highway
State Route
Street
N
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
Imagery © Google
SAUGUS, MA
Date: 5/4/2021


LYNNFIELD
PEABODY
WAKEFIELD
SALEM
LYNN
STONEHAM
MELROSE
NAHANT
MEDFORD
MALDEN
REVERE
EVERETT
MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
SAUGUS, MA
Map 11: Sea Level Rise
with Category 1 Hurricane
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Train Stations
Commuter Rail Lines
Trains
Locally Identified Hazard Areas
Brush Fires
Flooding
Historic
* See Section IV Risk Assessment
Development Sites
* See data is in separate table
All Roads
Interstate
U.S. Highway
State Route
Street
SLR 2038 with Cat 1 Hurricane
Depth (ft)
0 - 2
2 - 5
5 - 8
8 - 10
> 10
0
0.5
1 Miles
N
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60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
Imagery © Google
SAUGUS, MA
Date: 5/4/2021

APPENDIX B: TEAM MEETING AGENDAS

Municipal Vulnerability Preparedness (MVP) and Hazard Mitigation Planning (HMP) Project

Saugus MVP/HMP Core Team

First Meeting

TUESDAY, OCTOBER 9, 2019, 9:30 AM
SAUGUS TOWN HALL, AUDITORIUM
298 CENTRAL STREET

AGENDA

Project Overview

1. Welcome and Introductions
2. Overview of Municipal Vulnerability Preparedness (MVP) Program and Workshop Methodology (see handout)
3. Overview of Hazard Mitigation Plan to be updated
4. Scope and schedule of project (see handout)

Preparing for the MVP Workshop

5. The role of this MVP Core Team and MAPC
6. Pre-View: Examples of Workshop Materials
7. Date and Location of MVP Workshop and Core Team Meetings
8. Discussion of Workshop Invitees (see handout)
9. Other Business / Next steps

Saugus Municipal Vulnerability Preparedness (MVP) and Hazard Mitigation Planning (HMP) Project

Saugus MVP/HMP Core Team

AGENDA
Saugus Local Team Meeting #2

Tuesday, December 17, 2019
9:30 to 11:00 AM

Saugus Town Hall, Auditorium
298 Central Street

---

1. Review Summary of the Hazard Mitigation Process

2. Update Critical Facilities Inventory and Mapping

3. Update Local Hazard Areas

   a) Flood Hazard Areas
   b) Fire Hazard Areas (brushfires/wildfires)
   c) Other hazards (e.g. Dams, Extreme Heat, Winter Storms, etc)

4. Update New and Potential Development Sites

5. Prepare for MVP Workshop (Nov. 20, 2019)

   - Identify local stakeholders to invite
   - Invitation Letter, town outreach, RSVP's
   - Review Workshop agenda

Saugus Municipal Vulnerability Preparedness (MVP) and Hazard Mitigation Planning (HMP) Project

Saugus MVP/HMP Core Team

AGENDA

Saugus Local Team Meeting #3

Thursday, March 12, 2020

9:30 to 11:00 AM

Saugus Town Hall, Auditorium

298 Central Street

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1. Debrief MVP Workshop
    a) Briefly summarize workshop findings
2. Listening Session
    a) Date and Logistics
3. HMP
    b) Review and update Pre-existing Mitigation from the 2014 plan
    c) Update Recommended Mitigation from the 2014 plan
    d) Review and update Hazard Mitigation Goals

Saugus Municipal Vulnerability Preparedness (MVP) and Hazard Mitigation Planning (HMP) Project

Saugus MVP/HMP Core Team

AGENDA

Saugus Local Team Meeting #4

Monday, February 22, 2021

9:00 AM

Remote Meeting via Zoom

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1. Review and Finalize Mitigation Recommendations

❖ Review the attached summary of mitigation recommendations:

