TOWN OF CHESTER, MA
HAZARD MITIGATION PLAN UPDATE
AUGUST 2024

Town of Chester
15 Middlefield Road
Chester, MA 01011

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https://townofchester.net

Prepared by:

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Acknowledgements

The Town of Chester would like to thank the following people for supporting the development of this plan. This group was considered the Hazard Mitigation Planning Committee (HMPC) throughout the planning process.

- Nate Bolduc, Fire Chief, Town of Chester
- Bob Daley, Water Department, Town of Chester
- Charles (Chip) Dazelle, Highway Superintendent/Emergency Management Director, Town of Chester
- Jennifer Dubiel, Chief of Police, Town of Chester
- Brian Forgue, Selectman, Town of Chester
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- Muriel Hall, Planning Board, Town of Chester
- Diane Hall, Manager, Chester Municipal Electric Light Department
- Donald F. Humason Jr., Town Administrator, Town of Chester
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- Liz Massa, Board of Health, Town of Chester
- Ed Quinn, Facilities Director, Gateway Regional School District, Jade Rice, Chief Financial Officer, Hilltown Community Ambulance Association, Richard (Andy) Sutton, Selectman, Town of Chester
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- Richard (Andy) Sutton, Selectman, Town of Chester
- Lora Wade, Conservation Commission, Town of Chester

F1. For single-jurisdictional plans, has the governing body of the jurisdiction formally adopted the plan to be eligible for certain FEMA assistance? (Requirement §201.6(c)(5))

Local Adoption Resolution

CHESTER BOARD OF SELECTMEN
and ZONING BOARD OF APPEALS
15 MIDDLEFIELD ROAD
CHESTER, MASSACHUSETTS 01011
(413) 354-7760 TownofChester.net

A RESOLUTION ADOPTING THE
TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

WHEREAS the Town of Chester recognizes the threat that natural hazards pose to people and property within the Town of Chester; and

WHEREAS the Town of Chester has prepared a multi-hazard mitigation plan, hereby known as TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS the TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Town of Chester from the impacts of future hazards and disasters; and

WHEREAS adoption by the Town of Chester Selectboard demonstrates its commitment to hazard mitigation and achieving the goals outlined in the TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE.

NOW THEREFORE, BE IT RESOLVED BY THE TOWN OF CHESTER, MA, THAT:

Section 1. In accordance with M.G.L. c. 40, the Town of Chester Selectboard adopts the TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE.

1

While content related to the Town of Chester may require revisions to meet the plan approval requirements, changes occurring after adoption will not require the Town of Chester to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

ADOPTED by a vote of ___3___ in favor and ___0___ against, and ___0___ abstaining,

this ___16th____ day of __December_____, ____2024____.

SELECT BOARD

By: ____________________ John Baldasaro, Chairman

By: ____________________ Richard (Andy) Sutton, Vice Chairman

By: ____________________ Craig Gauthier, Clerk

APPROVED AS TO FORM:

By: ____________________ Donald F. Humason, Jr., Town Administrator

December 16, 2024

2

Record of Changes

This Town of Chester, MA Hazard Mitigation Plan Update will be reviewed and approved on a biannual basis by the HMPC and following any major disasters. All updates and revisions to the plan will be tracked and recorded in the following table. This process will ensure the most recent version of the plan is disseminated and implemented by the Town.

Table 1. Summary of Changes.

Date of Change	Entered By	Summary of Changes

Chapter 1. Introduction

The Federal Emergency Management Agency (FEMA) defines hazard mitigation per the Code of Federal Regulations (CFR) 44 Section 201.2 as "any **sustained** action taken to reduce **or eliminate** the **long-term risk** to human life and property from hazards."

"Disaster Mitigation Act (DMA) 2000 (Public Law 106-390)[1] provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and Indian Tribal entities to closely coordinate mitigation planning and implementation efforts."[2]

The Town of Chester, Massachusetts created this plan as part of an ongoing effort to reduce the negative impacts and costs from damages associated with natural hazards, such as nor'easters, floods, and hurricanes. This plan meets the requirements of the Disaster Mitigation Act 2000. More importantly, the plan was created to reduce loss of life, land, and property due to natural hazards that affect the Town of Chester. It is difficult to predict when natural hazards will impact the planning area, but it is accurate to say that they will. By implementing the mitigation actions listed in this plan, the impact of natural hazards will be lessened.

Local Mitigation Plans must be updated at least once every five years to remain eligible for FEMA hazard mitigation project grants. A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years to continue to be eligible for mitigation project grants.

Purpose of the Plan

The purpose of the Hazard Mitigation Plan Update is to provide the Town of Chester with a comprehensive examination of all natural hazards affecting the area, as well as a framework for informed decision-making regarding the selection of cost-effective mitigation actions. When implemented, these mitigation actions will reduce the Town's risk and vulnerability to natural hazards.

This plan is a result of a collaborative effort between the Town of Chester and the surrounding communities of Huntington, Middlefield, Becket, Worthington and Blandford. Throughout the development of the plan, the Hazard Mitigation Planning Committee (HMPC) consulted the public and key stakeholders for input regarding identified goals, mitigation actions, risk assessment data, and mitigation implementation strategy. A sample of key stakeholders who participated, included the

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[1] Disaster Mitigation Act of 2000, Pub. L. 106-390, as amended

[2] Disaster Mitigation Act of 2000. https://www.congress.gov/106/plaws/publ390/PLAW-106publ390.pdf

Massachusetts Emergency Management Agency (MEMA), Hilltown Community Ambulance, Gateway Regional School District, and the Pioneer Valley Planning Commission (PVPC).

Guiding principles for plan development

The HMPC adhered to the following guiding principles in the plan's development.[3]

- Plan and invest for the future.
- Collaborate and engage early.
- Integrate community planning.

This plan update meets the requirements outlined 44 CFR § 201.6(d)(3). These requirements are included in the plan in the green call-out boxes, like the one below.

> A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

Yellow call-out boxes like the one to the right, are definitions taken from the Federal Emergency Management Agency Local Policy Guide, April 2023. These are included throughout the plan for reference and explanation.

The HMPC prioritized mitigating impacts of climate change, mitigating risk to vulnerable communities, and protecting the built environment both today and in the future.

> ***COMMUNITY RESILIENCE*** *is the ability of a community to prepare for anticipated hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. Activities such as disaster preparedness (which includes prevention, protection, mitigation, response and recovery) and reducing community stressors (the underlying social, economic and environmental conditions that can weaken a community) are key steps to resilience.*[1]

The HMPC identified the following list of hazards to profile, shown below in alphabetical order:

- Average/Extreme Temperatures
- Drought
- Earthquakes
- Flooding from Precipitation and Dam Overtopping
- Hurricanes and Tropical Storms
- Invasive Species

[3] Federal Emergency Management Agency. (April 19, 2022). Local Mitigation Planning Policy Guide, p.13.

- Landslides
- Other Severe Weather
- Severe Winter Storms
- Tornadoes
- Wildfires/Brushfires

Mitigation Strategy

C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

The hazard mitigation strategy is the culmination of work presented in the Planning Area Profile (Chapter 2), Risk Assessment (Chapter 4), and Capability Assessment (Chapter 5). It is also the result of multiple meetings and sustained public outreach. The HMPC developed the goals shown below. The goals from the previous Chester Hazard Mitigation Plan Update 2016 and the Town's Municipal Vulnerability Preparedness Plan 2021 were revised to develop this current list. Information about the goal development process is in Chapter 6: Mitigation Strategy. The goals are considered "broad policy-type statements"[4] that represent the long-term vision for mitigating risk to natural hazards in the Town of Chester.

[4] Federal Emergency Management Agency. (2013). *Local Mitigation Planning Handbook,* p. 6.

Save Lives and Property

- Reduce risk to people and property from natural hazards and climate change.

Infrastructure

- Mitigate risk to critical facilities and infrastructure from natural hazards and climate change.

Capacity

- Expand the Town's capacity to mitigate risk by adopting a culture of hazard mitigation through regulations, planning, and regional collaboration.

Natural Resources

- Implement actions that minimize risk from climate change and natural hazards to preserve or restore the functions of natural systems.

Education

- Educate all stakeholders about the value of hazard mitigation and how to implement it in their work, businesses, and homes.

Figure 1. Goal Statements.

Land Use and Development

Changes in Development

E1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

Chester has not seen major changes in development since the last plan update in 2016. This is primarily due to the general lack of new construction and population growth in the community. In fact, Chester has experienced a slow but steady population decrease over the last few decades, including an 8 percent decline between 2010 and 2020. This trend of steady population decline is generally expected to continue over the decades ahead, as projections from the UMass Donahue Institute estimate that Chester will decrease from 1,228 residents today to 757 in the year 2050. Per the HMPC, minor changes in development since 2016 have been limited to tree cutting, which has resulted in some lost tree canopy,

> ***CHANGES IN DEVELOPMENT** means recent development (for example, construction completed since the last plan was approved), potential development (for example, development planned or under consideration by the jurisdiction), or conditions that may affect the risks and vulnerabilities of the jurisdictions (for example, climate change, declining populations or projected increases in population, or foreclosures) or shifts in the needs of underserved communities or gaps in social equity. This can also include changes in local policies, standards, codes, regulations, land use regulations and other conditions.*

and the creation of more fire ponds on private properties in rural areas. However there have been no major changes such as new subdivisions or other major developments that have resulted in an increase or decrease in hazard vulnerabilities.

New development of residential, commercial, and industrial uses is fairly constrained in Chester due to its existing development patterns coupled with physical characteristics of land (e.g., steep slopes, heavy forestland) and the amount of land that is protected in some way. Many of the Town's other undeveloped areas are protected by its planning and regulatory framework which has a long history of conserving and protecting natural resources and environmentally sensitive areas. As further described in Chapter 5 (Capability Assessment), land use in Chester is regulated through the Town's zoning bylaw and other regulations, including subdivision and wetlands protection regulations. These regulations are all strictly enforced through the Town's special permit process which is considered an effective tool for preventing changes in development from increasing hazard vulnerability. The Town does not have a history of large development proposals which has made the implementation of its local bylaws and regulations a straightforward process.

Although there is no recent development or potential development in Chester that is believed to be increasing the risks and vulnerabilities of the community to hazards, it is anticipated that climate change and projected future conditions will increase the threats posed by multiple hazards. As further described in the Risk Assessment (Chapter 4) and the Town's MVP Summary of Findings Report, among the greatest concerns for Chester are increases in the frequency and severity of heavy rainfall events, potentially longer periods of dry/drought conditions during summers (affecting surface water/fire ponds in rural areas), rising average and maximum temperatures with more frequent heat wave events, and an increase in the frequency and magnitude of extreme weather which could come in the form of tropical storms, or other high intensity wind and rain events. Increasing risks associated with these hazards could result in more severe impacts to the community and especially those populations considered to be more vulnerable to their effects, including Chester's aging population and other segments of the community as described in Chapter 4.

In summary, there is no recent, planned, or proposed development in Chester that is believed to be increasing the risks and vulnerabilities of the community to hazards. Future development may still occur in certain areas of the community, but existing land use policies and regulations effectively discourage construction in hazard-prone areas. The greater concern for Chester is building its overall resilience to projected future climate conditions and the anticipated effects of those conditions on the natural hazards the community is already dealing with. As such, many of the Town's ongoing or proposed mitigation efforts are focused on existing versus new development, which should result in decreases in future hazard vulnerabilities. For example, this includes addressing the Town's aging infrastructure through roadway improvements and bridge/culvert upgrades, along with routine maintenance activities such as beaver control, tree pruning, and localized drainage improvements.

Progress in Mitigation Efforts

E2. Was the plan revised to reflect changes in priorities and progress in local mitigation efforts? (Requirement §201.6(d)(3))

This plan update includes the Town of Chester's priority to maintain its rural character and natural resources. These priorities are consistent with those of the previous Hazard Mitigation Plan. There are very few commercial businesses in Chester and that is unlikely to change. However, Chester is determined to capitalize on their Railway Station and Museum by developing events to bring visitors to the Town. This plan reflects the Town's priorities to protect the natural environment to mitigate natural hazard risk.

The status of each mitigation action from the Town of Chester Hazard Mitigation Plan Update 2016 is included in Chapter 6 (Mitigation Strategy). The text in this chapter includes a designation of Completed, Completed & To Be Continued, Partially Completed/In Progress, Delayed, or Cancelled with a description. In addition, if the mitigation action has moved forward to this Plan's list of mitigation actions that is indicated.

The 2016 Hazard Mitigation Plan Update was integrated into the Town's 2021 Municipal Vulnerability Preparedness Plan (MVP). The MVP builds on the findings of the 2016 Hazard Mitigation Plan by including the high risk natural hazards average/extreme temperatures, flooding from precipitation and dam overtopping, other severe weather (wind), and severe winter storms. The Pioneer Valley Planning Commission was the lead author on each of these plans. The MVP Plan includes hazard mitigation principles and recommendations for mitigation actions. These recommendations were considered in the development of this plan update (Chapter 6). Chester has had significant turn-over in terms of paid staff which creates a challenge to create consistency between plans and speaks to the need for explicit documentation. The current Town Administrator and Conservation Commission lead are dedicated to developing an Open Space and Recreation Plan soon which will integrate hazard mitigation principles and actions. As the Town develops and implements planning documents, such as the Hazard Mitigation Plan, the MVP, and the OSRP, the integration of these plans reduces risk and increases resilience in the Town, these co-benefits are examples of how to integrate hazard mitigation principles.

Continuing the trend of plan integration, this plan identified MVP recommendations to include toward reducing the impacts of climate change. Many of the MVP recommendations are similar if not exact to the mitigation actions listed in the 2016 Hazard Mitigation Plan Update and carried forward to this 2024 Hazard Mitigation Plan Update.

The Town has not integrated hazard mitigation principles into other planning mechanisms primarily because they have not utilized other planning mechanisms. This trend is shifting in a positive direction which is seen by the heavy public participation and staff involvement in the development of this plan.

Authority and Assurances

The Town of Chester will continue to comply with all applicable Federal laws and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 201.6. It will amend its plan whenever necessary to reflect changes in City, State or Federal laws and regulations, as required in 44 CFR 201.6. The list of laws and regulations the Town will adhere to is below.

- Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended.
- National Flood Insurance Act of 1968, as amended.
- National Dam Safety Program Act (Pub. L. 92-367), as amended.
- 44 CFR Part 201 Mitigation Planning.
- 44 CFR, Part 60, Subpart A, including § 60.3 Flood plain management criteria for flood-prone areas.
- 44 CFR Part 77 Flood Mitigation Grants.
- 44 CFR Part 206 Subpart N. Hazard Mitigation Grant Program.

Plan Adoption

The Town of Chester will adopt the Plan when it has received "approved-pending adoption" status from the Federal Emergency Management Agency (FEMA). The Certificate of Adoption is included on page 8.

Document Overview

Below is a summary of the Town of Chester, MA Hazard Mitigation Plan Update chapters, including appendices. The planning process closely adhered to FEMA guidelines and to the intent of those guidelines.

Chapter 2: Planning Area Profile
The Planning Area Profile chapter describes the Town of Chester, including history, population, government, and infrastructure.

Chapter 3: Planning Process
The Planning Process chapter documents the methodology and approach of the hazard mitigation planning process. The chapter summarizes the HMPC meetings and the public outreach process (including public meetings). This chapter guides the reader through the process of generating this plan and reflects its open and inclusive public involvement process.

Chapter 4: Risk Assessment
The Risk Assessment identifies the natural hazard risks to the Town of Chester and its residents. The risk assessment looks at current and future vulnerabilities based on land use development including structures and infrastructure. Included in this chapter is a list of critical facilities identified by the HMPC.

Chapter 5: Capability Assessment

The Capability Assessment looks at the Town's ability to mitigate risk prior to and following disaster. This chapter is structured around the following four categories: (1) planning and regulatory, (2) administrative and technical, (3) financial, as well as (4) education and outreach. The chapter concludes with information regarding the National Flood Insurance Program (NFIP) and recommendations for increase capacity to mitigate risk.

Chapter 6: Mitigation Strategy

This chapter provides a blueprint for reducing losses identified in the Risk Assessment. The chapter presents the hazard mitigation goals and identifies mitigation actions. Each mitigation action includes essential details, such as Town lead, potential funding sources, and implementation timeframe.

Chapter 7: Plan Implementation and Maintenance

The Plan Implementation and Maintenance chapter establishes a system and mechanism for periodically monitoring, evaluating, and updating the Hazard Mitigation Plan Update. It also includes a plan for continuing public outreach and monitoring the implementation of the identified mitigation actions.

Appendices

The Appendices includes documentation regarding the planning process, the list of mitigation actions and the *Hazus* Reports.

Chapter 2: Planning Area Profile

The Town of Chester has a population of 1,525,[5] and is in Hampden County, Massachusetts at the base of the Berkshires. Chester has a land area of approximately 37 square miles and is bordered by Huntington to the east, Becket to the west, Middlefield and Worthington to the north, and Blandford to the south. The Town is just 30 miles from the major cities of Pittsfield and Springfield as well as 115 miles from Boston and 70 miles from Albany, New York.[6]

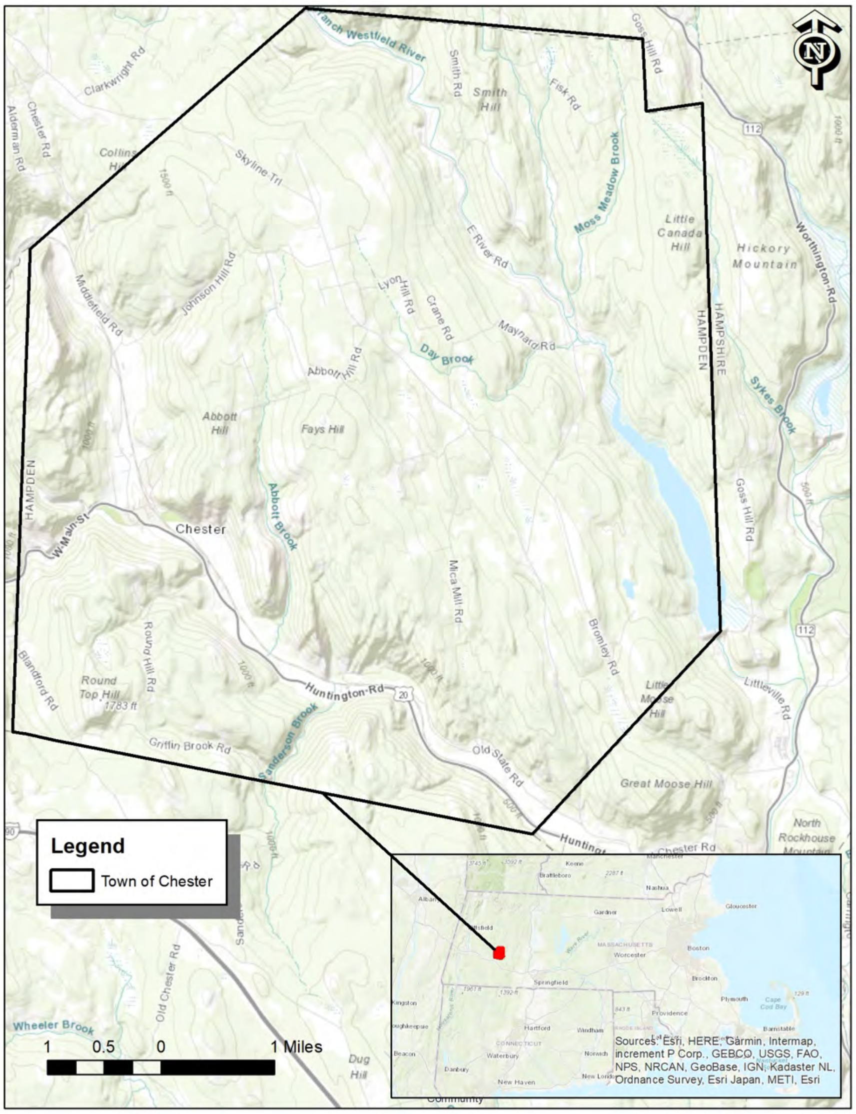

Figure 2. Chester Base Map.