- Confirm the new mitigation measures (in red text)
- Confirm and/or update data in columns to right side of table
- Consider additional mitigation from the MVP workshop (page 4)
- Add other mitigation measure agreed to by the team, if any

2. Prepare for the Public Listening Session Meeting – March 18, 2021

3. Next Steps / Adjourn

APPENDIX C: PUBLIC MEETINGS

Saugus Public Meeting on the Hazard Mitigation Plan and Municipal Vulnerability Preparedness

Natural hazards and climate change can have serious impacts on Saugus residents and businesses



The Town of Saugus is preparing a FEMA *Hazard Mitigation Plan* as well as a *Municipal Vulnerability Preparedness* (MVP) project to reduce the town's vulnerability to natural hazards such as flooding, hurricanes, and blizzards, and increase resilience to the impacts of climate change. Please join the Town for a public presentation about the Hazard Mitigation Plan and MVP project at a meeting of the Planning Board:

Thursday, March 18, 2021, 7:00 PM

Join Zoom Meeting

https://us02web.zoom.us/j/83788984308?pwd=MkdOL095NDlLeGwwbzY3ZW5sbFplUT09

Meeting ID: 837 8898 4308

Passcode: 048280

Phone# 1-929-205-6099

For more information, contact Alexander Mello at amello@saugus-ma.gov

MAPC

Saugus meeting scheduled on hazard mitigation plan and municipal vulnerability preparedness

Wicked Local

Town Manager Scott Crabtree issued the following press release

Town Manager Scott C. Crabtree announced the Town of Saugus is preparing a FEMA hazard mitigation plan as well as a Municipal Vulnerability Preparedness (MVP) project to reduce the town's vulnerability to natural hazards such as flooding, hurricanes, and blizzards, and increase resilience to the impacts of climate change for the residents of Saugus.

Please join the town and the Planning Board for a public presentation about the Hazard Mitigation Plan and MVP project.

The Planning Board meeting is set for Thursday, March 18, 2021, at 7 p.m. on Zoom. Join the Zoom meeting at
https://us02web.zoom.us/j/83788984308?pwd=MkdOL095NDlLeGwwbzY3ZW5sbFplUT09

Meeting ID: 837 8898 4308

Passcode: 048280

Phone# 1-929-205-6099

For more information, contact Senior Planner Alexander Mello at 781-231-4045 or amello@saugus-ma.gov.

WICKEDLOCAL.com

Saugus meeting scheduled on hazard mitigation plan and municipal vulnerability preparedness

Wicked Local
Saugus Advertiser
March 11, 2021

Town Manager Scott Crabtree issued the following press release

Town Manager Scott C. Crabtree announced the Town of Saugus is preparing a FEMA hazard mitigation plan as well as a Municipal Vulnerability Preparedness (MVP) project to reduce the town's vulnerability to natural hazards such as flooding, hurricanes, and blizzards, and increase resilience to the impacts of climate change for the residents of Saugus.

Please join the town and the Planning Board for a public presentation about the Hazard Mitigation Plan and MVP project.

The Planning Board meeting is set for Thursday, March 18, 2021, at 7 p.m. on Zoom. Join the Zoom meeting at
https://us02web.zoom.us/j/83788984308?pwd=MkdOL095NDlLeGwwbzY3ZW5sbFplUT09

Meeting ID: 837 8898 4308

Passcode: 048280

Phone# 1-929-205-6099

For more information, contact Senior Planner Alexander Mello at 781-231-4045 or amello@saugus-ma.gov.

MEETING POSTING

TOWN OF SAUGUS

Pursuant to MGL Chapter 30A, § 18-25
All meeting notices and agenda must be filed and time stamped with the Town Clerk's Office and posted at least 48 hours prior to the meeting (excluding Saturdays, Sundays and Holidays)

RECEIVED
2021 MAR 11 P 3:05
TOWN CLERK'S OFFICE
TOWN OF SAUGUS, MASS.

Committee/Board/s	Planning Board
Day, Date, and Time	Thursday, March 18, 2021 at 7:00pm
Location / Address	Virtual Meeting via Zoom (See Attached Zoom Information)
Signature of Chair or Authorized Person	Nancy Stead
WARNING:	**IF THERE IS NO QUORUM OF MEMBERS PRESENT, OR IF MEETING POSTING IS NOT IN COMPLIANCE WITH THE OML STATUTE, NO MEETING MAY BE HELD!**

AGENDA

Please list below the topics the chair reasonably anticipates will be discussed at the meeting

NOTE: Pursuant to Governor Baker's March 12, 2020 Order Suspending Certain Provisions of the Open Meeting Law, and his March 15, 2020 Order limiting the number of people who may gather in one place, the Planning Board hearing will be held remotely via Zoom. The public may not physically attend the meeting, but every effort will be made to allow the public to view/listen to the meeting in real time.

1. Approval of Minutes: March 4, 2021
2. Chairman's Update: Peter A. Rossetti, Jr.
3. Consulting Engineer's Report: James Sotiros
4. Subdivision Submissions/Site Plan Submission
5. Preliminary Subdivision Plan – Treher Street (Attorney Richard Magnan)
6. Discussion on the Hazard Mitigation Plan (HMP) update and Municipal Vulnerability Preparedness (MVP) Project.

(Below see the Zoom Meeting information)

1

Town of Saugus, Massachusetts

PLANNING BOARD

Town Hall*298 Central Street*Saugus, MA 01906* (781) 231-4196*Fax (781) 231-4109
e-mail: nstead@saugus-ma.gov

PETER A. ROSSETTI, JR., *Chairman*
DOROTHY POPPE, *Vice Chairman*
R. JAMES SOTIROS, P.E., P.L.S. *Consulting Engineer*
Nancy Stead, *Clerk*

PHILIP SILVANI
DENNIS MOSCHELLA
JOHN O'BRIEN

Saugus Planning Board Minutes for March 18, 2021 Zoom Meeting

The Saugus Planning Board held a scheduled Zoom meeting at 7:00 in the evening of March 18, 2021. The public was invited to attend via Zoom connection ID. 83788984308, Passcode 048280. Members in attendance were: Chairman, Peter A. Rossetti, Jr., Vice Chairman, Dorothy Poppe, Dennis Moschella, John O'Brien and Consulting Engineer, James Sotiros. Member, Philip Silvani was not in attendance.

1. Approval of Minutes: March 4, 2021

   Ms. Poppe motioned to approve the minutes and was seconded by Mr. Moschella and passed 4-0.

2. Chairman's Update: Peter A. Rossetti, Jr.
   None

3. Consulting Engineer's Report: James Sotiros
   None

4. Subdivision Submissions/Site Plan Submissions:
   None

5. Preliminary Subdivision Plan – Treher Street (Attorney Richard Magnan)

   Attorney Magnan representing Caddy Farm, LLC, along with Engineer, Domenic Renaldi and Attorney Greg Samson, explained that there will be an access road to Route 1 for National Grid to exit to service the transmission lines and the layout of a standard cul-de-sac, they explained the paper street and grading of land. The chairman read the comments from the Fire Department (see attached) and the Department of Public Works (see attached), the report from the Planning Department (see attached) and comments from Town Counsel (see attached).

Town of Saugus, Massachusetts

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Nancy Stead, *Clerk*
PHILIP SILVANI
DENNIS MOSCHELLA
JOHN O'BRIEN

Ms. Poppe motioned to deny approval of the Preliminary Subdivision application due to being incomplete according to the guidelines as stated (see attachments) and was seconded by Mr. O'Brien and passed 4-0.