[5] "ACS 5-Year Demographic and Housing Estimates." (2020). United States Census Bureau.

[6] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

The Town is home to "steep, rocky, forested hills" alongside farmland, open fields, and the branches of the Westfield River. [7] The Westfield River shapes the scenic landscape of the Town, and the natural character of Chester is captured by its hills and valleys.[8]

Chester's industrial history was prominent up until the 1930s, when a granite quarry, stone processing shed, and emery mill were present within the community. Much of the long-standing heavy industry no longer exists, but the Bannish Lumber Company remains. [9]

The Town is governed by a Town Administrator and Board of Selectmen. There are three board members which include a Chairman, Vice Chairman, and Clerk.[10]

People

As of 2020, 99.0% of the Town identified as White, 0.3% identified as Black or African American, and 0.8% identified as Two or More Races. Additionally, 0.5% identified as Hispanic or Latino.[11] About 2.2% of the population is foreign-born. There are approximately 539 households in Chester.[12] The median household income is $73,523.[13] The number of people living below the poverty level is 6.4%.[14] Ninety-one percent of the Town, aged 25 years or older, have a high school or higher diploma.[15]

The State of Massachusetts' defines "Environmental Justice Populations" as areas of a community where at least one of the following criteria it true:

1. Annual median household income is 65% or less of the state's annual median household income.
2. Minorities make up 40% or more of the city or town's population.
3. Twenty-five percent or more of households speak English "less than very well."
4. Minorities make up 25% or more of the population *and* the annual median household income of the municipality where the neighborhood is located does not exceed 150% of the statewide annual median household income.[16]

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[7] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[8] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[9] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[10] "Board of Selectmen." (2017-2024). Town of Chester, Massachusetts.
[11] "ACS 5-Year Demographic and Housing Estimates." (2020). United States Census Bureau.
[12] "ACS 5-Year Selected Social Characteristic in the United States." (2020). United States Census Bureau.
[13] "ACS 5-Year Income in the Past 12 Months (In 2020 Inflation-Adjusted Dollars)." (2020). United States Census Bureau.
[14] "ACS 5-Year Poverty Status in the Past 12 Months." (2020). United States Census Bureau.
[15] "ACS 5-Year Selected Social Characteristic in the United States." (2020). United States Census Bureau.
[16] "Environmental Justice Populations in Massachusetts." (2024). Commonwealth of Massachusetts. https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts

These populations are more vulnerable due to being disproportionately affected by the negative impacts of natural hazards nationwide. The data for identifying Environmental Justice Populations comes from the Executive Office of Energy and Environmental Affairs (EEA) who uses American Community Survey data.[17]

Chester has no designated Environmental Justice Populations, but according to the Hazard Mitigation Planning Committee (HMPC), there are vulnerable populations which include those living in Chester Commons and the elderly population located throughout the Town. Many residents are also connected to private wells and on-site septic systems which can increase their vulnerability to power outages, droughts, and other natural hazards.

Land Use and Development (Structures)

Development within the Town is continuously challenged by Chester's steep slopes. The Town has a village center with historic buildings and businesses. Most of the land in Chester is forest and all residentially or commercially developed areas are located directly beside the forestland or dispersed within it. Most of the residences in the Town are single-family homes. Approximately 21% of the Town's land is permanently protected, while a total of 47% of land has "some kind of protection." [18] The only unforested areas outside of residences and businesses are wetlands, water, or land used for agriculture.[19]

Chester's zoning includes four base zoning districts which include:

1. Residential (R) – low-density residential development.
2. Agricultural-Residential (AR) – low-density residential development; land uses that maintain the Town's rural character such as farm or forest use.
3. Mixed Use Village Business (B) – areas that reflect Chester's historic character and focus on municipal services and commercial development.
4. Industrial (I) – areas where industrial development is appropriate. [20]

There are an additional two overlay districts that further regulate land use which include:

1. Floodplain and Westfield River Protection (FWR) – areas abutting the Westfield River within 100 feet of the riverbank.
2. Route 20 Commercial – allows for commercial development subject to special permit along Route 20. [21]

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[17] "Environmental Justice Populations in Massachusetts." (2024). Commonwealth of Massachusetts. https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts
[18] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[19] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[20] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[21] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

Natural Resources

Natural resources provide habitats for plants and animals, increase biodiversity, and support various ecosystems while also providing recreational opportunities and access to the natural environment. Natural resources include features such as bodies of water like rivers and wetlands and open space like forests and parks. These features play an important part in maintaining environmental sustainability and life, but they are also threatened by natural hazards and climate change. As a result, they need to be protected and managed to mitigate risk to people and the built environment, prevent irreparable damage to the resources themselves, and lessen the impacts of major threats such as floods or drought.

Rivers and Waterways

The Westfield River travels throughout the Town of Chester. The entire Westfield River Corridor offers many "valuable features and resources" which include a cold-water fishery with naturally reproducing trout and is the largest "uncontrolled" river in the State of Massachusetts.[22] The Corridor also has ideal conditions for whitewater canoeing which includes the course for the Westfield River Whitewater Canoe Race, historic features that include ten stone arch railroad bridges, and habitat for rare and endangered species.[23] The Corridor is also recognized for having great water quality. [24]

The Middle and West Branches of the Westfield River pass through Chester. The streams have both Class A and Class B water purity classification. Class A is suitable for public drinking water supply and can be found in the Middle Branch, while the West Branch has a Class B classification which is characterized for water being "suitable for bathing and recreational purposes, acceptable for public water supply, excellent for fish and wildlife habitat with an aesthetic aspect." [25] The branches also have the "Wild and Scenic" federal government designation, making the Westfield River the first river in the State to be recognized as such.[26]

In addition to the major river, the Town has fourteen brooks which can be found in the list below:

1. Abbot Brook
2. Austin Brook
3. Blair Brook
4. Cook Brook
5. Day Brook
6. Griffin Brook

[22] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[23] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[24] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[25] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[26] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

7. Kinne Brook
8. Mica Mill Brook
9. Moss Meadow Brook
10. Otis Wait Brook
11. Roaring Brook
12. Sanderson Brook
13. Smith Brook
14. Winchell Brook. [27]

Wetlands and Bodies of Water

In addition to significant waterways in the Town, there are also about 944 acres of wetlands, many of which are wooded. However, many of these wetlands are not identified by MassGIS or USGS maps and must be identified in the field. The most "extensive isolated" wetlands are in the northeastern corner of Chester, east of Meadow Brook. To protect the wetlands as a natural resource Town zoning bylaws limit development.[28]

Littleville Lake, formed in 1965 when the Army Corp of Engineers constructed a water reservoir dam and flood control measure, is present in the Town. The lake and dam are mostly in Chester; however, public access and parking can be found in the neighboring Town of Huntington. Littleville Lake, like the Middle Branch of Westfield River, is a Class A water and because of this, provides emergency water supply for the City of Springfield's water system. The Lake also reduces flooding from the Westfield and Connecticut Rivers. Littleville Lake is stocked with trout each spring by the Massachusetts Division of Fisheries and Wildlife for fishing and water is also released to provide flows for the annual Westfield River Wildwater Canoe Race making it a valuable recreational resource as well. [29]

There are many smaller ponds and swamps in the Town, but the largest pond in Chester, Round Hill Pond, is in the Chester State Wildlife Management Area and encompasses 388 acres of the Town's surface water. Horn Pond is a water body that provides water supply to the Town as well as to the Austin Brook Reservoir when needed.[30]

The Town's Austin Brook Reservoir is divided into two sections. The lower pool serves as the main storage reservoir. The reservoir's depth ranges from four to 20 feet. If the water level drops below "a prescribed level," Horn Pond will flow by gravity through a conduit to Austin Brook and then into the reservoir. [31]

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[27] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[28] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[29] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[30] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[31] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

Forests

The Town is primarily a forested landscape that consists of oak, maple, birch, hemlock, and white pine. Some of the forestland is under Chapter 61 protection that requires owners to file management plans with the State and local Conservation Commission. The forests are not only a natural resource, but also an economic resource due to lumbering and the sale of forest species. They also provide flood management, water filtration, and wildlife habitat.[32]

Chester is part of the Chester-Blandford State Forest which is both a recreational and natural resource that draws residents and visitors alike.

Open Space and Recreation

Due to Chester's largely undeveloped landscape, it is home to several recreational opportunities that extend beyond those found in its water bodies. The Town is part of the Jacob's Ladder Trail that travels from the Town of Russell to the Town of Lee along Route 20 and connects to the Berkshire region.[33]

The Town also has a "Chester Walks Trail Map" which can be found below. This map provides trails that residents and visitors can travel to explore and experience the character of the Town and its various amenities and resources.

[32] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[33] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

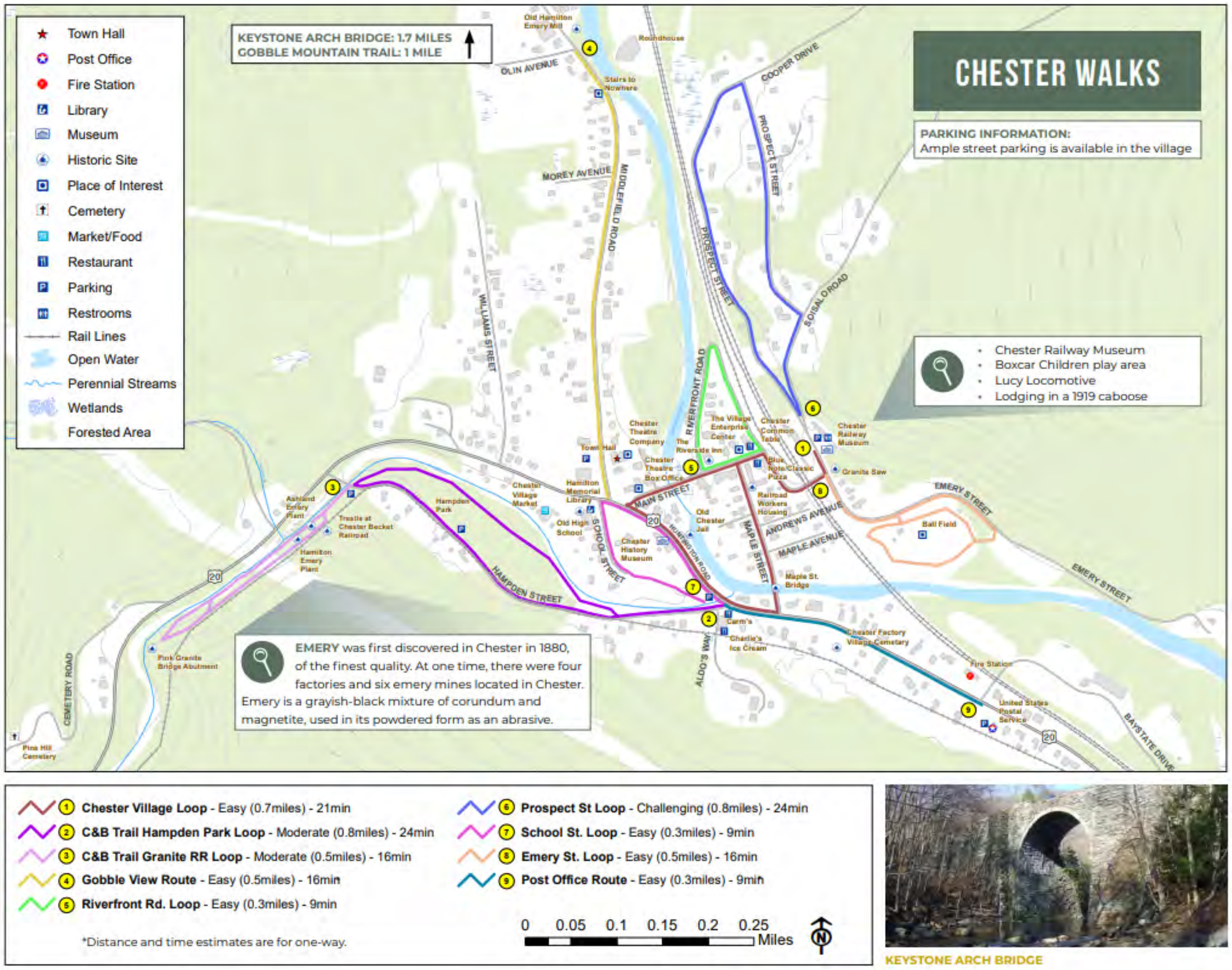

Figure 3. Chester Walks Trail Map.[34]

Critical Facilities and Infrastructure

Figure 4. Dam at Horn Pond.

Critical facilities and infrastructure are considered community lifelines; towns rely on these facilities before, during, and after a disaster. Critical facilities and infrastructure are important to identify and manage because of the services and access they provide daily. Mitigating risks related to natural hazards and climate change improves a town's resilience and economic vitality.

Water and Sewer Service

The Town's municipal water is served by Horn Pond and the Austin Brook Reservoir. Horn Pond, Chester's primary water supply, has a "safe yield" of 0.2 million gallons per day (MGD) and a 41-million-gallon storage capacity. The Town's water systems service about 260 households which accounts for

[34] Chester Walks Trail Map. (2023). Town of Chester, Massachusetts.

approximately 43% of the town's population. The remainder of the households draw water from private wells. [35]

There are also two 24,000-gallon tanks available from a private owner on Chester Hill as emergency back-up water supply. For fire suppression, there are half a million gallons available via Middlefield Pond.[36]

The Town does not have sewer service. Both residents and businesses rely on on-site septic systems. There is a municipal sewage treatment plant in Huntington. Chester considered connecting to this resource but determined that it would not meet the Town's needs.[37]

Energy

Chester has its own municipally owned electric distribution system; however, about 28 homes are located outside of the distributions system. The Town also has one solar field that is connected to municipally owned lines. There are no gas lines in the Town and homes are heated through oil, propane, or other methods.[38]

Critical Facilities

The term "critical facilities" is often used to describe structures necessary for a community to respond and recover in emergency situations. These facilities often include emergency response facilities (fire stations, police stations, rescue squads, and emergency operation centers [EOCs]), custodial facilities (jails and other detention centers, long-term care facilities, hospitals, and other health care facilities), schools, emergency shelters, utilities (water supply, wastewater treatment facilities, and power), communications facilities, and any other assets determined by the community to be of critical importance for the protection of the health and safety of the population. The adverse effects of damaged critical facilities can extend far beyond direct physical damage. Disruption of health care, fire, and police services can impair search and rescue, emergency medical care, and even access to damaged areas.

> The Local Mitigation Planning Handbook (FEMA, 2013) explains that *"Critical facilities are structures and institutions necessary for a community's response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery. When identifying vulnerabilities, it is important to consider both the structural integrity and content value of critical facilities and the effects of interrupting their services to the community."*

[35] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[36] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[37] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[38] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

The number and nature of critical facilities in a community can differ greatly from one jurisdiction to another, and usually includes both public and private facilities. Each community needs to determine the relative importance of the publicly and privately owned facilities that deliver vital services, provide important functions, and protect special populations.

Figure 5. Chester Fire Station.

A list of the critical facilities in Chester is provided in the table below. This list was obtained from the previous edition of the hazard mitigation plan and the MVP-funded Community Resilience Building (CRB) plan; and reviewed by the HMPC throughout the planning process.

The Town has a multi-purpose building that is used as the Town Hall, Emergency Operations Center, Police Station, Senior Center, and Shelter which has back-up power along with the Fire Station on Route 20 and the Highway Department Garage on Town Road. Chester also relies on several critical facilities such as hospitals and schools that are in the neighboring communities of Westfield, Northampton, and others.

Table 2. List of Critical Facilities in the Town of Chester.

Name	Address
Town Hall/Emergency Operations Center/Police Station/Senior Center/Shelter	15 Middlefield Road
Fire Station	30 Route 20
Fire Station	300 Bromly Road
Chester Elementary School/Shelter	325 Middlefield Road
Highway Garage/Water Dept./Power Dept./Fuel	2 Town Road
Water Treatment Plant	Reservoir Road
Radio Tower	Holcomb Road
Chester Commons - Elderly Housing	School Street
Hamilton Memorial Library	195 West Main Street
Village Center	26 Main Street

Name	Address
Baystate Medical Center	Springfield (Nearby Community)
Noble Hospital	Westfield (Nearby Community)
Berkshire Medical Center	Pittsfield (Nearby Community)
Cooley-Dickinson Hospital	Northampton (Nearby Community)
Gateway Regional High School	Huntington (Nearby Community)
Hilltown Ambulance	Huntington (Nearby Community)
Blossom Center	Middlefield (Nearby Community)

Critical Transportation Infrastructure

Figure 6. Boston & Albany R.R. Bridge in Chester Village.

U.S. Route 20 is the major roadway that travels through the Town. Route 112, a state highway runs adjacent to the Town and intersects with Route 20 just southeast of Chester's border. The Massachusetts Turnpike (I-90) is located just south of the Town. In addition to these major corridors, the Town has approximately 66 miles of roads. [39]

A rail line travels through Chester and is currently owned by CSX and serves as a through station for the transportation of goods from Springfield to New York.[40] The Town does not have public transportation services.[41]

Dams

The Town is home to three dams which include:

1. Chester Water Works Dam
2. Chester-Blandford State Forest Dam

[39] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[40] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.
[41] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

3. Ideal Lodge Dam.[42]

Economy

Industry in the Town has declined which has left Chester with a "small residential tax base and a few small businesses." The area that Chester is located within is attracting second-home owners as well as artists or small home-based businesses. There are some industrial and commercial sections located in the northwest part of Town. A local attraction is Chester's Miniature Theatre as well as the restored Boston and Albany Railroad Station.[43]

As of 2020, Chester's top industries by occupation according to the United States Census include:

1. Educational services, healthcare and social assistance
2. Manufacturing
3. Retail trade.[44]

Historic and Cultural Resources

Figure 7. Chester Railway Station.