6. Discussion on the Hazard Mitigation Plan (HMP) update and Municipal Vulnerability Preparedness (MVP) Project.

Alex Mello, Town Planner, explained that this was the first meeting for a Hazard Mitigation Plan MAPC Workshop. Martin Pillsbury, MAPC, explained the Vulnerability Preparedness Project – FEMA Hazard Mitigation Plan to increase the communities resilience infrastructure. (see attached)
Saugus Climate Hazard – Climate Trends
Saugus Natural Resources
Saugus Social Vulnerability
CRB Workshop Actions
FEMA – Saugus Hazard Mitigation Plan all natural hazards
Long term plans for long term strategies
For Town input go to the Town Planning web page and link the download MVP Report.

Ms. Poppe motioned to adjourn and was seconded by Mr. Moschella and passed 4-0.

Adjourn time: 8:27PM

Respectfully submitted by,
Nancy Stead, Clerk

Saugus Public Meeting on the Natural Hazards Mitigation Plan

Natural hazards and climate change can have serious impacts on Saugus residents and businesses



The Town of Saugus has prepared a draft FEMA *Hazard Mitigation Plan* to reduce the town's vulnerability to natural hazards such as flooding, hurricanes, and blizzards, and increase our resilience to the impacts of climate change. Please join the Town for a public presentation of the draft Hazard Mitigation Plan at a meeting of the Planning Board via Zoom:

Thursday, June 3, 2021, 7:00 PM

Join Zoom Meeting
[ADD_ZOOM LINK]

Meeting ID: [ADD_ZOOM_Meeting ID]
Passcode: [ADD_ZOOM Passcode]
Phone# [ADD_ZOOM Phone#]

For more information, contact Alexander Mello at amello@saugus-ma.gov

CALENDAR LISTING / MEDIA ADVISORY

SAUGUS DRAFT HAZARD MITIGATION PLAN TO BE PRESENTED AT JUNE 3 PUBLIC MEETING

What: On Thursday, June 3, 2021at 7:00 PM the Saugus Planning Board will host an online public meeting via Zoom to present the town's Draft FEMA Hazard Mitigation Plan.

The Town of Saugus has prepared a FEMA Hazard Mitigation Plan to reduce the town's vulnerability to natural hazards such as flooding, hurricanes, and blizzards, and increase its resilience to the impacts of climate change. Please join the meeting for a public presentation about Hazard Mitigation Plan and MVP project at a virtual meeting of the Planning Board via Zoom. The presentation will be made by the Metropolitan Area Planning Council, which is assisting the Town in preparing the plan.

Who: Saugus residents, business owners, civic organizations and institutions are invited to participate in the public meeting and provide their questions and comments as part of this on-going effort to plan for a resilient future for the Town of Saugus.

When: Thursday, June 3, 2021, 7:00 PM

Where: Online meeting via Zoom

MEETING POSTING

TOWN OF SAUGUS
Pursuant to MGL Chapter 30A, § 18-25
All meeting notices and agenda must be filed and time stamped with the Town Clerk's Office and posted at least 48 hours prior to the meeting (excluding Saturdays, Sundays and Holidays)

RECEIVED
2021 MAY 28 A 11:39
TOWN CLERK'S OFFICE
TOWN OF SAUGUS, MASS.

Committee/Board/s	Planning Board
Day, Date, and Time	Thursday, June 3, 2021 at 7:00PM
Location / Address	Virtual Meeting via Zoom (See Attached Zoom Information)
Signature of Chair or Authorized Person	Nancy Stead

WARNING: **IF THERE IS NO QUORUM OF MEMBERS PRESENT, OR IF MEETING POSTING IS NOT IN COMPLIANCE WITH THE OML STATUTE, NO MEETING MAY BE HELD!**

AGENDA

Please list below the topics the chair reasonably anticipates will be discussed at the meeting

NOTE: Pursuant to Governor Baker's March 12, 2020 Order Suspending Certain Provisions of the Open Meeting Law, and his March 15, 2020 Order limiting the number of people who may gather in one place, the Planning Board hearing will be held remotely via Zoom. The public may not physically attend the meeting, but every effort will be made to allow the public to view/listen to the meeting in real time.