Historic and cultural resources shape a community's character and identity while also creating a sense of place for residents and visitors. Many New England cities and towns are home to significant sites and structures that capture the history and heritage of an area. Some resources may date back centuries, like burial grounds, while others can be more recent, like newly designated historic districts. Their importance lies in what they mean to a community and how they represent its people and place. Historic and cultural resources can be at risk due to the negative impacts of natural hazards and climate change. This plan identifies these resources so the HMPC may consider their vulnerability and potential need for mitigation.

Chester's village center has historic buildings such as the former mills that capture the Town's "industrial past."[45] The Town is also home to the Chester Historical Society whose mission is to preserve the Town's heritage and historical buildings. The society offers several resources for genealogical research and local history alongside a large collection of items from Chester's industrial heritage.[46]

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[42] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

[43] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

[44] "Industry By Occupation for the Civilian Employed Population 16 Years and Over ACS 5-Year Estimates." (2020). United States Census Bureau.

[45] Hazard Mitigation Plan Update. (2016). Town of Chester, Massachusetts.

[46] "Mission." (n.d.). Chester Historical Society.

Additional local landmarks and historic/cultural resources that can be found within the Town include:

- Chester Blandford State Forest
- Chester Railway Station
- Cobble Mountain Preserve
- Highlands Footpath
- Keystone Arch Bridges Trail
- Old Chester Jail
- Round Top Hill
- Western Mass Hilltown Hikers.[47]

The Town also hosts several annual events which include:

- Maple Fest (March)
- Chester on Track (May)
- Memorial Day Parade (May)
- Littleville Fair (August)
- Hobo Harvest Dinner (October)
- Snowflake Craft Fair (November)
- Chester Tree Lighting (November).[48]

Figure 8. Littleville Fairgrounds.

[47] Chester Walks Trail Map. (2023). Town of Chester, Massachusetts.
[48] Chester Walks Trail Map. (2023). Town of Chester, Massachusetts.

Chapter 3. Planning Process

The planning process was developed in full compliance with the current planning requirements of the Federal Emergency Management Agency (FEMA) per the following rules and regulations:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000
- Code of Federal Regulations – Title 44, Chapter 1, Part 201 (§201.6: Local Mitigation Plans)
- Federal Emergency Management Agency Local Mitigation Planning Policy Guide, (Released April 19, 2022, Effective April 19, 2023)
- In addition, the plan was prepared with the suggestions found in the Demonstrating Good Practices Within Local Hazard Mitigation Plans, FEMA Region 1, January 2017.

A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))

A priority through the planning process was equity, which FEMA defines as the “consistent and systematic fair, just and impartial treatment for all individuals.” This was a central theme throughout the planning process and effort was made to develop an inclusive planning process. The whole community (individuals, communities, private and nonprofit sectors, faith-based organizations, and all levels of government) were given an opportunity to participate.

The planning process for this updated mitigation plan began in March 2024 and concluded in August 2024 (this does not include the months of plan review and adoption). The Town developed a Municipal Vulnerability Preparedness (MVP) Program summary of findings in 2021. This planning effort contributed to the update of the mitigation plan. Below is a graphical display of the plan development timeline.

	March	April	May	June	July	August	September
Convene LHMP Committee	Kick-off Meeting	HMPC Meeting	HMPC Meeting	Public Meeting	HMPC Meeting	HMPC Meeting & Public Meeting 2	
Update Hazard Profiles			Draft Risk Assessment	Finalize Risk Assessment			
Update Critical Facility Inventory		GIS and Data Gathering					
Update Mitigation Goals			Capability Assessment Meetings				
Update Actions		Previous Actions Meeting		New Actions Meeting	Final Mitigation Action List	Prioritize Mitigation Actions	
Plan Review, Evaluation, and Implementation						Complete Draft for HMPC Review	
Public Review of Draft						Complete Plan For Public Review	
Review and Approval							**Submit Plan to MEMA**

Figure 9. Planning Process Timeline.

Hazard Mitigation Planning Committee

The Town's Selectman, Richard (Andy) Sutton, developed the Hazard Mitigation Planning Committee (HMPC) and was the point of contact for the Consulting Team. The HMPC included Town employees, neighboring community members, and regional partners who represented six sectors of the community shown in the table below. A full list of HMPC members is shown in the table after that. The HMPC met four times, April 11, 2024, May 2, 2024, July 9, 2024, and August 13, 2024. All the meetings were conducted via Zoom, however sometimes Town employees gathered at their Town offices. A list of participants at each of these meetings is included in Appendix A.

Table 3. Sectors of the Community Represented on HMPC.

Sectors of the Community	HMPC Members
• Emergency Management	• Highway Superintendent/Emergency Management Director • Fire Department Chief • Hilltown Community Ambulance Association, Chief Financial Officer • Chief of Police

Sectors of the Community	HMPC Members
• Economic Development	• Board of Selectmen • Town Administrator
• Land Use and Development	• Conservation Commission • Highway Department • Planning Board • Town Administrator • Water Commissioner
• Health and Social Services	• Board of Health • Highway Superintendent/Emergency Management Director • Fire Department Chief • Gateway Regional School District (Facilities Director) • Hilltown Community Ambulance Association, Chief Financial Officer • Police Department Chief
• Infrastructure	• Chester Municipal Electric Light Department, Manager • Facilities Director, Gateway Regional School District • Highway Superintendent/Emergency Management Director • Planning Board • Town Administrator • Water Commissioner
• Natural Resources	• Conservation Commission

Table 4. HMPC Members.

First Name	Last Name	Title	Affiliation	Phone	Email
Nate	Bolduc	Fire Chief	Town of Chester		
Bob	Daley	Water Department	Town of Chester	413-354-7760	rdchester@comcast.net
Charles (Chip)	Dazelle	Highway Superintendent/Emergency Management Director	Town of Chester	413-354-2276	highwaysuper@townofchester.net
Jennifer	Dubiel	Chief of Police	Town of Chester	413-207-2397	
Henry	Fristik	Fire Chief (Former)	Town of Chester	413-354-7810	chiefhfristik@chesterfd.com
Muriel	Hall	Planning Board	Town of Chester	413-207-3198	lovehall4ever@gmail.com
Diane	Hall	Manager	Chester Municipal Electric Light Department	413-354-7811	cmeldmgr@townofchester.net
Donald F.	Humason Jr.	Town Administrator	Town of Chester	413-354-7760	townadministrator@townofchester.net
Bailey	Jones	Service Director	Hilltown Community Ambulance Association	413-667-3277	Bailey@hilltownambulance.org
Liz	Massa	Board of Health	Town of Chester	413-354-7781	boardofhealth@townofchester.net
Ed	Quinn	Facilities Director	Gateway Regional School District	413-685-1006	district. equinn@grsd.org
Jade	Rice	Chief Financial Officer	Hilltown Community Ambulance Association	413-667-3277	Jade@hilltownambulance.org
Richard (Andy)	Sutton	Selectman	Town of Chester	413-667-4611	suttonrichard367@gmail.com
Lora	Wade	Conservation Commission	Town of Chester	413-354-7760	lorawade76@gmail.com

A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))

Stakeholders were invited to participate in the planning process through the HMPC, public meetings, and plan review. Appendix A includes the press releases and flyers used to announce meetings and opportunities for participation. The Town Administrator with support from the HMPC conducted outreach specifically to local and regional agencies involved in hazard mitigation, Town boards and departments that regulate development, neighboring communities, nonprofit organization representatives that serve socially vulnerable populations, as well as business and academic organizations.

To reach underserved communities and vulnerable populations, the HMPC relied on local organizations and resources, such as the Council on Aging and regional media outlets for sharing information through multiple mediums (e.g., hard copy materials, online versions, across frequent buildings, in local newspapers, etc.). The goal for this multi-faceted engagement approach was to reach those who may not have access to the internet and who otherwise may not have participated. Holding in-person public meetings also aided in this effort.

The first HMPC meeting, held on April 11, 2024, was an introduction to the development of the hazard mitigation plan as well as an overview of the project timeline and HMPC responsibilities. The consulting team was able to gather input from the HMPC about which additional stakeholders should be invited to future meetings in addition to better understanding the current conditions across the Town as they related to hazard mitigation.

The HMPC emphasized that they wanted to involve regional stakeholders that provided community services such as the Hilltown Community Health Center and Hilltown Community Ambulance in addition to representatives from Chester Commons which houses elderly and other vulnerable residents. After identifying additional stakeholders, hazards were discussed. It was noted that the Town faced challenges “geographically and topographically” which negatively impacted their development, emergency services, and response to hazards. The proximity of the railroad to vegetation and roadways was also noted as a concern, particularly as a brushfire hazard. Critical facilities were evaluated, many of which were in or near the Village Center. Another important point made in the meeting was that there was a large staff turnover that occurred in the last few years. The meeting ended with a discussion on changes in development which has been limited throughout the Town for several years, proposed plan integration which the HMPC stressed was needed alongside collaboration amongst Town departments, and the need for increased institutional knowledge in the Town’s municipal roles.

The second HMPC meeting, held on May 2, 2024, focused on the assessment of risk to the Town of Chester. Major takeaways from the list of hazards that were identified focused on flooding as many historic buildings, hazardous material facilities, and the Town's Fire Station are in the floodplain. The Town Hall and School are located adjacent to the floodplain, as well. The risk of landslides was also a major point of concern but more so as designated rockfalls. The HMPC shared that soil and sediment comes off the banks near Johnson Hill Road and increases the risk of erosion. Maynard Hill was discussed as being problematic because of its steepness, though guardrails were not deemed appropriate for the area. Other risks included invasive species such as the Ash Tree Borer which has been prevalent in the watershed as well as Giant Hogweed. In terms of drought, because half of the population relies on well water, there was a concern of wells running dry. The Town is also impacted by severe winter storms and negative impacts are further exacerbated by the Town's elevation and abundance of hills and slopes.

The HMPC then went on to review the capabilities in Chester. The Town was lacking critical plans such as an Emergency Operations Plan, Comprehensive Emergency Management Plan, Stormwater Management Plan, Transportation Plan, and Capital Improvement Plan. The Water Department, however, did have its own Emergency Response Plan. The meeting ended by considering looking at neighboring Towns' best practices for future plans that Chester wants to create. There was also discussion on public outreach and engagement for the first public meeting which would be in the Theater within the Town Hall.

After the second HMPC meeting, the consulting team had a site visit to the Town to look at the current conditions that impact hazard mitigation efforts and which needed to be considered for the plan. Some major takeaways during the site visit included the old high school and library building being affordable housing, an overview of the 1000 Acre Watershed, Horn Pond being identified as the back-up water supply for the Town, and the presence of the privately-owned Walker Brook Campground which is located on the river at the end of Town and has flooded in the past. It was noted that the river runs through the downtown area, which has the potential to flood. The overall topography of the Town was looked at with site-specific areas like Johnson Hill and Prospect Road. During the visit, it was mentioned that the closest gas station was ten miles away, which is something to consider during a natural hazard event.

The third HMPC meeting, held on July 9, 2024, began with a discussion on some final outreach and logistics for the first public meeting. The meeting then turned to a discussion of mitigation actions and prioritization of those actions. The HMPC shared that the 50-year septic systems in Chester Village are failing, and action needs to be taken. This would include coordinating with the Board of Health, Conservation Commission, and State Agencies, especially for funding sources and updates to infrastructure. The Town identified creating a Water Source Protection Plan as a high priority action and shared that Chester is a State Declared Tier 3 community for underserved and vulnerable populations.

The HMPC then discussed increasing coordination amongst the Police and Fire Departments, particularly when responding to events around major roadways (e.g., Route 20) and the railroad tracks. This coordination could lead to generating contingency plans for when issues arise. Other recommendations included making wind and severe weather high hazards for the Town and addressing the many railroad tracks that are negatively impacted by vegetation. Towards the end of the meeting, capabilities were reviewed. The HMPC suggested creating a Continuity of Operations Plan in the future due to staff turnover and little to no “chain of command” which has led to a loss of knowledge in critical roles. The Town has noted that education and outreach efforts are in place, including classes and resources provided by the Council on Aging, Hilltown Community Ambulance Association, and an extensive telephone/text network with additional resources for the Gateway Regional School District that spans six towns and includes Chester. Though these efforts are in place, historically public engagement has been limited and therefore outreach was noted as difficult.

The fourth HMPC meeting, held on August 13, 2024, began with planning for the upcoming second public meeting located at the Fire Station Headquarters on August 20, 2024. Public outreach would be like the first meeting since there was a good turnout from local and regional stakeholders. The meeting then turned to a finalization of mitigation actions and their prioritization. The ranking and list of mitigation actions was provided to the HMPC after the meeting for further review and consideration; however, during the meeting, the actions as they were presented made sense to the HMPC. There was a brief discussion on the current water issues in the Town and the involvement of DEP and MEMA. The consulting team then discussed how to walk through the final plan for review and the HMPC aimed to keep this plan active and “off the shelf” to mitigate effectively. A plan was put in place for HMPC and public review to gather comments and feedback regarding the draft plan.

Alongside these meetings, the HMPC also participated in two public meetings, one on July 16, 2024, and one on August 20, 2024. Finally, the HMPC reviewed the draft Town of Chester, MA Hazard Mitigation Plan Update prior to sending it to the Massachusetts Emergency Management Agency (MEMA) for their review in September 2024.

Public Outreach

> A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

The Public Outreach Strategy was designed to involve the whole community in the mitigation planning process. The public was engaged in the planning process during the drafting of the plan and prior to plan approval through two public workshops (a flyer for the second workshop is shown below). Each public meeting was held both in-person and virtually via Zoom. The public was also given a chance to look over the plan and provide feedback prior to its review by MEMA or FEMA. The purpose of public engagement was to:

- Generate public interest in mitigation planning.
- Identify and accommodate special populations.
- Solicit public input.
- Engage local stakeholders.
- Create opportunities for public and local stakeholders to be actively involved in the mitigation planning process.

Each public meeting included a PowerPoint presentation and plenty of opportunity for questions and discussion. In addition to the presentation, various questions were asked by the consulting team to facilitate input from meeting participants throughout the meeting. This has proven to be an effective way of engaging people and gives them an opportunity to share their thoughts and concerns. The HMPC participated in each meeting. Representatives from all community lifelines were included in public engagement efforts. Community lifelines are a driving force behind FEMA's strategic goals for building a culture of preparedness and readying the nation for catastrophic disasters. The eight community lifelines can be a powerful tool for local governments when evaluating risk and developing mitigation actions. The HMPC considered the eight community lifelines when conducting outreach through this planning process. The eight community lifelines and their respective components are shown in the figure below.

COMMUNITY LIFELINES *are the most fundamental services in the community that, when stabilized, enable all other aspects of society.*

Figure 10. Community Lifelines List.

Outreach for the public meetings and for plan review was sent via press release, email blasts, and reaching out to adjacent communities. The Town website (https://townofchester.net/) included announcements for meetings, the press releases were sent to municipal committees, vulnerable populations, regional partners and media sources, and posted around the Town at frequented buildings such as on the large informational board at the front of Fire Department Headquarters. The Town thought it best to have the Hazard Mitigation Plan Update Public Meetings scheduled at accessible Town locations to allow for community members without internet to participate easily. Both the Town Hall and the Fire Department Headquarters were located near the Town Village, with ample parking, and in close proximity to other Town offices such as the Council on Aging, Library, and Post Office. This allowed the public to attend the meetings with greater ease.

Information gathered during the public meetings contributed to the plan's development. The first public meeting was held in-person in the Town Hall's Theater and via Zoom on **July 16, 2024**. The meeting was attended by 18 members of the public, neighboring towns, and the HMPC, alongside three members of the consulting team. Most of the attendees were present in-person, while four joined via Zoom. The meeting included a project introduction, explaining what a hazard mitigation plan is, outlining hazard profiles and critical facilities, and a preliminary discussion on mitigation actions.

Figure 11. Public Meeting 2 Flyer.

The meeting asked participants a series of questions to engage them and help them understand the process of developing a hazard mitigation plan. The questions are listed below.

- What do you like most about your community?
- What concerns do you have about your community?
- What buildings and infrastructure are critical to your community?
- What weather-related hazards can impact your community?
- Name specific locations in your community that flood or are vulnerable to natural hazards.
- What can be done to mitigate risks you have identified? Think of activities to protect the people, buildings, and infrastructure named previously.

When asked "What do you like most about Chester?" the following answers were given:

- Natural Resources
- Beautiful Rocks
- Small Town Environment
- Remote
- Safe
- Westfield River

After a discussion about natural hazards, the consulting team asked, "What are other natural hazards that can impact the Town?" and the following answers were given:

- Forest Fires - Train Sparks and Lightning
- Wind
- Lack of Healthy and Local Nutrition for People
- Ice Storms
- Earthquakes - 2 Summers Ago, Water Main Break (Not from Earthquake but from Aging Infrastructure and Town Was Out of Water) and Now a Risk for Earthquakes
- Global Warming and Its Impact on Surface Water
- Drought
- Gravel Road Runoff - Choosing Between Asphalt V. Gravel and the Impact It Has on the Highway Department
- Erosion
- Westfield River in North Chester (Two Branches of The Westfield River in Town)
- Elevation
- Expansion of Goods and Services in Case of a Natural Hazard

Figure 12. Public Meeting #1.

The meeting participants also began to discuss several mitigation actions that could be implemented in the Town such as improving the Prospect Street and Abbot Hill connection due to there being no access out and fire trucks getting stuck if needing to service the area, protecting trees, animal life, and farms, maintaining a rural environment, cutting back trees, identifying back-up power supply sources, general vegetation management, and increasing efforts to identify and apply for grant funding.

The second public meeting, held on August 20, 2024, was attended by eight individuals in-person at the Fire Station, three people virtually on Zoom, alongside two members of the consulting team. The meeting began with an overview of the Hazard Mitigation Plan Update development, current timeline, and the content of the plan chapters. The consulting team then went on to explain how hazards and risks were considered in developing mitigation actions for the Town. A comment regarding the plan in general came from one resident who stated that new transformative legislation was coming from the State regarding zoning and as a result may have to be considered when undertaking this plan and any future implementation of actions. Two comments came out of the mitigation strategy portion of the meeting which included acknowledging the drastic difference in weather conditions caused by Chester's unique elevation changes. For example, if a snow storm were to hit the Town, the Village Center could receive little to no snow since it sits at a lower elevation, while those in the hills at higher elevations and only minutes away could see 15 inches of snow. The impact of elevation on hazards was therefore deemed important for the plan.

Finally, a mitigation action was suggested by the Fire Chief which included reopening the portion of Abbot Hill Road from Prospect Street that is currently washed out. Reopening this road would allow for an additional evacuation route to be created if bridges were to collapse, if major flooding occurred, or if a train derailed in the area. There are currently over 100 households in that part of Town which also needs to be considered. The meeting wrapped up with how to review the draft plan and where the public would be able to access hard-copy and online versions during the plan's public review period.

Contributions from the HMPC and public engagement impacted the plan in multiple ways. The table below indicates some of the contributions, others are included above and throughout the plan.