1. Approval of Minutes: May 20, 2021
2. Chairman's Update:
3. Consulting Engineer's Report:
4. Subdivision Submissions/Site Plan Submissions:
5. Public Hearing: 7:15PM Definitive Subdivision Plan Homeland Avenue (Hancock Associates)
6. ANR: Adelaide Avenue (Attorney Marc Chapdelaine)
7. Review and Public Comment of Draft Hazzard Mitigation Plan (HMP)

(see below for Zoom Meeting information)

1

Residents Invited to Give Input to the Saugus Draft Hazard Mitigation Plan to be Presented at June 3 Virtual Planning Board Meeting - May 28, 2021

POSTED ON: MAY 28, 2021 - 12:18PM

Residents Invited to Give Input to the Saugus Draft Hazard Mitigation Plan to be Presented at June 3 Virtual Planning Board Meeting

(Saugus, MA) May 28, 2021 – Town Manager Scott C. Crabtree and the Saugus Planning Board invite residents, business owners, and local organizations to attend the virtual Planning Board meeting on Thursday, June 3, 2021 at 7:00 p.m. At this time, the Town will present the Town's Draft Hazard Mitigation Plan, in accordance with the United Stated Federal Emergency Management Agency (FEMA). The draft plan can be viewed on the Planning and Economic Development webpage at: https://www.saugus-ma.gov/planning-and-economic-development.

The Town of Saugus has prepared a draft FEMA Hazard Mitigation Plan to reduce the Town's vulnerability to natural hazards such as flooding, hurricanes, and blizzards, and increase its resilience to the impacts of climate change. Please join the meeting for a public presentation about the Hazard Mitigation Plan project at a virtual meeting of the Planning Board via Zoom. The presentation will be made by the Metropolitan Area Planning Council (MAPC), which is assisting the Town in preparing the plan.

Saugus residents, business owners, civic organizations and institutions are invited to participate in the public meeting and provide their questions and comments as part of this on-going effort to plan for a resilient future for the Town of Saugus. The Town also welcomes written comments, which should be directed to Senior Planner, Alexander Mello, at amello@saugus-ma.gov. Please contact Alexander with any questions via email or at 781-231-4045.

"We hope residents, business owners, and local organizations will attend this meeting to learn more about the Town's draft Hazard Mitigation Plan and MVP project, and continue to ask questions and share their input," said Town Manager Crabtree. "

Zoom meeting information:

Saugus Planning Board Meeting

Thursday, June 3, 2021

https://us02web.zoom.us/j/81496409452?pwd=N1A2MzZhWEljRnRVcWdJZEZsMDVqZz09

Meeting ID: 814 9640 9452

Passcode: 400571

One tap mobile

+19292056099,,81496409452# US (New York)

+13017158592,,81496409452# US (Washington DC)

From: Pillsbury, Martin
Sent: Friday, May 28, 2021 1:53 PM
To: jrowe@lynnma.gov; dginivan@lynnma.gov; dhammerbeck@town.lynnfield.ma.us; lemerson@town.lynnfield.ma.us; glucey@cityofmalden.org; kfoote@cityofmelrose.org; amelnik@revere.org; bsheeran@wakefield.ma.us
Subject: Notice of Public Meeting on Saugus Hazard Mitigation Plan, June 3, 2020 at 7:00 PM

TO: City and Town Clerks in Lynn, Lynnfield, Malden, Melrose, Revere, and Wakefield, MA

The Town of Saugus has prepared its draft FEMA *Hazard Mitigation Plan 2021 Update* to reduce the town's vulnerability to natural hazards such as flooding, hurricanes, and winter storms.