Table 5. Where Public Engagement Informed the Plan.

Area of the Plan Impacted	Contributions
Planning Area Profile	• The HMPC updated the list of critical facilities, shown in Appendix B. They also contributed information regarding current land use practices and priorities.
Planning Process	• Participated in every aspect of the planning process and made recommendations regarding how to engage the public and key stakeholders.
Risk Assessment	• Described extent of hazard impacts based on previous events. • Offered first-hand insight and experiences of Town residents. • Added the qualitative review to the risk analysis for determination of the hazard risk ranking.
Capability Assessment	• Contributed plans, bylaws, and reports for review. • Completed three Capability Assessment questionnaires including the National Flood Insurance survey and the Safe Growth survey.
Mitigation Strategy	• Identified and prioritized mitigation actions based on their concerns. • Focused on the concerns raised by community members.

Area of the Plan Impacted	Contributions
Implementation Plan	• Committed to integrating this plan more thoroughly throughout Town government and to posting the plan on the Town's website.

List of Key Stakeholders Invited to Public Meetings

The following groups were considered "key stakeholders." These stakeholders were invited to public meetings and to review the draft plan:

- Members of all Chester Committees
- Members of all Chester Boards
- Town of Chester Employees
- Town of Becket
- Town of Westhampton
- Town of Blandford
- Town of Russell
- Town of Huntington
- Town of Middlefield
- Hilltown Community Ambulance Association
- Regional School Districts
- Pioneer Valley Planning Commission
- WWLP - 22 News (local news network)
- Country Journal, Ellen Downer Editor
- Massachusetts Emergency Management Agency - Patrick Carnevale
- Senator Paul Mark
- Representation Nicholas Boldyga
- Executive Office of Housing and Economic Development - Anne Gobi
- Hilltown Community Development Corporation

Review of Draft Plan

The Town made the plan available for public review in August and September 2024. A press release announcing the availability to review the plan was sent to all the stakeholders listed above and the announcement was posted to the Town website. The HMPC sent emails to specific stakeholders in Town and to adjacent towns and organizations. Flyers were posted in the Town Hall. Hard copies of the plan were kept in the Town Hall. The public was instructed to provide comments via a Google Form or to leave comments with the Town Administrator or the Selectboard.

The public did not leave comments. However, several comments were received following the second public meeting. These included a question about Chester Commons from the property manager for Hilltown CDC and owner of the building. He asked about if this building is considered a critical facility since it includes the Town Library, and fifteen affordable apartments for people over the age of 55 and people with disabilities. Chester Commons is noted in the plan as a critical facility.

The other comment received following the public meeting related to re-opening Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders. The HMPC supported this additional mitigation action, and it was added as a mitigation action.

The Town of Chester was under a “boil water notice” during the period of plan review. This put incredible strain on residents and Town leaders. It is possible that this fact distracted the public from plan review.

Chapter 4. Risk Assessment

Hazard Identification

> ***RISK** for the purpose of hazard mitigation planning, is the potential for damage or loss created by the interaction of natural hazards with assets, such as buildings, infrastructure, or natural and cultural resources.*

The first step in the risk assessment was to revisit and evaluate the hazards identified for study and inclusion in the Town's previous hazard mitigation plan. This was a key topic of discussion at the first Hazard Mitigation Planning Committee (HMPC) meeting, along with the consideration of any additional hazards to include in the updated risk assessment. While only natural hazards are required to be addressed by FEMA, other hazards such as technological and human-caused hazards may be included if they are of significant concern to the community and determined to be a mitigation priority.

In completing the updated hazard identification process, the HMPC considered the results of the Town's Municipal Vulnerability Preparedness (MVP) planning effort (completed in 2021), as well as the "ResilientMass Plan" (2023[49]) which is the formal update to the 2018 State Hazard Mitigation and Adaptation Plan (SHMCAP). As a result of this process all hazards from the prior hazard mitigation plan (adopted in 2016) remain in this updated risk assessment. For this updated assessment, some hazards have been consolidated or renamed to be consistent with the ResilientMass Plan, as further described below. The top natural hazards identified for the MVP effort are thoroughly covered in this assessment. Invasive species as a hazard was added to reflect the concern for this becoming a more prevalent challenge with projected climate change; and to ensure that the risk assessment is aligned with the ResilientMass Plan. Coastal hazards such as coastal flooding, erosion, and surge were not included due to the location and not being a coastal community. The profiled hazards are as follows:

- Average/Extreme Temperatures
- Drought
- Earthquakes
- Flooding from Precipitation and Dam Overtopping
- Hurricanes and Tropical Storms
- Invasive Species

[49] https://www.mass.gov/doc/resilientmass-plan-2023

- Landslides
- Other Severe Weather
- Severe Winter Storms
- Tornadoes
- Wildfires/Brushfires

One "hazard" profiled in the ResilientMass Plan – "changes in groundwater" – is included as appropriate in the flood and drought hazard profiles in this plan.

Massachusetts Emergency Declarations

The Town of Chester has been subject to numerous federal disaster declarations along with the entirety of Hampden County. Some of these disaster declarations correspond to emergency declarations in portions of Massachusetts. The following table cross-references the 13 Massachusetts emergency declarations starting in 2011 with the corresponding federal disaster declarations. All the Massachusetts emergency declarations corresponding to Chester have involved natural hazards addressed in this plan except for the shelter capacity crisis, which is not a natural hazard and not profiled in this plan. Hazards that do not appear in this table (i.e., earthquakes) have not been subject to Massachusetts emergency declarations.

Table 6. Massachusetts Emergency Declarations.

Massachusetts Emergency	**Start**	**Termination**	**Corresponding Federal Disaster Declaration**	**FEMA Public Assistance Available**	**Applicable to Chester?**
Storm Lee	9/15/2023	9/16/2023	Not applicable	Not applicable	Yes
Severe Weather and Flooding	9/12/2023	9/16/2023	Not applicable	Not applicable	Yes
Shelter Capacity Crisis	8/8/2023	Pending	Not applicable	Not applicable	Yes, but not a natural hazard and not a FEMA declaration for Massachusetts

Massachusetts Emergency	Start	Termination	Corresponding Federal Disaster Declaration	FEMA Public Assistance Available	Applicable to Chester?
COVID-19	3/10/2020	5/11/2023	DR-4496-MA	All counties	Yes
Merrimack Valley Gas Explosion	9/14/2018	10/4/2018	Not applicable	Not applicable	No
Coastal Storm	3/3/2018	3/6/2018	DR-4372-MA	Essex, Norfolk, Plymouth, Bristol, Barnstable, and Nantucket Counties	No
Winter Storm	2/9/2015	2/25/2015	Not applicable	Not applicable	No
Winter Storm	1/26/2015	1/28/2015	DR-4214-MA	Worcester County and eastward	No
Winter Storm	2/8/2013	2/13/2013	DR-4110-MA	All counties	Yes
Hurricane Sandy	10/27/2012	11/1/2012	DR-4097-MA	Suffolk, Bristol, Plymouth, Barnstable, Dukes, and Nantucket Counties	No
Nor'easter	10/29/2011	11/7/2011	DR-4051-MA	Berkshire, Franklin, Hampshire, Hampden, Worcester, and Middlesex Counties	Yes

Massachusetts Emergency	Start	Termination	Corresponding Federal Disaster Declaration	FEMA Public Assistance Available	Applicable to Chester?
Hurricane Irene	8/26/2011	9/6/2011	DR-4028-MA	Berkshire, Franklin, Hampshire, Hampden, Norfolk, Bristol, Plymouth, Barnstable, and Dukes Counties	Yes
Tornadoes	6/1/2011	6/19/2011	DR-1994-MA	Hampden and Worcester Counties	Yes

Links to Massachusetts Climate Change Assessment

The *2022 Massachusetts Climate Change Assessment* report was issued in December 2022 (https://www.mass.gov/info-details/massachusetts-climate-change-assessment#read-the-report-). This report provided statements about the impacts of climate change in five sectors within each of seven designated regions of Massachusetts. Chester is in the "Berkshires and Hilltowns" region shown in dark green in the figure below.

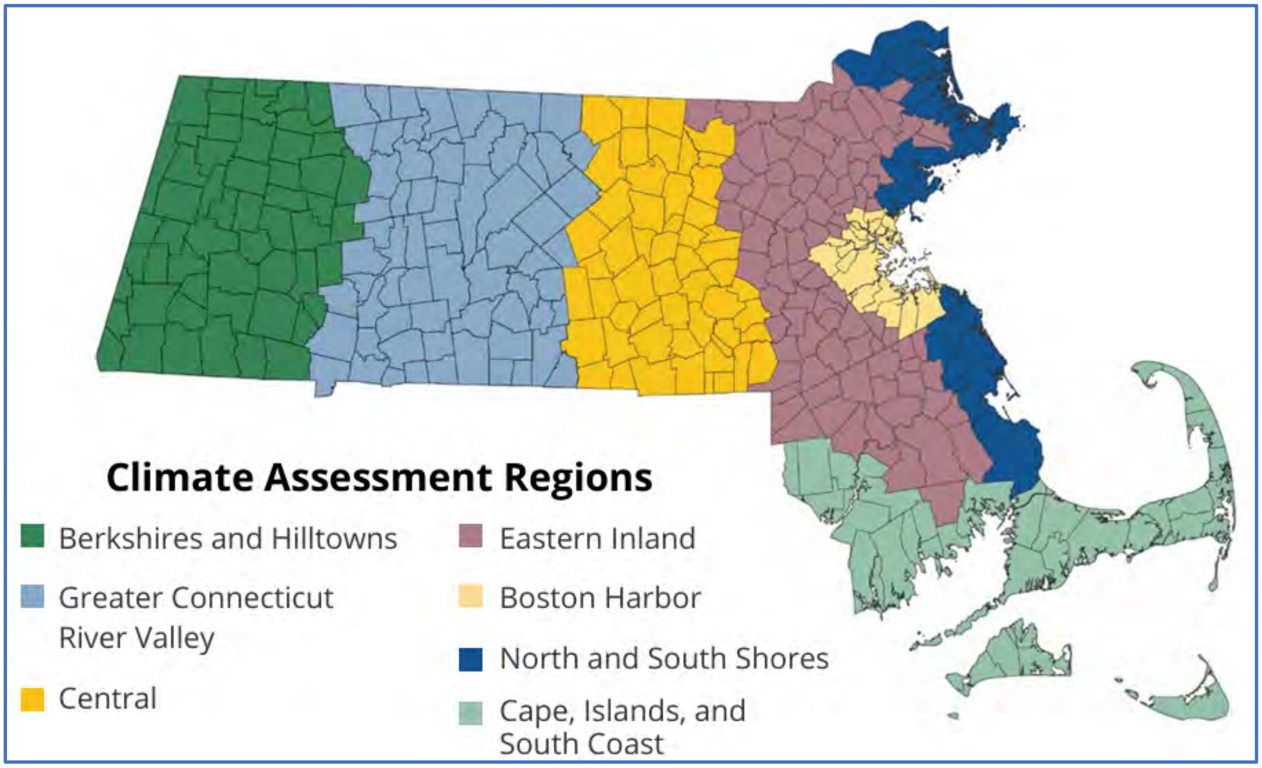

Figure 13. Climate Assessment Regions. Chester is in the Berkshires and Hilltowns Region.

The table below lists the top two or three impacts of climate change in each of the five sectors within this region.

Table 7. Top Impacts of Climate Change per Sector in Berkshires and Hilltowns Region.

Sector	Top Impacts per Sector	Comments
Human	Increase in vector-borne disease incidence and bacterial infections	Including West Nile Virus and Lyme due to favorable conditions for mosquitos and ticks
	Reduction in food safety and security	Causes are production and supply chain issues as well as spoilage during outages
Infrastructure	Damage to buildings	Causes are heavy rainfall and overwhelmed drainage

Sector	Top Impacts per Sector	Comments
	Reduction in clean water supply	Causes are changes in precipitation, flooding of surface water supplies, risks to dams, and droughts
	Damage to electric transmission and distribution	From heat stress and extreme storms
Natural Environment	Freshwater ecosystem degradation	Causes are warming waters, drought, and runoff
	Forest health degradation	Causes are warming temperatures, changing precipitation, wildfire frequency, and increasing pests
Governance	Increase in costs of responding to climate migration	Includes planning for abrupt increases in local populations
	Increase in demand for State and municipal services	Emergency response, food assistance, and health care
Economy	Reduction in availability of affordably priced housing	Direct damage (floods) and scarcity caused by demand
	Damage to tourist attractions and amenities, particularly those associated with seasons	All hazards may impact seasonal tourism, from flooding to droughts, and from invasive species to wildfires. Changes in temperatures and winter storms will affect winter recreation.

The Town proposes to incorporate these top climate change impacts in this edition of its plan as outlined below.

Table 8. How This Plan Addresses the Top Impacts of Climate Change per Sector.

Sector	Top Impacts per Sector	Approach to Incorporating Impacts
Human	Increase in vector-borne disease incidence and bacterial infections	Vector-borne and infectious diseases are a hazard profiled in this plan.

Sector	Top Impacts per Sector	Approach to Incorporating Impacts
	Reduction in food safety and security	Local droughts that impact food security will be addressed. Food safety and security nationwide will not be directly addressed, but the capability assessment will help describe town wide capabilities for food security.
Infrastructure	Damage to buildings	Damage to buildings is addressed in the vulnerability assessment for each hazard.
	Reduction in clean water supply	Droughts are profiled in this plan. Hazards that can secondarily affect water supply such as invasive species and severe storms (which can cause power outages) are also profiled.
	Damage to electric transmission and distribution	Severe weather events that damage transmission and distribution are hazards profiled in this plan.
Natural Environment	Freshwater ecosystem degradation	Changes in precipitation, drought, and invasive species are all hazards addressed in this plan.
	Forest health degradation	Extreme temperatures, changing precipitation, wildfires, and invasive species are all hazards addressed in this plan.
Governance	Increase in costs of responding to climate migration	The capability assessment and related mitigation actions will help address response functions.
	Increase in demand for State and municipal services	The capability assessment and related mitigation actions will help address increased demands for municipal services.
Economy	Reduction in availability of affordably priced housing	The individual hazards addressed in this plan can reduce the availability of affordably priced housing, and the specific actions for each hazard will help protect housing options and opportunities.
	Damage to tourist attractions and amenities, particularly those associated with seasons	The hazards that may impact seasonal tourism are discussed in this plan.

Hazard Profiles

B1. Does the plan include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction? Does the plan also include information on previous occurrences of hazard events and on the probability of future hazard events? (Requirement 44 CFR §201.6(c)(s)(i))

B2. Does the plan include a summary of the jurisdiction's vulnerability and the impacts on the community from the identified hazards? Does the summary also address NFIP-insured structures that have been repetitively damaged by floods? (Requirement 44 CFR §201.6(c)(s)(ii))

***IMPACTS** are the consequences or effects of each hazard on the participant's assets identified in the vulnerability assessment. For example, impacts could be described by referencing historical disaster damages with an estimate of potential future losses (such as percentage of damage vs. total exposure).*

The risk assessment for the ResilientMass Plan describes the natural hazards that have the potential to impact the Commonwealth and provides the underlying narrative for this hazard profile for the Town. Because this section repeats information from the ResilientMass Plan, some citations have been removed for brevity. The original citations can be found in the ResilientMass Plan.

Profiles have been developed for each identified hazard, organized by primary climate change interaction. Hazard profiles include the following sections: Hazard Description, Location, Previous Occurrences, Extent, Probability of Future Events, and Vulnerability Assessment; these are described in the table below.

Table 9. Hazard Characterization.

Category/Method	Definition
Description	Description of hazard, its characteristics, and potential effects.
Location	Describes geographic areas within the town that are affected by the hazard.
Previous Occurrences	Provides information on the history of previous hazard events for the region, including their impacts on people and property.
Extent	Describes potential strength or magnitude of a hazard. Where possible, extent is described using established scales.

Category/Method	Definition
Probability of Future Events	Describes likelihood of future hazard occurrences in the town based on best available and climate-informed science.
Vulnerability Assessment	Describes potential impact on the community, including estimated potential losses and the anticipated effects of climate change.

To describe previous occurrences, this plan update highlights major events from history but relies primarily on a roughly ten-year lookback (2014 through 2023) ending with any events from the date of plan development (2023-2024). This helps maintain a concise narrative. Where applicable, narratives about warning times (i.e., floods, heat advisories, and wildfires) are incorporated into the *"Extent"* subsections.

***VULNERABILITY** is a description of which assets, including structures, systems, populations and other assets as defined by the community, within locations identified to be hazard prone, are at risk from the effects of the identified hazard(s).*

The vulnerability assessment characterizes how hazards have impacted and may impact the different aspects of the community. In the vulnerability assessment sub-sections, the magnitude and likelihood of a hazard event are evaluated, and impacts are quantified using hazard models. Some hazards, like earthquakes and winter storms, will impact the entire community while other hazards, like floods and landslides, impact specific locations in the community. The areas that could be impacted are defined as the community's exposure. The results of the vulnerability assessment are used to help identify mitigation measures the community may take to lessen the impact and better understand their benefits.

Average and Extreme Temperatures

According to the ResilientMass Plan, extreme heat for Massachusetts is usually defined as daily high temperatures above 90 degrees Fahrenheit (°F) which may be accompanied by high humidity. Extreme cold is also considered relative to the normal climatic lows in a region. Extreme cold is a period of excessively low temperatures, particularly with the addition of wind chill. The ResilientMass Plan notes that typically in Massachusetts the highest temperatures are experienced in the southeast while the coldest are typically in the northwest.

The Town of Chester Community Resilience Building Workshop Summary of Findings (2021) lists "extreme heat including temp fluctuation" as one of the top hazards of concern.

Description

Extreme cold is a dangerous situation that can result in health emergencies for susceptible or vulnerable people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat. Extreme cold events are events when temperatures drop well below normal in an area. When winter temperatures drop significantly below normal, staying warm and safe can become a challenge. Extremely cold temperatures often accompany a winter storm, which may also cause power failures and icy roads. During cold months, carbon monoxide may be high in some areas because the colder weather makes it difficult for car emission control systems to operate effectively, and temperature inversions can trap the resulting pollutants closer to the ground.

Likewise, extreme heat is a dangerous situation that can result in health emergencies for susceptible and vulnerable people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without adequate cooling.

A heat wave is defined as three or more days of temperatures of 90°F or above. A basic definition of a heat wave implies that it is an extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle, and which may have adverse health consequences for the affected population. Heat waves cause more fatalities in the U.S. than the total of all other meteorological events combined. According to the EPA, more than 11,000 Americans have died from heat-related causes (EPA, 2016) since 1979.[50]

Heat impacts can be particularly significant in urban areas. Buildings, roads, and other infrastructure replace open land and vegetation. Dark-colored asphalt and roofs also absorb more of the sun's energy. These changes cause urban areas to become warmer than the surrounding areas. This forms "islands" of higher temperatures, often referred to as "heat islands." Heat islands can affect communities by increasing peak energy demand during the summer, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation (EPA).

Many conditions associated with heat waves or more severe events (including high temperatures, low precipitation, strong sunlight, and low wind speeds) contribute to a worsening of air quality in several ways. High temperatures can increase the production of ozone from volatile organic compounds and other aerosols. Weather patterns that bring high temperatures can also transport particulate matter air pollutants from other areas of the continent. Additionally, atmospheric inversions and low wind speeds allow polluted air to remain in one location for a prolonged period.

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[50] https://www.epa.gov/climate-indicators/climate-change-indicators-heat-related-deaths#:~:text=Some%20statistical%20approaches%20estimate%20that,set%20shown%20in%20Figure%201.

Location

The Massachusetts Climate Assessment (2022) explains that recent efforts to characterize extreme heat have underscored that risks are present throughout the entire commonwealth. Therefore, the entire Town of Chester is subject to extreme heat. As with the entire commonwealth, Chester is also exposed to extreme cold temperatures.

Previous Occurrences

Extreme Cold: The ResilientMass Plan notes that since 1995, there have been 120 cold weather events within the Commonwealth, ranging from Cold/Wind Chill to Extreme Cold/Wind Chill events. The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists three extreme cold and/or wind chill events for the area of Chester during the timeframe 2014-2023.

Extreme Heat: The ResilientMass Plan notes that according to the NOAA's Storm Events Database there have been 4 warm weather events (Heat to Excessive Heat events) between 2010 and 2022. Excessive heat results from a combination of temperatures well above normal and high humidity. Whenever the heat index values meet or exceed locally or regionally established heat or excessive heat warning thresholds, an event is reported in the database.

In 2012, Massachusetts temperatures broke 27 heat records. Most of these records were broken between June 20 and June 22, 2012, during the first major heat wave of the summer to hit Massachusetts and the East Coast. In July 2013, a long period of hot and humid weather occurred throughout New England. One fatality occurred on July 6, when a postal worker collapsed as the Heat Index reached 100°F. August 2022 was the hottest August on record for the Commonwealth, and 2020 and 2022 were the two hottest records for the state. Boston experienced two six-day heat waves and 17 days above 90 degrees in 2022.

The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists two extreme heat events for the area of Chester in the timeframe 2010-2023. These are listed below, with notations for temperatures and dates differing from entry to entry as reported by the various contributors.

Table 10. NCEI Severe Storm Database Entries Covering Heat in Chester.

Date	Description
7/6-7/10	A strong ridge built into Southern New England resulting in temperatures nearing 100 with high humidity. Heat index values ranged from 100 to 106 for most of Southern New England on the 6th and again on the 7th in a more limited area, generally the Connecticut River Valley.

Date	Description
7/21/11	A strong upper level ridge brought very hot temperatures to Southern New England. A moist southwest low level flow increased humidity levels such that heat index values rose above 105 degrees for a period of a few hours.

Cold events are typically reported with winter storms and will be described in the winter storm section of this chapter.

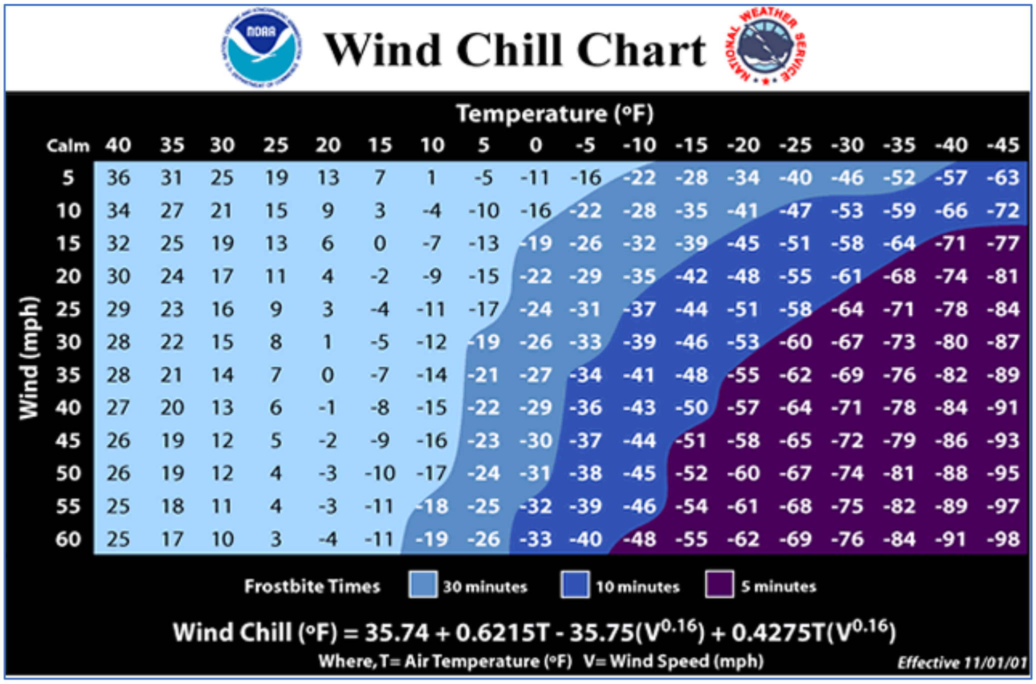
USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The events related to extreme temperatures in Hampden County are listed below.

Table 11. USDA Disasters Events That Refer to Extreme Temperatures.

Year	Event	Event "Begin Dates"
2013	Extreme heat, excessive humidity	5/8/2013
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Frost/freeze	2/12/2016, 2/14/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016

Extent

Extreme Cold: The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature Index. Wind Chill Temperature is the temperature that people and animals feel when they are outside, and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body loses heat at a faster rate, causing the skin's temperature to drop. The National Weather Service (NWS) issues a Wind Chill Advisory if the Wind Chill Index is forecast to dip to –15°F to – 24°F for at least 3 hours, based on sustained winds (not gusts). The NWS issues a Wind Chill Warning if the Wind Chill Index is forecast to fall to –25°F or colder for at least 3 hours. On November 1, 2001, the NWS implemented a Wind Chill Temperature Index (Figure 14) designed to more accurately calculate how cold air feels on human skin.



Wind Chill Chart

Temperature (°F)

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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

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

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 14. NWS Wind Chill Temperature Index and Frostbite Risk.

<u>Extreme Heat</u>: The NWS issues a Heat Advisory when the NWS Heat Indices are between 95 and 99 degrees for two or more hours or two consecutive days, or if they are between 100 and 104 degrees for two or more hours in a single day. The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105°F or higher for 2 or more hours. The NWS Heat Index is based both on temperature and relative humidity and describes a temperature equivalent to what a person would feel at a baseline humidity level. It is scaled to the ability of a person to lose heat to their environment. Exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can increase the risk of heat-related impacts.

NWS Heat Index — Temperature (°F)

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

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution · Extreme Caution · Danger · Extreme Danger

Figure 15. NWS Heat Index Chart.

The NWS advisory and warning products are applicable to all extreme temperature events that may affect Chester, as they are used throughout Massachusetts on a routine basis and appropriately characterized the most recent extreme cold and heat events over the last few years. Extreme temperatures have not occurred that are outside of the NWS advisory/warning systems.

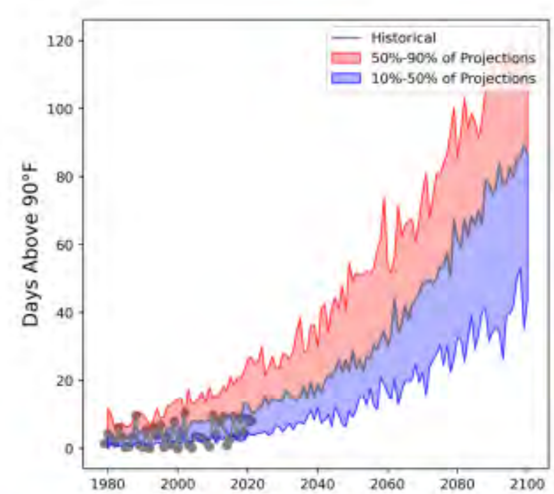
Probability of Future Events

The ResilientMass Plan notes that Massachusetts averaged three declared cold weather events and two extreme cold weather events annually between January 2018 and October 2022. The years 2018 and 2019 were particularly notable, with 10 cold weather events in each year, including five extreme cold/wind chill events in 2018 and six in 2019. The ResilientMass Plan also notes that there was an average of 3.6 heat events and two excessive heat events between January 2018 and December 2022. Many practitioners believe that some heat wave related circulation patterns are occurring more frequently due to climate change.

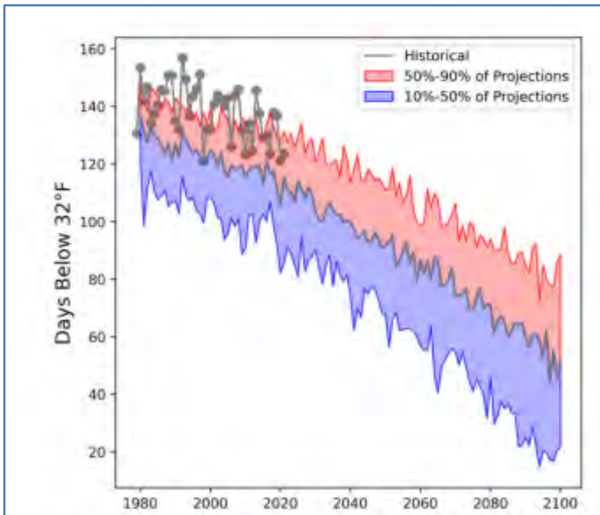
There are a number of climatic phenomena that determine the number of extreme weather events in a specific year. However, there are significant long-term trends in the frequency of extreme hot and cold events. Since 2010, U.S. daily record high temperatures have occurred over eight times as often as record low. This is compared to a nearly 1:1 ratio in the 1950s. Models suggest that this ratio could climb to 20:1 by midcentury, if GHG emissions are not significantly reduced (C2ES, n.d.).

Various climate forecasts support the trends of an increased frequency of extreme hot weather events and a decreased frequency of extreme cold weather events. High, low, and average temperatures in Massachusetts are all likely to increase significantly over the next century as a result of climate change.

The graphics below (from resilient MA, 2018) show the projected annual days with maximum temperature above 90 degrees and projected annual days with minimum temperature below 32 degrees.



Source: CMIP6 downscaled projections (Thrasher et al., 2022), warming scenario SSP 5-8.5, historical data from GridMET.



Source: CMIP6 downscaled projections (Thrasher et al., 2022), warming scenario SSP 5-8.5, historical data from GridMET.

Figure 16. Projected Annual Days with Temperatures above 90 Degrees (left) and below 32 degrees (right).

Vulnerability Assessment

Exposure

Extreme temperatures are not a hazard with a defined geographic boundary. The entire Town should be considered exposed to the hazard. Excessive heat can occur at any time during the year but is most dangerous during the summer between June and August when average temperatures are at their highest.

Built Environment Impacts

The impact of excessive heat is most prevalent in developed areas, where the Town lacks a tree canopy. Secondary impacts of excessive heat are severe strain on the electrical power system and potential brownouts or blackouts. Extreme heat can have a negative impact on transportation. Highways and roads are damaged by excessive heat as asphalt roads soften and concrete roads expand and can buckle, crack, or shatter. Moreover, concrete has been known to "explode," lifting chunks of concrete and putting those nearby at serious risk. Stress is also placed on automobile cooling systems, diesel trucks, and railroad locomotives which lead to an increase in mechanical failures. Steel rails are at risk of overheating and warping which can lead to train derailments.

Extreme cold weather poses a significant threat to utility production, which in turn threatens facilities and operations that rely on utilities, specifically climate stabilization. As temperatures drop and stay low, increased demand for heating places a strain on the heating system, which can lead to temporary outages. These outages can impact operations throughout the Town, which can result in interruptions and delays in services. Broken pipes may cause flooding in buildings, causing property damage and loss of utility service. Some of the secondary effects presented by extreme/excessive cold include dangerous conditions to livestock and pets.

Climate change will increase the probability of extreme temperatures which may impact utilities, transportation, and especially older structures. Future development should consider keeping more mature trees, less dark asphalt areas, and more natural areas.

Population Impacts

Extreme cold events are predicted to decrease in the future, while extreme heat days, as well as average temperatures are projected to increase. The projected increase in extreme heat and heat waves is the source of one of the key health concerns related to climate change. 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.

The greatest danger from extreme cold is to people, as prolonged exposure can cause frostbite or hypothermia, and can become life threatening. Body temperatures that are too low affect the brain, making it difficult for the victim to think clearly or move well. This makes hypothermia particularly dangerous for those suffering from it, as they may not understand what is happening to them or what to do about it. Hypothermia is most likely at very cold temperatures but can occur at higher temperatures (above 40 degrees Fahrenheit) if the person exposed is also wet from rain, sweat, or submersion. Warning signs of hypothermia include shivering, exhaustion, confusion, fumbling hands, memory loss, slurred speech, or drowsiness. In infants, symptoms include bright red, cold skin and very low energy. A person with hypothermia should receive medical attention as soon as possible, as delays in medical treatment may result in death.

Older adults are often at elevated risk due to a high prevalence of pre-existing and chronic conditions. In Chester, 26.4% of the population is over age 64. 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. Heat impacts are more likely to be felt by residents without air conditioning, by those who work outdoors, and those with underlying health conditions.

Extreme heat can pose severe and life-threatening problems for people. According to the NWS, it is one of the leading weather-related killers in the United States, resulting in hundreds of fatalities each year and even more heat-related illnesses. Extreme heat has a special impact on the most vulnerable segments of the population - the elderly, young children and infants, impoverished individuals, and persons who are in poor health. The high-risk population groups with specific physical, social, and economic factors that make them vulnerable include:

- Older persons (age > 65)
- Infants (age < 1)
- Homeless population
- Very low- and low-income persons
- People who are socially isolated
- People with mobility restrictions or mental impairments
- People taking certain medications (e.g., for high blood pressure, depression, insomnia)
- People engaged in vigorous outdoor exercise or work or those under the influence of drugs or alcohol.

Climate change will increase the rate of heat illness and need for cool spaces. Outdoor workers and vulnerable populations will need to be considered during extreme heat events.

Environment Impacts

Extreme heat can lead to water quality issues, wildlife concerns, and impact vegetative growth when combined with drought. Other environmental impacts include algae blooms in the surface water. The Town is responsible for monitoring and treating the water to remove the algae blooms. Extreme heat and drought create better conditions for algae blooms to thrive.

Problem Statements for Extreme Temperatures.

Problem statements summarize risk and vulnerability and are included following each hazard profile. The problem statements were developed to bridge the gap between identified hazard and development of the mitigation actions. Problem statements are included in each hazard profile section.

Table 12. Problem Statements for Extreme Temperatures.

Assets	Problems Associated with Extreme Temperatures
People (including underserved communities and socially vulnerable populations)	• Extreme heat will be a significant public health threat to all residents, but especially for vulnerable populations living in older homes or homes without air conditioning. • The elderly and those with mobility issues may not be able to leave their homes and travel safely. • People working in businesses without air conditioning may be at risk of heat illness. • First responders may also be impacted by extreme temperatures. • Pets may be adversely impacted by extreme heat.
Structures (including facilities, lifelines, and critical infrastructure)	• Older homes without insulation and single-pane glass are difficult to heat and cool and may not provide safe living conditions. • Businesses that require refrigerated trucks or refrigeration units may see business losses and increased utility costs. • The electric grid may become stressed and fail during extreme heat events.
Systems (including networks and capabilities)	• Extreme heat mitigation and adaptation has not been fully integrated into existing local plans and regulations for new development, though progress is being made.
Natural, historic, and cultural resources	• Extreme heat may lead to, or exacerbate, impacts to natural systems related to wildfires and invasive species (refer to those sections). • Extreme heat may lead to water quality concerns including algae blooms.
Activities that have value to the community	• Recreational activities may be adversely impacted by extreme heat.

Droughts

Droughts are typically defined as periods of deficient precipitation. How this deficiency is experienced can depend on factors such as land use, the existence of dams, and water supply withdrawals or diversions. Droughts can vary widely in duration, severity, and local impact.

Description

The National Drought Mitigation Center references five common, conceptual definitions of drought:

1. Meteorological drought is a measure of departure of precipitation from normal.
2. Hydrological drought is related to the effects of precipitation shortfalls on stream flows and on reservoir and groundwater levels.
3. Agricultural drought links various characteristics of meteorological and hydrological drought to agricultural impacts and occurs when there is not enough water available for a particular crop to grow at a particular time.
4. Socioeconomic drought is associated with the supply and demand of economic goods with elements of meteorological, hydrological, and agricultural drought.
5. Ecological drought is an episodic deficit in water availability that drives ecosystems beyond thresholds of vulnerability and impacts ecosystem services.

Drought conditions can cause a shortage of water for human consumption and reduce local firefighting capabilities. Public water suppliers may struggle to meet system demands while maintaining adequate pressure for fire suppression and meeting water quality standards. The Massachusetts Department of Environmental Protection (DEP) requires all public water systems (PWSs) to maintain an emergency preparedness plan.

The Chester Water Department provides public drinking water to about half of the Chester residents using the Austin Brook Reservoir with Horn Pond (in the Town of Becket) as a backup supply. Others have private wells which can be vulnerable to droughts. With declining groundwater levels, well owners may experience dry wells or sediment in their water due to the more intense pumping required to pull water from the bedrock or overburden aquifer. Wells may also develop a concentration of pollutants, which may include nitrates and heavy metals depending on local geology.

The loss of clean water for consumption and for sanitation cause significant impacts depending on the affected population's ability to quickly drill a deeper or a new well or to relocate to unaffected areas. During a drought, dry soil and the increased prevalence of wildfires can increase the number of irritants (such as pollen or smoke) in the air. Reduced air quality can have widespread deleterious health impacts but is particularly significant to the health of individuals with pre-existing respiratory health conditions like asthma (Centers for Disease Control [CDC]).

Lowered water levels can result in direct environmental health impacts, as the concentration of contaminants in swimmable bodies of water will increase when less water is present. Harmful algal blooms may occur, closing recreational areas.

One primary hazard in this plan that is commonly associated with drought is wildfire. A prolonged lack of precipitation dries out soil and vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. A drought may increase the probability of a wildfire occurring.

Location

Massachusetts Drought Management Plan (DMP, 2019) assesses drought conditions in seven regions: Western, Connecticut River Valley, Central, Northeast, Southeast, and Cape Cod, and Islands. A regional approach allows customization of drought actions and conservation measures to address situations in each region; and allows for the determination of a drought on a watershed basis. This approach recognizes that parts of Massachusetts can experience significantly different weather patterns due to topography, distance from coastal influence, as well as a combination of regional, national, and global weather patterns. Droughts have the potential to impact the entirety of Chester, which is in the Western region.