As part of the planning process, all neighboring communities to Saugus are being notified of a public meeting on the draft plan to be hosted by the Saugus Planning Board as follows:

Thursday, June 3, 2021 at 7:00 PM
Saugus Planning Board
Remote meeting via zoom (link attached)

A flyer announcing the meeting details and Zoom link is attached. If you have any questions about this please feel free to contact me.

Best regards,

Martin Pillsbury
Director of Environmental Planning
Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111
617-939-3896
mpillsbury@mapc.org

Town of Saugus, Massachusetts

PLANNING BOARD

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Nancy Stead, *Clerk*

PHILIP SILVANI
DENNIS MOSCHELLA
JOHN O'BRIEN

Saugus Planning Board Minutes for June 3, 2021 Zoom Meeting

The Saugus Planning Board held a scheduled Zoom meeting at 7:00 in the evening of June 3, 2021. The public was invited to attend via Zoom connection I.D. 814 9640 9452, Passcode 400571. Members in attendance were; Dorothy Poppe, Acting Chairman, Philip Silvani and John O'Brien.
Vice Chairman, Dorothy Poppe is attending the meeting as Acting Chairman.

1. Approval of Minutes: May 20, 2021

Mr. O'Brien motioned to accept the minutes received and was seconded by Mr. Silvani and passed 3-0.

Roll call vote: Mr. O'Brien – Yes
Mr. Silvani – Yes
Ms. Poppe – Yes

2. Chairman's Update: None

3. Consulting Engineer's Report: None

4. Subdivision Submissions/Site Plan Submissions:

An application was submitted for 1639 Broadway - Definitive Subdivision Plan Permit

Mr. Silvani motioned to take agenda item #6 out of order and was seconded by Mr. O'Brien and passed 3-0.

5. ANR: Adelaide Avenue (Attorney Marc Chapdelaine)

Attorney Chapdelaine shared a screen to show the amended version of the plan.

Town of Saugus, Massachusetts

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DENNIS MOSCHELLA
JOHN O'BRIEN

d

The amended plan addressed the frontage qualification, Lot C is not buildable, Lot B has 100ft. of frontage on Adelaide Ave. and the road is to be improved.
Mr. Silvani asked for the ledge in the road to be removed by the developer and not the town and to specify on the my-lar that Lot C is not to be buildable.

Mr. Silvani motioned to table the 7:15PM meeting and was seconded by Mr. O'Brien and passed 3-0.

Chris Reilly, Planning Department Director, agreed on the access of the way and recommends indorsement with changes.

Mr. O'Brien motioned to approve and to correct the mylar for Lot C not to be buildable and was seconded by Mr. Silvani and passed 3-0.

Roll call vote: Mr. O'Brien – Yes
Mr. Silvani – Yes
Ms. Poppe – Yes

5. Public Hearing: - 7:15PM – Definitive Subdivision Plan Permit, Homeland Avenue (Hancock Associates)

Deb Cobert, Engineer, Hancock Associates, Attorney Nelson Chang, represented the applicant. The engineer shared the screen showing the extension of Homeland Avenue and explained an upgrade to the existing roadway for the four lot subdivision with four houses and also the storm water analysis. Seven waivers are requested for the excavation impact report, Sections 4.A.3 minimum width, 4.A.5.b 500ft. access to property, 4.A.c, dead end street, 4.F.4.1. infiltration basin to be relocated for maintenance, 4.F.7. no street lighting,4.8. sidewalks on one side of the street. The Town Engineer's comments have been addressed on installing water and sewer. Chris Reilly, stated that the Fire Department did not approve the Y turnaround and would like a cul-de-sac.

Town of Saugus, Massachusetts

PLANNING BOARD

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Nancy Stead, *Clerk*
PHILIP SILVANI
DENNIS MOSCHELLA
JOHN O'BRIEN

Saugus Planning Board Minutes for June 3, 2021 Zoom Meeting – Continued

(See attached Staff Report)

Public Comments:
Acting Chairman read email received from Cheryl Reilly Trembly in opposition.
Lisa Reilly, 4 Homeland Circle, in favor of the development.
Peter Ogren, Hayes Engineering, Hayes Engineering Trust, 603 Salem Street, concern with sewer easement at the rear of the 4 lots.
Chris Sparages, 57 Elmwood Ave. Chester Tilly Trust, concern with sewer extension.