Previous Occurrences

The Commonwealth of Massachusetts has never received a Presidential Disaster Declaration for a drought-related disaster. However, several substantial droughts have occurred over the past 100 years. Massachusetts experienced its most significant drought on record in the 1960s. The severity and duration of the drought caused significant impacts on both water supplies and agriculture.

Although short or relatively minor droughts occurred over the 50 years following the drought of the 1960s, the next long-term event began in March 2015 when Massachusetts began experiencing widespread abnormally dry conditions. In July 2016, based on a recommendation from the Drought Management Task Force (DMTF), the Secretary of the Executive Office of Energy and Environmental Affairs (EOEEA) declared a Drought Watch for Central and Northeast Massachusetts and a Drought Advisory for Southeast Massachusetts and the Connecticut River Valley. Drought warnings were issued in five out of six drought regions of the state. Many experts stated that this drought was the worst in more than 50 years. DMTF declared an end to the drought in May 2017 with a return to wetter-than-normal conditions.

The previous edition of this plan includes a narrative description of the Town’s experience during the 2015-2017 drought. The Chester Water Department issued a voluntary water restriction.

Chester has an existing agreement with a local owner of a private water supply for emergency water but a prolonged drought where water must be purchased from other sources, or where reservoir water needs to be more extensively treated due to quality issues, could be expensive for the town.

USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The line items related to droughts in Hampden County are listed below, corresponding to 2014-2016, 2017-2018, and 2020.

Table 13. USDA Disasters Events That Refer to Drought.

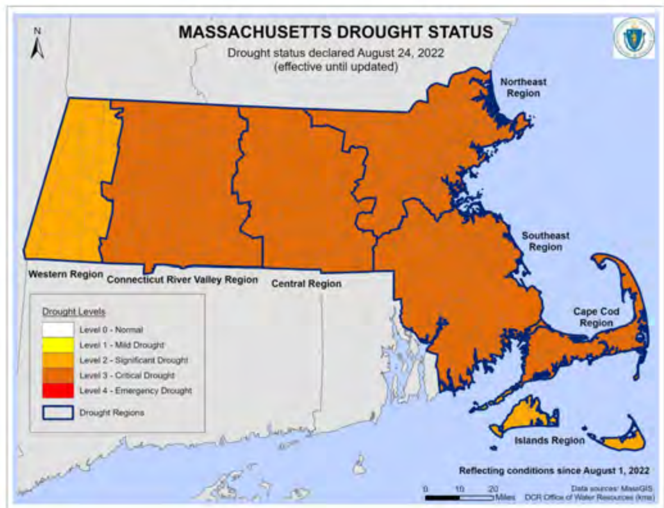
Year	Event	Event "Begin Dates"
2020	Drought	8/18/2020, 9/22/2020, 9/29/2020
2018	Drought	7/17/2018, 8/1/2018
2017	Drought	3/3/2017
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Drought	4/26/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016
2015	Drought	4/1/2015
2014	Drought	7/1/2014

The drought of 2020, a so-called "flashy drought" that impacted southern New England, was sufficiently impactful in Hampden County to be included in the USDA data table above. Flashy droughts are described below under *Extent*.

Applying the same ten-year lookback as the severe storms database review, USDA payments to Massachusetts agricultural sectors for drought impacts associated with events from 2012 through 2023 were reviewed. This timeframe includes the droughts of 2015-2017 and 2020. USDA reimbursements for droughts have not been distributed in Chester.

The severity of a drought depends on the degree of moisture deficiency, duration, spatial extent, and location relative to resources or assets. The drought of the 1960s is the drought of record because duration, spatial extent, moisture deficiency, and impact all contributed to historic levels. In contrast, the severity of the 2016-2017 drought was due to impacts on natural resources (record low stream flows and groundwater levels), many water supplies, farms, and agriculture and to the swift onset of the drought.

The drought of 2022 was ongoing when this plan development commenced, but its severity was alleviated by rainfall in September 2022. At the present time, the drought of 2022 appears to be typical of a flashy drought.



Extent

Drought is defined by a combined look at several indices as detailed in the Massachusetts DMP (EOEEA and MEMA, 2019). The indices are:

- Precipitation: The Standard Precipitation Index, which is widely used, is based on monthly precipitation totals from Massachusetts Department of Conservation and Recreation's (DCR) Precipitation Program and the NWS.
- Streamflow: Is an early indicator of impacts to rivers, streams, wetlands, and other riparian habitats.
- Groundwater: This provides information on impacts over a longer period of time due to groundwater recharge rates.
- Lakes and Impoundments: Captures the effects on surface water including lakes, ponds, water supply, and flood control reservoirs.
- Fire Danger: The Keetch Byram Drought Index indicates fire potential and flammability of organic matter.
- Evapotranspiration: The Crop Moisture Index is used to assess short-term or current conditions of dryness or wetness relative to agricultural crops.

These indices are monitored weekly to generate monthly hydrological conditions report and used to determine the onset, severity, and end of droughts. Five levels of increasing drought severity are defined in the DMP: *Normal, Mild, Significant, Critical,* and *Emergency*. The drought levels are associated with actions outlined in the DMP. Recommendations of drought levels are made by the DMTF to the Secretary of the EEA, who then declares the drought level for each region of the state.

Other entities may measure drought conditions by these or other criteria more relevant to their operations. For example, water utilities may calculate the days of supply remaining. Farmers may assess soil moisture and calculate the water deficit for specific plants to determine irrigation needs or decide to change their crop based on the deficit or harvest early for non-irrigated crops.

The five drought levels in the 2019 DMP provide a basic framework for taking actions to assess, communicate, and respond to drought conditions. Under the “Normal” condition, data are routinely collected, assessed, and distributed. When drought conditions are identified, the four drought levels escalate moving to heightened action, which may include increased data collection and assessment, interagency communication, public education and messaging, recommendations for water conservation measures, and a state of emergency issued by the Governor. At the “Emergency” level, mandatory water conservation measures may be enacted. These regionally declared drought levels and associated state actions are intended to communicate and provide guidance to the public and stakeholders across industries to enable them to respond early and effectively and to reduce impacts. Individual public water suppliers may have their own drought management plan, drought levels, and associated actions, which they may follow at all levels except at the Emergency level when mandatory actions may be required.

NOAA and others are advancing the science of early warning for droughts like the early warnings for floods and earthquakes to better project flashy, or fast-onset, droughts. Based on projected climate change, the distributions of precipitation events will continue to become more extreme, with periods of minimal rain alternating with extreme rain events. Therefore, developing ways to project and adapt to flash droughts may be critical for sectors such as agriculture and water supply.

The Massachusetts Water Resources Commission publishes the hydrologic condition report monthly, which includes the six drought indices and the National Climate Prediction Center’s U.S. Monthly and Seasonal Drought Outlooks. The National Drought Mitigation Center produces a weekly Drought Monitor map. In accordance with the DMP, drought declarations are made monthly.

The Massachusetts drought warning and characterization products are applicable to all droughts that may occur in Chester, as they are used throughout Massachusetts on a routine basis and appropriately characterized previous droughts affecting Chester. Droughts have not occurred that are outside of the framework established in the Massachusetts Drought Management Plan or, more broadly, outside federal resources such as the USGS Drought Monitor.

Probability of Future Events

Climate change will increase the probability of droughts. The Massachusetts Climate Change Assessment notes that the region will experience slight increases in the number of consecutive dry days and the number of days without rain from 2050 onward. By 2090 the number of consecutive dry days per year will increase to 33, compared to the annual statewide baseline of 31 days from 1986 to 2005.

Table 12 summarizes this data and indicates the projected number of consecutive dry days according to the “high” and “low” limits of the Northeast Climate Adaptation Science Center (NE CASC) data. The Town of Chester is represented by the Berkshires and Hilltowns region.

Table 14. Number of Consecutive Dry Days (CDD) and Days without Rain (DWR) per Year.

Region	Baseline		2030		2050		2070		2090	
	CDD	DWR	CDD	DWR	CDD	DWR	CDD	DWR	CDD	DWR
Berkshire and Hilltowns	29	159	29	161	30	165	30	167	31	170
Greater Connecticut River Valley	31	171	31	172	32	175	32	178	33	181
Central	32	180	32	182	32	185	33	188	33	192
Eastern Island	32	186	32	181	32	185	33	188	33	193
Boston Harbor	31	192	31	185	32	192	32	194	33	198
North and South Shores	31	184	31	182	32	187	32	190	33	195
Cape, Islands, and South Coast	31	186	31	182	32	187	32	191	33	194
Statewide	**31**	**176**	**31**	**175**	**31**	**179**	**32**	**182**	**33**	**187**

CDD = Consecutive Dry Days per Year (ResilientMass, Steinschneider & Najibi (2022))
DWR = Days Without Rain per Year (MA Climate Assessment (Commonwealth of Massachusetts, 2022))

These projections suggest that the days without precipitation are likely to increase across the Commonwealth, while the number of consecutive dry days will vary across the state while increasing over the coming decades.

Vulnerability Assessment

Exposure

Drought is a gradual phenomenon, and its condition occurs naturally in a broad geographic area. The entire Town would be exposed to drought conditions.

Built Environment Impacts

Major water users are more susceptible to drought, and these include water utilities and some commercial users.

With an increased probability of drought and drought magnitude, water utilities should consider reviewing or developing extreme drought scenarios.

Population Impacts

Populations considered most vulnerable to drought impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard. Senior and low-income populations are particularly susceptible. The Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Socioeconomic impacts of the drought may also include anxiety and depression about economic impact, health problems associated with poor water quality, fewer recreational activities, higher incidents of heat stroke, and even loss of human life.

With an increased probability of drought and increased drought magnitude, and the potential of increased water costs, vulnerable populations may be more severely impacted in the future.

Environment Impacts

Although agriculture is limited in the Town, there are some natural areas which may be adversely impacted by drought. Drought amplifies the risk of loss of biodiversity and affects animal and plant species. Economic impacts include higher food and lumber prices. Drought can shrink the food supplies of animals and plants dependent on water and damage their habitats. Sometimes the environmental damage caused by a drought is temporary, and other times it is irreversible.

Problem Statements for Drought

Table 15. Problem Statements for Drought.

Assets	Problems Associated with Drought
People (including underserved communities and socially vulnerable populations)	• Vulnerable communities may have difficulty accessing potable water during an emergency drought event. If the water sources are at emergency levels, having a plan to get vulnerable people water should be considered. If rates are increased to lower water

Assets	Problems Associated with Drought
	demand, this may also adversely impact underserved and vulnerable communities. • Private wells may be affected by droughts.
Structures (including facilities, lifelines, and critical infrastructure)	• Water supply infrastructure may need to be shut down and water quality may become substandard. Businesses requiring water for daily operations may have their operations limited due to water restrictions. Possible water quality issues within Horn Pond and Austin Brook Reservoir are a concern. • Age and condition of pipe conduit connecting Horn Pond to Austin Brook Reservoir is a concern.
Systems (including networks and capabilities)	• Outdoor water use restrictions and other water conservation measures during periods of extreme drought can be challenging to enforce, even when mandated through local declaration.
Natural, historic, and cultural resources	• Water quality may be adversely impacted by major droughts.
Activities that have value to the community	• None applicable.

Earthquakes

An earthquake is the vibration of the Earth's surface that follows a release of energy in the Earth's crust. New England experiences intraplate earthquakes because it is located within the interior of the North American plate. Although damaging earthquakes are rare in Massachusetts, low-magnitude earthquakes occur regularly in the state.

Description

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse; disrupt gas, electric, and telephone lines; and often cause landslides, flash floods, fires, avalanches, and tsunamis. Earthquakes can occur at any time without warning.

The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. Earthquakes are described based on their magnitude and intensity as explained below under *Extent*.

New England's earthquakes appear to be the result of the cracking of the crustal rocks due to compression as the North American Plate is being very slowly squeezed by the global plate movements. As a result, New England epicenters do not follow the major mapped faults of the region, nor are they confined to particular geologic structures or terrains. Because earthquakes have been detected all over New England, seismologists suspect that a strong earthquake could be centered anywhere in the region. Furthermore, the mapped geologic faults of New England currently do not provide any indications detailing specific locations where strong earthquakes are most likely to be centered.

In addition to earthquakes occurring within the Commonwealth, earthquakes in other parts of New England can impact widespread areas. Large earthquakes in Canada, which is more seismically active than New England, can affect buildings in Massachusetts. This is due in part to the fact that earthquakes in the eastern U.S. are felt over a larger area than those in the western U.S. The difference between seismic shaking in the East versus the West is primarily due to the geologic structure and rock properties that allow seismic waves to travel farther without weakening (United States Geological Survey [USGS], 2012).

In some places in New England, including locations in Massachusetts, small earthquakes seem to occur with some regularity. In articles appearing in 2016, John Ebel Ph.D., a Senior Research Scientist at the Weston Observatory, was quoted as saying "The Acton, Boxborough and Littleton areas are actually sporadically active… We tend to get a small earthquake once every three-to-five years." It is not clear why some localities experience such clustering of earthquakes, but clusters may indicate locations where there is an increased likelihood of future earthquake activity.

Location

Given the above discussion, the potential exists for earthquakes to occur within Chester or to occur elsewhere and be felt in Chester.

Previous Occurrences

According to the previous edition of this plan, no documented earthquakes have been centered in the Town of Chester. The largest earthquake since 1900 to strike Massachusetts was a magnitude 3.9 located east of the Quabbin Reservoir in 1994. Two recent earthquakes with epicenters close to the Berkshires included a magnitude 3.3 in the area around Westfield in 2000, and a magnitude 1.9 in the area around Northampton in 2012. To the west, a magnitude 3.1 struck in the Catskills region of New York in 2009.

To determine whether earthquakes have occurred more recently near or in Chester, all events listed by Weston Observatory were reviewed for all towns in Massachusetts since the date of last edition of this plan. Listed earthquakes above magnitude 2.0 include the following very minor earthquakes, and none were near Chester:

- 12/21/18 – 3 km WSW of Gardner, MA, 2.1/2.1 [Mn*/Mc**]
- 8/21/19 – 2 km SSE of Wareham, MA, 1.7/2.4
- 12/3/19 – 4 km SSE of Plymouth, MA, 1.6/2.2
- 11/8/20 – 11 km SW of New Bedford, MA, 3.8/3.4
- 11/22/20 – 12 km WSW of New Bedford, MA, 1.7/2.6
- 7/25/21 – 5 km W of Peabody, MA, 1.4/2.5
- 1/1/22 – 13 km N of Rockport, MA, 2.3/3.0
- 3/4/22 – 5 km WSW of Orange, MA, 2.2/2.7
- 3/19/22 – 36 km ENE of Rockport, MA, 1.4/2.2

*Mn is the Nuttli Magnitude (see *Extent* below)
**Mc is the Coda Duration Magnitude (see *Extent* below)

A magnitude 4.8 earthquake in New Jersey on April 5, 2024, was felt in Massachusetts. Residents in the region reporting feeling the earthquake as well as a strong aftershock later in the day.

Extent

Magnitude is an estimate of the relative size or strength of an earthquake and is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of earthquake waves recorded on instruments that have a common calibration. The magnitude of an earthquake is thus represented by a single instrumentally determined value recorded by a seismograph, which records the varying amplitude of ground oscillations.

The Richter scale was developed in 1935 and was used exclusively until the 1970s. The scale set the magnitude of an earthquake based on the logarithm of the amplitude of recorded waves. Being logarithmic, each whole number increase in magnitude represents a tenfold increase in measured strength. Earthquakes with a magnitude of about 2.0 or less are usually called "microearthquakes" and are generally only recorded locally. Earthquakes with magnitudes of 4.5 or greater are strong enough to be recorded by seismographs all over the world.

As more seismograph stations were installed around the world following the 1930s, it became apparent that the method developed by Richter was valid only for certain frequency and distance ranges, particularly in the southwestern United States. New magnitude scales that are an extension of Richter's original idea were developed for other areas. In particular, the Moment magnitude scale (Mw) was developed in the 1970s to replace the Richter scale and has been in official use by the USGS since 2002.

According to USGS, these multiple methods are used to estimate the magnitude of an earthquake because no single method is capable of accurately estimating the size of all earthquakes. Some magnitude types are calculated to provide a consistent comparison to past earthquakes, and these scales are calibrated to the original Richter scale. However, differences in magnitude of up to 0.5 can be calculated for the same earthquake through different techniques. In general, Moment magnitude provides an estimate of earthquake size that is valid over the complete range of magnitudes and so is commonly used today.

Although Moment magnitude is the most common measure of earthquake size for medium and larger earthquakes, the USGS does not calculate Mw for earthquakes with a magnitude of less than 3.5 which is the more common situation for Massachusetts. Localized Richter scales or other scales are used to calculate magnitudes for smaller earthquakes.

Regionally, the Weston Observatory utilizes two scales to track the magnitude of earthquakes. These include the Nuttli magnitude (Mn) for North America east of the Rocky Mountains and is more appropriate for the relatively harder continental crust in Connecticut compared to California. Weston Observatory also utilizes the Coda Duration magnitude (Mc), which is based on the duration of shaking at a particular station. The advantages of the Coda Duration magnitude are that this method can quickly estimate the magnitude before the exact location of the earthquake is known.

The effect of an earthquake on the earth's surface is called the intensity. The Modified Mercalli Intensity Scale consists of a series of key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It is an arbitrary ranking based on observed effects.

Table 16. Modified Mercalli Intensity.

Modified Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.

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

Source: USGS

A comparison of Richter magnitude to typical Modified Mercalli intensity is presented below.

Table 17. Modified Mercalli Intensity and Moment Magnitude.

Moment Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 to 3.0	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX

Moment Magnitude	Typical Maximum Modified Mercalli Intensity
7.0 and above	VIII or higher

Source: USGS

The above earthquake characterization systems are applicable to all earthquakes that may occur in Chester, as they are used throughout the northeastern United States on a routine basis and appropriately characterized previous earthquakes that were felt in Chester. Earthquakes have not occurred that are outside of the Richter, Moment Magnitude, and Mercalli scales.

Probability of Future Events

Earthquake location and magnitude probabilities are exceptionally difficult to predict in Massachusetts. Minor earthquakes are relatively common in New England, but damaging earthquakes are not. Therefore, USGS instead characterizes the probability of ground acceleration rather than estimating a probability of magnitude. The Seismic Hazard Map for the state of Massachusetts (USGS) shows a peak ground acceleration of 8% to 10% of gravity in Chester having a 2% probability of being exceeded in 50 years.

Vulnerability Assessment

Exposure

A major earthquake could cause severe damage to buildings in Chester, including older structures that were built before a 1975 law requiring new buildings to withstand earthquakes. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

Built Environment Impacts

Historic data for earthquake events indicate that between 1991 and 2023, no major (>5.0 magnitude) earthquakes were recorded in Hampden County during this period, causing no damage to property. The entire built environment of Chester is vulnerable to earthquakes. Older, unreinforced masonry buildings are very susceptible to earthquakes.

To identify built environment impacts to the Town, FEMA's risk assessment software, Hazus, was implemented. The economic loss results of the 1500-year event are shown in Table 18 while the results for the 2500-year event are shown in Table 19. The Town's Average Annual Loss (AAL) is modeled to be $2,370.

Table 18. Building Loss for a 1500-Year Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	0.38	0.10	0.17	**0.65**
Content Loss	0.10	0.03	0.07	**0.20**
Business Inventory Loss	0.00	0.00	0.00	**0.00**
Business Income Loss	0.01	0.04	0.00	**0.05**
Business Relocation Loss	0.02	0.02	0.04	**0.08**
Rental Income Loss	0.04	0.02	0.01	**0.07**
Wage Loss	0.02	0.03	0.02	**0.07**
Total	**0.57**	**0.24**	**0.31**	**1.12**

Table 19. Building Loss for a 2500-Year Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	0.81	0.20	0.36	**1.37**
Content Loss	0.23	0.07	0.16	**0.46**
Business Inventory Loss	0.00	0.01	0.01	**0.02**
Business Income Loss	0.02	0.06	0.00	**0.08**
Business Relocation Loss	0.05	0.03	0.07	**0.15**
Rental Income Loss	0.07	0.03	0.02	**0.12**
Wage Loss	0.04	0.05	0.04	**0.13**
Total	**1.22**	**0.45**	**0.66**	**2.33**

Population Impacts

Populations considered most vulnerable to earthquake impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Senior and low-income populations are particularly susceptible. The Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Hazus was used to model injuries and fatalities for the 1500- and 2500-year events. For the 1500-year event, there are fewer than 5 injuries and no injuries requiring medical attention. For the 2500-year event there are up to 5 minor injuries with no injuries requiring medical attention.

Environment Impacts

The environment may be impacted by cascading impacts from the earthquake, such as a truck accident or train derailment caused by track or road damage, landslide, or dam breach. This could result in a hazardous material release.

Problem Statements for Earthquakes

Table 20. Problem Statements for Earthquakes.

Assets	Problems Associated with Earthquakes
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations located in unreinforced masonry structures may sustain injuries. • Elderly people may fall during events.
Structures (including facilities, lifelines, and critical infrastructure)	• Unreinforced masonry and utility lifelines impacted. • Utility systems impacted.
Systems (including networks and capabilities)	• None apparent or projected.
Natural, historic, and cultural resources	• Historical buildings constructed out of unreinforced masonry are susceptible and may be impacted.
Activities that have value to the community	• None apparent or projected.

Flooding from Precipitation and Dam Overtopping

The Town of Chester Community Resilience Building Workshop Summary of Findings (2021) lists "rainfall and flooding" as one of the top hazards of concern.

Nationally, flooding causes more damage annually than any other severe weather event. Flooding in Massachusetts is often the direct result of frequent weather events such as coastal storms, nor'easters, tropical storms, hurricanes, heavy rains, and snowmelt. Increases in precipitation and extreme storm events will result in increased inland flooding. Common types of flooding are described below.

Description

River and Stream Flooding: River and stream flooding often occurs after heavy rain. Areas of the state with high slopes and minimal soil cover (such as found in western Massachusetts) are particularly susceptible to flash flooding caused by rapid runoff that occurs in heavy precipitation events and in combination with spring snowmelt, which can contribute to riverine flooding. Frozen ground conditions can also contribute to low rainfall infiltration and high runoff events that may result in riverine flooding. Some of the worst riverine flooding in Massachusetts' history occurred because of strong nor'easters and tropical storms in which snowmelt was not a factor. Tropical storms can produce very high rainfall rates and volumes of rain that can generate high runoff when soil infiltration rates are exceeded.

Floodplains are the low, flat, and periodically flooded lands adjacent to rivers, lakes, and oceans. These areas are subject to geomorphic and hydrologic processes. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined. These areas form a complex physical and biological system that supports a variety of natural resources and flood storage.

Drainage-Related Flooding: Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and adjacent properties. They make use of a conveyance system that channels water away from a developed area to surrounding streams, bypassing natural processes of water infiltration into the ground, groundwater storage, and evapotranspiration. Flooding from overwhelmed drainage entails floods caused by increased water runoff due to development and drainage systems that are not capable of conveying high flows. Since drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding can occur more quickly and reach greater depths than if there were no urban development at all. In almost any community with some degree of development, basement, roadway, and infrastructure flooding can result in significant damage due to poor or insufficient stormwater drainage.

Dam Overtopping: Dam overtopping is caused by floods that exceed the capacity of the dam, and it can occur as a result of inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors. Overtopping accounts for one-third of all dam failures in the U.S. The two primary types of dam failure are catastrophic failure (characterized by the sudden, rapid, and uncontrolled release of impounded water) and design failure (which occurs as a result of minor overflow events). There are a number of ways in which climate change could alter the flow behavior of a river, causing conditions to deviate from what a dam was designed to handle. For example, more extreme precipitation events could increase the frequency of intentional discharges. Many other climate impacts, including shifts in seasonal and geographic rainfall patterns, could also cause the flow behavior of rivers to deviate from previous hydrographs. When flows are greater than expected, spillway overflow events (often referred to as "design failures") can occur. These overflows result in increased discharges downstream and increased flooding potential. Therefore, although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

<u>Beaver Dams</u>: Additional causes of flooding include beaver dams. Beaver dams obstruct the flow of water and cause water levels to rise. Significant downstream flooding can occur if beaver dams break.

<u>Ice Jam</u>: An ice jam is an accumulation of ice that acts as a natural dam and restricts the flow of a body of water. A freeze-up jam usually occurs in early winter to midwinter during extremely cold weather when supercooled water and ice formations extend to nearly the entire depth of the river channel. This type of jam can act as a dam and begin to back up the flowing water behind it. A breakup jam, forms as a result of the breakup of the ice cover at ice-out, causing large pieces of ice to move downstream, potentially piling up at culverts, around bridge abutments, and at curves in river channels. Breakup ice jams occur when warm temperatures and heavy rains cause rapid snowmelt. The melting snow, combined with the heavy rain, causes frozen rivers to swell. The rising water breaks the ice layers into large chunks, which float downstream and often pile up near narrow passages and obstructions (bridges and dams). Ice jams may build up to a thickness great enough to raise the water level and cause flooding upstream of the obstruction.

<u>Secondary Hazards</u>: The most problematic secondary hazards for flooding are fluvial erosion, riverbank erosion, and landslides affecting infrastructure and other assets located within floodplains. Without the space required along river corridors for natural physical adjustment, such changes in rivers after flood events can be more harmful than the actual flooding. The impacts from these secondary hazards are especially prevalent in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging buildings, and structures closer to the river channel or cause them to fall in. Landslides can occur following flood events when high flows oversaturate soils on steep slopes, causing them to fail. These secondary hazards also affect infrastructure.

Roadways and bridges are impacted when floods undermine or wash out supporting structures. Dams may fail or be damaged, compounding the flood hazard for downstream communities. Failure of wastewater treatment plants from overflow or overtopping of hazardous material tanks and the dislodging of hazardous waste containers can occur during floods as well, releasing untreated wastewater or hazardous materials directly into storm sewers, rivers, or the ocean. Flooding can also impact public water supplies and the power grid in similar ways, through inundation and/or erosion.

Location

Heavy rainfall events occur regularly in Massachusetts. As a result, inland flooding such as riverine and drainage-related flooding affect most of the communities in the Commonwealth, including Chester. A few dams are located in and upstream of Chester. Ice jams have reportedly occurred adjacent to Chester along the Middle Branch Westfield River, Westfield River, and Sykes Brook. Therefore, all flood-related hazards (riverine floods, stormwater flooding, dam overtopping, and ice jams) are relevant to the Town of Chester.

The previous edition of this plan includes a concise but detailed description of the locations where flood risks are present. This narrative is presented below:

- Because of Chester's location amid steep slopes and mountains, floodplains can become quickly inundated in heavy rains. Dams located upstream also have an impact on flooding levels; in 2011 the release of upstream dams had a detrimental impact on flooding in downtown Chester.
- Recreational ponds and privately owned dams upstream of Chester have historically had uncoordinated water releases which have resulted in heavy flooding in the Town. Campgrounds have been evacuated.
- There has been flooding on Main Street, Middlefield Road, Johnson Hill Road, Abbot Road, Riverfront Road, Old State Road, Maple Avenue, Maple Street, and Andrews Avenue.

Previous Occurrences

Floods

The Westfield River at Huntington USGS stream gauge #01181000 is located on the West Branch of the Westfield River and reflects some of the flood events experienced in the Town of Chester. The flood event of record with the highest water level was the flood on August 28, 2011, with a gage height of 16.78 feet and a stream flow 32,400 cubic feet per second (cfs). Gage height values above 9 feet are considered flood conditions. Flood conditions have occurred in 1936, 1938, 1949, 1951, 1955, 1956, 1969, 1972, 1974, 1980, 1981, 1984, 1987, 1990, 2005, 2006, 2007, 2011, and 2021.

Since the previous edition of this plan, the water level at the gauge has exceeded flood stage once in 2021.

The previous edition of this plan includes narratives about areas of flooding:

- The most recent large flood event to occur in Chester was Tropical Storm Irene in August 2011. Recreational ponds and privately owned dams upstream were uncoordinated in their releases, resulting in heavy flooding in town. Sidewalks were washed out, bridges were damaged (including the water lines spanning them), and campgrounds had to be evacuated. In addition, the Route 8 and Route 20 intersection was flooded as well as the sidewalk and two water lines on Route 20 were flooded. Route 20 had to be rebuilt.
- In 2003, there was significant flooding on Main Street, Middlefield Road, Riverfront Road, Old State Road, Maple Avenue, Maple Street, and Andrews Avenue.
- On February 24-25, 2016, 2.32" inches of rain fell in a single overnight storm event. Flooding occurred on Abbot Road, Johnson Hill Road, Cooper Street, Prospect Street, Middlefield Street, and Soisalo Road. Several dirt roads washed out and a state of emergency was declared.

As noted earlier, this plan update relies primarily on a roughly ten-year lookback (2014 through 2023). The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists two flood events impacting the Chester area for the period 2014-2023.

Table 21. NCEI Severe Storm Database Entries Covering Floods in Chester.

Date	Description	Losses Reported
2/25/16	*Flood.* Low pressure tracked north through New York bringing a warm front through southern New England. Unseasonably deep moisture accompanied this front. This was a very complicated weather situation as a strong low level inversion was in place over the area with a very strong low level jet just above the inversion. As showers and thunderstorms developed, the storms and heavy rain allowed the stronger winds to mix down to the surface. In other areas, temperatures warmed enough at the surface to break the inversion and allow the stronger winds to mix down. This resulted in a complicated combination of severe thunderstorm winds and high winds. To add to the historical nature of this event, it occurred in February all during the overnight hours. Portions of Abbott Hill Road were washed away. One mile north of Old Chester Road, a portion of Skyline Trail was washed out.	---
7/10/23	*Flood.* An anomalously amplified mid-level trough moving east from the Great Lakes closed off and brought widespread showers and scattered thunderstorms which lead to flooding in western and	$1.5 million in other communities

Date	Description	Losses Reported
	central Massachusetts. Many roads were closed, and cars were stuck in flood waters. In Chester, Blandford Rd at Rt 20 was closed due to flooding.	

Ice Jams

Ice jams are known to have occurred near Chester. According to the U.S. Army Corps of Engineers Ice Jam database, there have been 29 ice jam events in towns adjacent to Chester. These occurred on the West Branch of the Westfield River, Sykes Brook, and Middle Branch of the Westfield River. An event in January of 1994 on the Middle Branch of the Westfield River caused damage to a home and bridge in Middlefield. This was the only event which caused recorded damage.

Dam Overtopping

Dams upstream of Chester and in Chester have not overtopped. However, according to Town staff, rain from Hurricane Irene caused the private dam operators to make an unplanned release which flooded areas downstream in Chester.

Extent

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the "100-year discharge" has a 1 percent chance of being equaled or exceeded in any given year. The "annual flood" is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The 1% annual chance flood is the standard used by most federal and state agencies. It is used by the National Flood Insurance Program (NFIP) to guide floodplain management and determine the need for flood insurance. The extent of flooding associated with a 1% annual probability of occurrence (the base flood or 100-year flood) is called the 100-year floodplain, which is used as the regulatory boundary by many agencies. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. The term "500-year flood" is the flood that has a 0.2% chance of being equaled or exceeded each year. Base flood elevations and the boundaries of the 1% annual chance (100-year) and the 0.2% annual chance (500-year) floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principal tools for identifying the extent and location of the flood hazard.

Both the 100-year and the 500-year floodplains are determined based on past events. As a result, the flood maps do not reflect projected changes in precipitation events.

Flooding in Massachusetts is forecast and classified by the National Weather Service (NWS) Northeast River Forecast Center as minor, moderate, or severe based upon the types of impacts that occur. Minor flooding is considered “disruptive” flooding that causes impacts such as road closures and flooding of recreational areas and farmland. Moderate flooding can involve land with structures becoming inundated. Major flooding is a widespread, life-threatening event. River forecasts are made at many locations in the state containing USGS river gauges with established flood elevations and levels that correspond to each of the degrees of flooding.

Due to the pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Flash flooding, which occurs when excessive water fills either normally dry creeks or riverbeds or dramatically increases the water surface elevation on currently flowing creeks and rivers, can be less predictable. However, potential hazard areas can be warned in advance of potential flash-flooding danger. Flooding is more likely to occur due to a rainstorm when the soil is already wet and/or streams are already running high from recent previous rains. NOAA’s Northeast River Forecast Center provides flood warnings for Massachusetts, relying on monitoring data from the USGS stream gauge network. Notice of potential flood conditions is generally available several days in advance. State agency staff also monitor river, weather, and forecast conditions throughout the year. Notification of potential flooding is shared among state agency staff, including the Massachusetts Emergency Management Agency (MEMA) and the Office of Dam Safety. The NWS provides briefings to state and local emergency managers and provides notifications to the public via traditional media and social networking platforms.

The FEMA flood products and the NWS warning products are applicable to all floods that may occur in Chester, as they are used throughout Massachusetts on a routine basis and appropriately characterized previous floods in Chester. Floods have not occurred that are outside of the FEMA flood characterization framework or the NWS watch/warning systems for floods.

Probability of Future Events

Although it can be complex to forecast, scientists expect that there will be an overall increase of precipitation on an annual basis across Massachusetts. It is expected that precipitation patterns will become more variable over time, with fewer days with precipitation, but heavier and more intense events when it does rain or snow. Most areas across the state are expected to have small increases in annual total precipitation, but a substantial change in seasonal precipitation patterns.

Climate change will increase the probability of flooding caused by intense precipitation. The National Climate Assessment and NCEI both project more fall, winter, and spring precipitation as well as more intense precipitation. As noted in the ResilientMass Plan, extreme river flow events are projected to increase, elevating the probability of damaging floods. In addition, smaller flood events are likely to occur more frequently. For example, the current 24-hour 10-year storm (about 3 inches) could double in frequency by 2050 in western and central Massachusetts and triple in frequency in coastal regions.

Vulnerability Assessment

Exposure

In Chester, the 1% annual chance floodplain (100-year floodplain) covers about 1,343 acres, or approximately 5.6 percent of Chester. In addition to the 100- year floodplains, stormwater has the potential to cause localized flooding.

The fire station on Route 20 and the Village Center on Main Street are exposed to flooding. Additionally, Chester Elementary School and the Town Hall are adjacent to the floodplain and may be impacted during a flood event. There are approximately 292 buildings in the floodplain including all building occupancies. A privately-owned campground and historical cemeteries are also in the floodplain. Additionally, several roads experience flooding including Main Street, Middlefield Road, Johnson Hill Road, Abbot Road, Riverfront Road, Old State Road, Maple Avenue, Maple Street, and Andrews Avenue. There are several culverts which are older and undersized which can contribute to flood impacts. The railroad also crosses the floodplain and may be impacted. There are 128 structures listed on the National Register of Historic Places in the floodplain. According to EPA's Toxic Release Inventory (TRI) database, there are four facilities which contain hazardous materials in the 100-year floodplain: Abrasive Industries Inc., Ritchie's Garage, and Lafond Construction Inc. Table 22 shows the types of buildings exposed to the flood and their value. The number in parathesis shows the total number of buildings and building values for the Town.

Table 22. Buildings in 100-Year Floodplain.

Building Type	Number of Buildings in 100-Year Floodplain (Total in Town)	Building Value in 100-Year Floodplain (Total in Town)
Single Family	184 (923)	$23,436,000 ($150,508,800)
Mobile Home	0 (15)	$0 ($1,427,500)
Multi-Family	22 (42)	$3,848,700 ($7,663,200)
Mixed-Use	20 (202)	$3,341,500 ($38,670,400)

Building Type	Number of Buildings in 100-Year Floodplain (Total in Town)	Building Value in 100-Year Floodplain (Total in Town)
Commercial	32 (52)	$9,981,100 ($15,574,300)
Agricultural	2 (29)	$32,000 ($533,500)
Educational	1 (1)	$4,900,000 ($4,900,000)
Government	1 (9)	$144,000 ($895,400)
Religious/Non-Profit	9 (26)	$1,809,700 ($5,143,900)
Industrial	7 (13)	$1,155,200 ($2,044,900)
Garage/Outbuilding	11 (22)	$146,460 ($259,450)
Vacant	3 (48)	$105,000 ($1,486,000)
Total	**292 (1,382)**	**$48,794,660 ($227,621,350)**

The population exposed to the 100-year floodplain is shown in Table 23. The column on the left shows the population in and around the floodplain (wherever the Census Block overlapped with the floodplain boundary) while the column on the right shows the total population numbers for the Town. The population exposed to the flood hazard is similar to that in the Town as a whole with a slightly higher percentage of lower income households in the floodplain.

Table 23. Population Exposed to 100-Year Floodplain (2020 U.S. Census).

Demographics	Population in and Adjacent to 100-Year Floodplain	Total Population
Population	917	1,228
Households	477	622
White	834 (90.9%)	1,117 (91.0%)
Black	3 (0.3%)	3 (0.2%)
American Indian	7 (0.8%)	9 (0.7%)
Asian	2 (0.2%)	3 (0.2%)
Pacific Islander	0 (0.0%)	0 (0.0%)
Other Race	16 (1.7%)	19 (1.5%)
Two or More Races	55 (6.0%)	77 (6.4%)
Hispanic or Latino:	34 (3.7%)	51 (4.2%)
Population under 18:	227 (24.8%)	308 (25.1%)
Population over 64:	144 (15.7%)	193 (15.7%)
Annual Income < $30K/year	76 (15.9%)	96 (15.4%)
Population in EJ Zone*	0 (0.0%)	0 (0.0%)

**Massachusetts Office of Energy and Environmental Affairs, 2022*

The 100-year Floodplain (FEMA) with the Town's critical facilities is shown in Figure 18. The fire station on Route 20 and the Village Center on Main Street are exposed are exposed to flooding. Train tracks do cross the 100-year floodplain and may be vulnerable to flooding.