Mr. O'Brien motioned to accept the continuance until the next meeting and was seconded by Mr. Silvani and passed 3-0.

Roll call vote: Mr. O'Brien – Yes
Mr. Silvani – Yes
Ms. Poppe – Yes

7. Review and Public Comment of Draft Hazzard Mitigation Plan (HMP)
(Planning and Development Department)

Martin Pillsbury, MAPC, presented the 2021 plan update and explained that this will meet FEMAS requirement to make the Town eligible for FEMA Mitigation Project Grants.
A Plan Mitigating all Natural Hazards – Defining Hazard Mitigation – Breaking the Cycle of Disaster and Rebuilding – How the Plan is Developed – Hazard Identification & Mapping – Critical Facilities Identifying – Hazard Areas – Rumney Marsh – Multiple Natural Hazards – Vulnerability Analysis – Estimated Damages – Mitigation Strategies – Updated Mitigation Strategies – Final Steps – Hazard Mitigation Plan.
The Draft Plan is available online.

Town of Saugus, Massachusetts

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JOHN O'BRIEN

Saugus Planning Board Minutes for June 3, 2021 Zoom Meeting – Continued

Public Comments:
Debra Pannetta, 1 Bellevue St. concern with the flood zone area and impact on the Wheelabrator ash fill.

Joe Vicchione, Town Meeting Member Precinct 2, question on priorities to the studies and funding.

Ed Reiner, USCPC Boston Mass. Concern with increase of tides in east Saugus and restoration of the drainage from the past projects.

Scott Crabtree, Saugus Town Manager, expressed thanks for presenting the study to the Town to identify many projects needed in the Town.

Mr. O'Brien motioned to adjourn and was seconded by Mr. Silvani and passed 3-0.

Adjourn time: 8:37PM

Respectfully submitted by,
Nancy Stead, Clerk

APPENDIX D: PUBLIC COMMENTS RECEIVED

The Town of Saugus received the following comments after the June 3 Public Meeting:

1. A resident requested the Town participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS) program.

- The Town has initiated the process of participating in the NFIP CRS program. FEMA did not conduct community visits during the COVID-19 pandemic; therefore, FEMA needs to visit a long list of communities across the country. The Town was informed it could take at least a year (or possibly two) for FEMA to conduct a visit. In the meantime, the Town is working to implement prerequisite activities.

2. The Town is involved in two Regional efforts.

- The communities of Saugus, Revere, Lynn, Malden, and Everett are collaborating to request the Army Corp of Engineers (ACOE) restart a 1987 flood protection study (it was titled Saugus River Tide Gate Project) that was brought to the construction threshold but lost support. In summary, the ACOE Saugus River Tide Gate Project identified a variety of strategies to protect the five communities from repetitive regional flooding. Strategies included a flood barrier in Revere at the mouth of the Saugus River adjacent to the General Edwards Bridge, complimented by a series of dikes and sluice gates, rock revetments, marsh restoration, living shorelines, land acquisitions, and beach nourishment throughout the five communities. The five communities believe this study should be revisited as more frequent flooding and higher tide levels or occurring.

- The five communities were also awarded a Metropolitan Area Planning Council (MAPC) Accelerating Climate Resiliency Grant to support a regional working group.
    - The five communities will establish a regional resiliency working group with the support of technical assistance in the form of a planning consultant. The five communities came together in August 2020 in support of a feasibility study application submitted to the ACOE to explore regional flood protection. Throughout that process the communities recognized the potential benefits of strength in numbers while signing on together. This proposal, if approved, will stabilize a network of voices with a centralized focus for regional flood protection. The scope of the project would involve a period of data collection from each community regarding resiliency studies over the past two decades, identification of all resiliency stakeholders in each community within the radius of the project area, identify all critical infrastructure, develop a strategy to engage municipalities, state agencies, foster political support, and create a cohesive team that can collectively advocate for a regional solution. The top priority and goal of the work group- mitigate the dangerous conditions presented by sea-level rise to the vulnerable populations and restore the marsh to improve wildlife habitat the in the watershed.

APPENDIX E: PLAN ADOPTION

<TOWN LETTERHEAD>

CERTIFICATE OF ADOPTION

TOWN MANAGER

TOWN OF SAUGUS, MASSACHUSETTS

A RESOLUTION ADOPTING THE
TOWN OF SAUGUS HAZARD MITIGATION PLAN 2021 UPDATE

WHEREAS the Town of Saugus established a Committee to prepare the *Town of Saugus Hazard Mitigation Plan 2021 Update*; and

WHEREAS the *Town of Saugus Hazard Mitigation Plan 2021 Update* contains several potential future projects to mitigate impacts from natural hazards in the Town of Saugus, and

WHEREAS, duly noticed public meetings were held by the Saugus Planning Board on March 18, 2021 and June 3, 2021 and

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

NOW, THEREFORE the Town of Saugus through the Town Manager adopts the *Town of Saugus Hazard Mitigation Plan 2021 Update*, in accordance with M.G.L. 40 Sec. 4 and the Charter and Bylaws of the Town of Saugus.

ADOPTED AND SIGNED this Date. _____

Name: Scott C. Crabtree, Esq.

Title: Town Manager

Signature_____

APPENDIX F: SUMMARY OF MVP

HIGHEST PRIORITY ACTIONS IDENTIFIED BY THE SAUGUS MVP WORKSHOP,

See the full set of resilience and mitigation actions, along with strengths and vulnerabilities identified by Saugus MVP Workshop in the MVP Final Report that accompanies this plan in a separate volume.

1. **STORMWATER MANAGEMENT:** Stormwater management was identified as a top priority. Suggestions included providing adequate funding for recommended stormwater repairs, upgrades, and retrofits identified in the town's upcoming Stormwater Master Plan.
2. **BUILD A NEW FIRE STATION:** Several groups proposed that a new public safety building/fire station be built on the town's westside.
3. **DEVELOP COMMUNICATION STRATEGIES:** Several groups proposed targeted outreach to specific populations including seniors, low income residents, limited English language speakers, people with disabilities, people with cell phones, and people who work in Saugus but live elsewhere. Suggestions include collaborating with religious, community, and non-governmental organization (NGOs) to develop a plan to ensure effective and comprehensive communication. The plan should identify and address potential barriers to communication including cultural and religious differences.
4. **CREATE A DISASTER RESPONSE PLAN:** The plan should include evacuation strategies and target outreach to residents and vulnerable populations who live along streams and wetland areas known to flood.
5. **ENSURE ROBUST INFRASTRUCTURE:** Consider cyber security, redundancy, and generator backup.
6. **MARSH AND WETLAND PROTECTION:** Provide public education on the value and importance of wetlands and build support among local and state agencies to implement the Rumney Marsh Restoration Plan
7. **TREE CANOPY AND OPEN SPACE:** Care and maintenance of the town's existing tree canopy and planting of new trees were important resilience actions identified at the workshop in addition to the acquisition of open space parcels.
8. **PARTICIPATE IN CRS:** Participate in Community Rating System (CRS) to inform and educate residents and businesses and reduce flood insurance rates. Update zoning and floodplain regulations.
9. **CLEAR BROOKS AND STREAMS OF OBSTRUCTIONS:** Town brooks and streams need to be cleared of debris to prevent flooding. Continue to monitor and review separation of sewer waste and stormwater. Continue and expand annual efforts to prevent infrastructure damage and erosion.