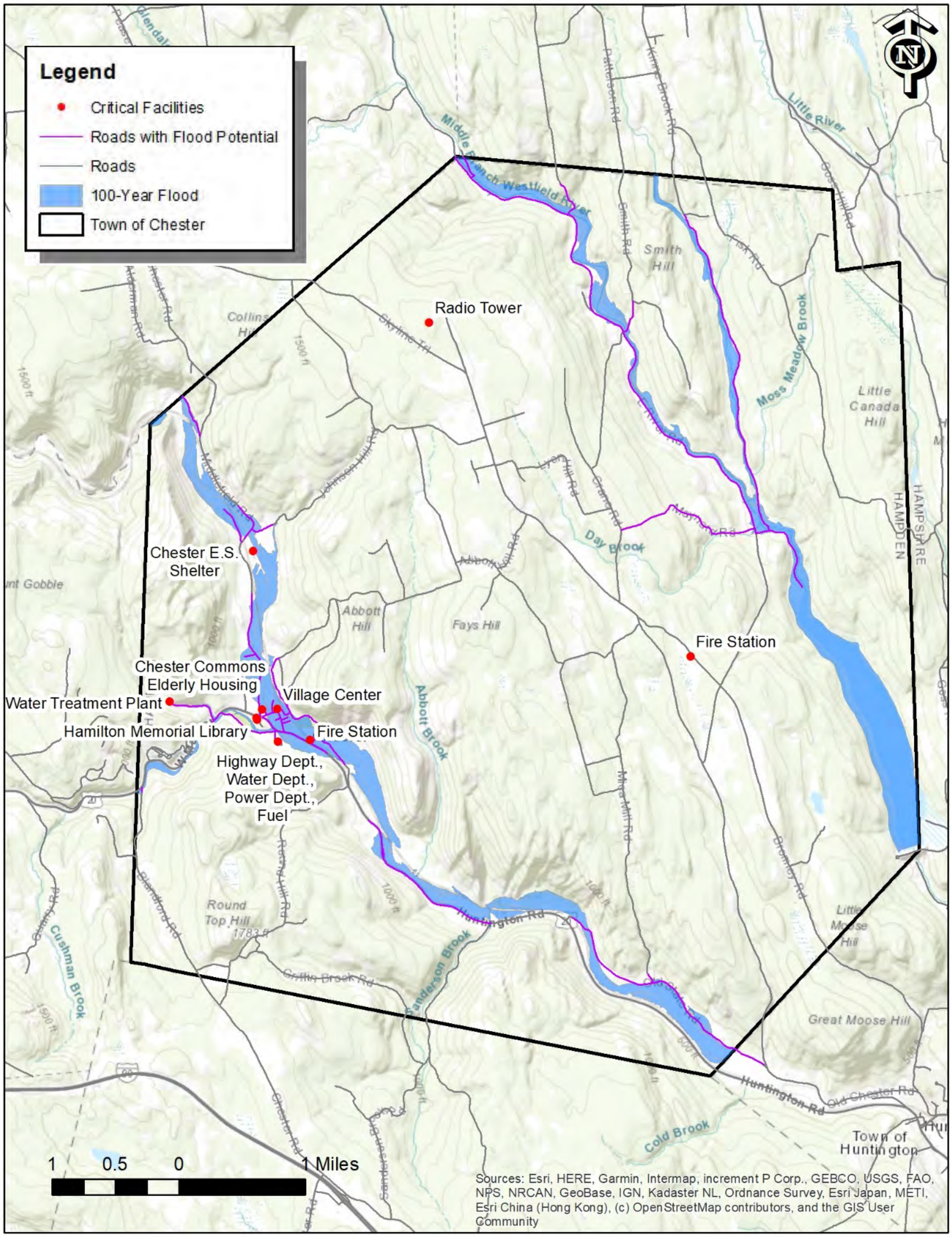


Figure 17. Chester Critical Facilities and 100-Year Floodplain.

Although dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control, they also pose a potential risk to lives and property. Dam failure is not a common occurrence, but dams do represent a potentially disastrous hazard. When a dam fails, the potential energy of the stored water behind the dam is instantly released, oftentimes with catastrophic consequences as the water rushes in a torrent downstream flooding an area known as an "inundation area." The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

There is one high hazard dam on the eastern border of Chester in Huntington and two smaller dams in Chester, Water Works Dam (also known as the Austin Brook Dam) and the privately-owned Ideal Lodge Dam. The high hazard dam would not impact Chester if breached. It would lower the water level in Littleville Lake. However, there are three other high hazard, and five significant hazard dams located in adjacent towns. The Robin Hood Lake Dam is privately-owned and is a dam-breach risk to Chester. The high hazard dams in Huntington do not pose a threat to Chester since the water flows away from Chester. Table 24 identifies the dams within the Town.

Table 24. Dams in Vicinity.

Name	Ownership	Hazard Type
Chester Water Works Dam (Chester)	Public	N/A
Ideal Lodge Dam (Chester)	Private	N/A
Black Brook Dam (Blandford)	Public	High
Indian Lake Dam (Becket)	Private	High
Knightville Dam (Huntington)	Public	High
Littleville Lake Dam (Huntington)	Public	High
Center Pond Dam (Becket)	Private	Significant
Chimney Corners Pond Dam (Becket)	Private	Significant
Crystal Pond Dam (Becket)	Private	Significant
Little Robin Hood Lake Dam (Becket)	Private	Significant
Robin Hood Lake Dam (Becket)	Private	Significant

The Town's dams are shown in Figure 18. Additionally, there are several beaver dams which may cause issues in the Town if breached.

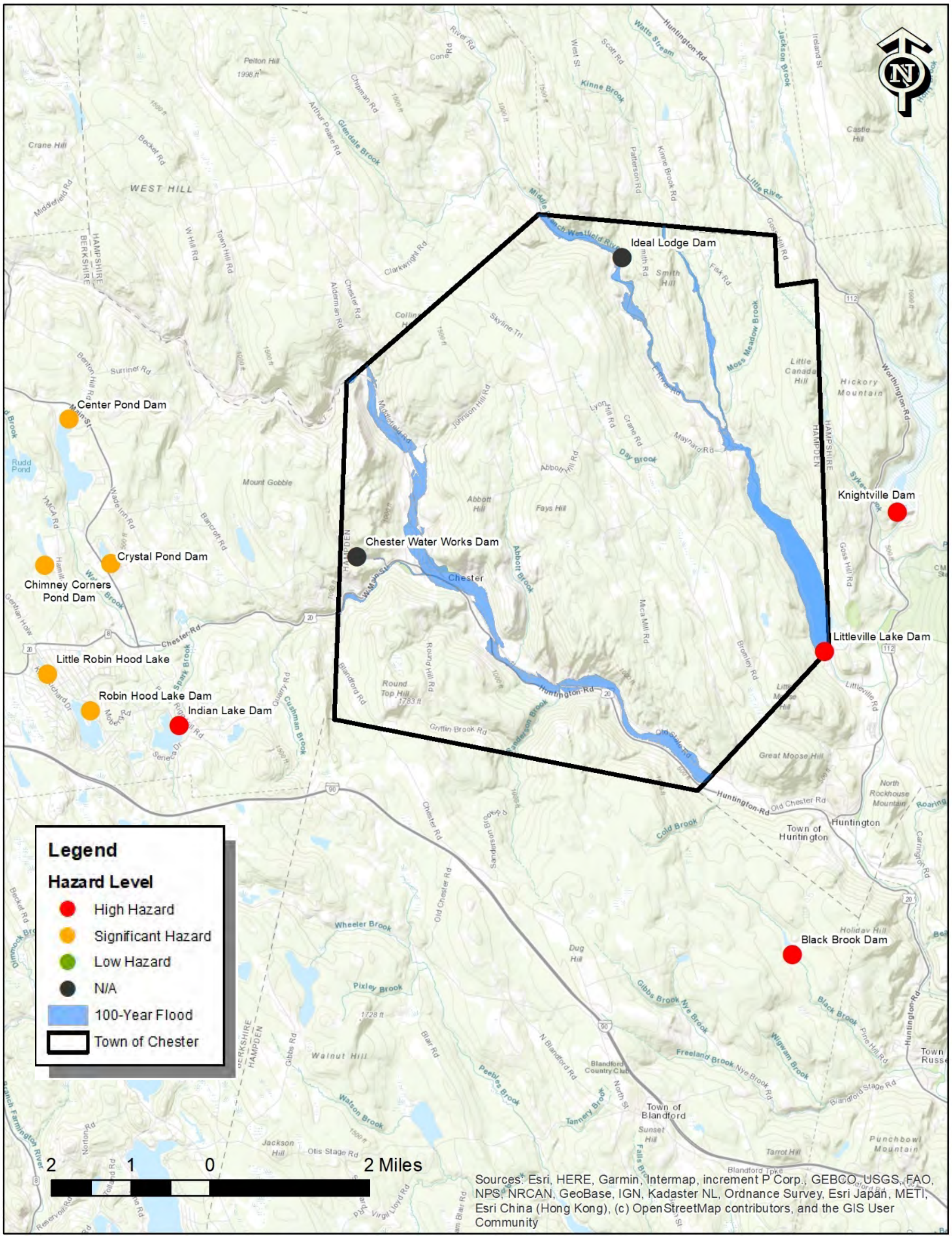


Figure 18. Chester Dam Locations.

Built Environment Impacts

To identify built environment impacts to the Town, FEMA's risk assessment software, Hazus, was implemented. Building footprint data and parcel data was used to update the model while the latest floodplain was also integrated into the software. The economic loss results of the 100-year event are shown in Table 25. The Town's Average Annual Loss (AAL) is calculated to be $664,400.

Table 25. Building Loss for the 100-Year Flood Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	4.49	1.46	2.09	**8.04**
Content Loss	1.97	4.21	10.09	**16.27**
Business Inventory Loss	0.00	0.51	0.78	**1.29**
Business Income Loss	0.00	4.42	1.51	**5.93**
Business Relocation Loss	1.53	0.75	1.32	**3.60**
Rental Income Loss	0.55	0.56	0.36	**1.47**
Wage Loss	0.00	3.82	26.02	**29.84**
Total	**8.54**	**15.73**	**42.17**	**66.44**

Climate change will increase the probability and magnitude of flood impacts to the built environment. Future floodplains may be larger than the current FEMA modeled floodplain and new development, including the Enclave development should consider these projected conditions. These new developments may cause additional stormwater issues which should be considered too.

Population Impacts

The Town should be aware that senior and low-income segments of Chester's population may be more vulnerable to hazard events due to a number of factors. Senior and low-income populations may be physically or financially unable to react and respond to a hazard event and require additional assistance. Access to information about the hazard event may be lacking, as well as access to transportation in the case of an evacuation. The location and construction quality of housing can also pose a significant risk. The Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Using the Hazus software, the 100-year flood scenario results showed that there would be approximately 91 displaced households and 12 people seeking public shelter.

Climate change will increase the probability and magnitude of flood impacts to the population. Future floodplains may be larger than the current FEMA modeled floodplain and new development should consider these projected conditions. Vulnerable populations should be considered when development near the current floodplain is planned.

Environment Impacts

One of the major environmental impacts of a major flood would be the potential release of hazardous materials. According to EPA's Toxic Release Inventory (TRI) database, there are four facilities which contain hazardous materials in the 100-year floodplain: Abrasive Industries Inc., Ritchie's Garage, and Lafond Construction Inc. Additionally, there are several facilities which contain hazardous materials that are adjacent to the floodplain.

Climate change will increase the probability and magnitude of flood impacts which may include environmental impacts due to hazardous materials release. Facilities which contain hazardous materials should be considered when new development is planned.

Problem Statements for Flood

Table 26. Problem Statements Related to Flooding.

Assets	Problems Associated with Flood
People (including underserved communities and socially vulnerable populations)	• Older populations in the floodplain may have difficulty evacuating. • The Village Center is exposed to the 100-year floodplain while the Elementary School and Town Hall have properties adjacent to the floodplain and operations may be impacted. Roads to and from the school could be impacted by flood water.
Structures (including facilities, lifelines, and critical infrastructure)	• The fire station is exposed to the floodplain. • There are approximately 292 buildings in the floodplain including all building occupancies. • The railroad is exposed to the flood hazard and several roads experience flooding including Main Street, Middlefield Road, Johnson Hill Road, Abbot Road, Riverfront Road, Old State Road,

Assets	Problems Associated with Flood
	Maple Avenue, Maple Street, and Andrews Avenue. There are several culverts which are older and undersized which can contribute to flood impacts. • Chester may experience flooding from a dam breach in Becket which could impact critical facilities and other structures downstream.
Systems (including networks and capabilities)	• Road closures may interrupt community systems during a flood event. • The Town is currently precluded from adopting higher regulatory standards to protect against flooding (must comply with State Building Code).
Natural, historic, and cultural resources	• According to EPA's Toxic Release Inventory (TRI) database, there are some facilities which contain hazardous materials in the 100-year floodplain including Abrasive Industries Inc., Ritchie's Garage and Lafond Construction Inc. • There are over 100 historic structures and sites listed on the National Register of Historic Places in the floodplain.
Activities that have value to the community	• Several road closures may disrupt community events. • Events at town hall and the school may be interrupted and cancelled during a flood event.

Hurricanes and Tropical Storms

Flooding in Massachusetts is often the direct result of tropical storms and hurricanes. These powerful storms can also cause significant widespread damage due to high winds. The impacts from high winds are the primary concern of this section.

> The Town of Chester Community Resilience Building Workshop Summary of Findings (2021) lists "wind" as one of the top hazards of concern.

Description

Tropical cyclones (tropical depressions, tropical storms, and hurricanes) that affect New England form over the warm, moist waters of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Tropical systems customarily come from a southerly direction and when they accelerate up the East Coast of the U.S., most take on a distinct appearance that is different from a typical hurricane. Although rain is often limited to the areas south and east of the track of the storm, these areas can incur the worst winds and storm surge. Dangerous flooding occurs most often to the north and west of the track of the storm. An additional threat associated with a tropical system making landfall is the possibility of tornado generation. Tornadoes would generally occur in the outer bands to the north and east of the storm, a few hours to as much as 15 hours prior to landfall.

Hurricane season runs from June 1 to November 30. In New England, these storms are most likely to occur in August, September, and the first half of October. The ResilientMass Plan notes that this is due in large part to the fact that it takes a considerable amount of time for the waters south of Long Island to warm to the temperature necessary to sustain the storms this far north. Also, as the region progresses into the fall months, the upper-level jet stream steering winds might flow from the Great Lakes southward to the Gulf States and then back northward up the eastern seaboard. This pattern is conducive for capturing a tropical system over the Bahamas and accelerating it northward.

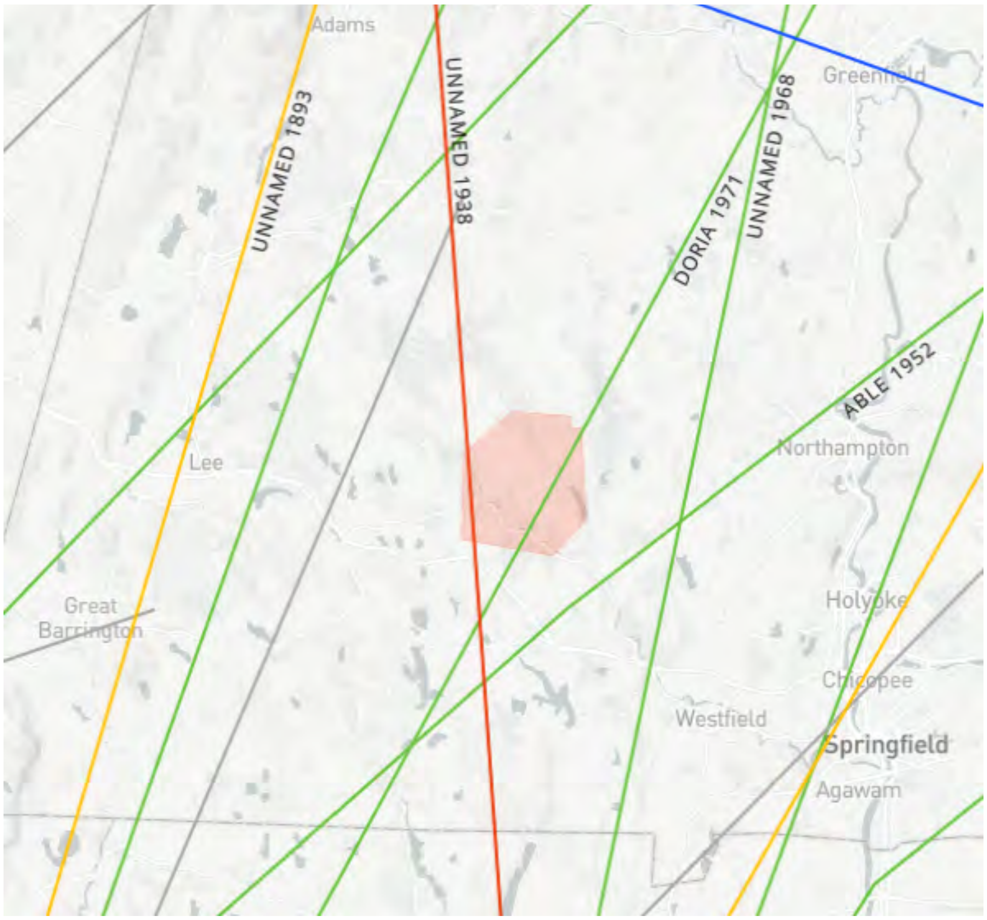
Location

Tropical storms and hurricanes can affect the entirety of Massachusetts, including the geographic extent of Chester.

Previous Occurrences

The ResilientMass Plan notes that hurricanes and tropical storms occur somewhat regularly in Massachusetts. Recent notable events include Tropical Storm Isaias (2020), Tropical Depression Henri (2021), and Tropical Storm Else (2021). Historical tropical system tracks near and through are depicted on the following page. This mapping is available from NOAA and updated continuously.

Historical Tropical Storm Tracks in Chester



A handful of tropical storms and hurricanes have passed near or through Chester since recordkeeping began. Unnamed storms pass near the Town in 1893 (two storms including the orange line above which represents a Category 1 storm), 1938, and 1968. The 1938 hurricane (red line) was one of the most destructive in the history of New England, with extensive wind damage throughout the region. Storms Doria (1971) and Irene (2011) caused little wind damage but produced significant flooding in the region.

Figure 19. Historical Tropical Storm Tracks in Chester.

As noted elsewhere, this Plan update relies primarily on a ten-year lookback (2014 through 2023) ending with the date of plan development. During that ten-year period, only one Massachusetts emergency declaration (Storm Lee of September 2023) was associated with a tropical system, but it is not yet in the NCEI database of severe storms for Hampden County. T.S. Isaias of 2020 is the sole tropical storm appearing in the inventory for Western Hampden County for the last ten years:

- August 4, 2020: Tropical Storm Isaias moved from coastal Virginia eastern New York state, near the Connecticut/Massachusetts border on Tuesday, August 4. As the storm reached the New York City area, southerly winds were maximizing across southern New England, causing widespread wind damage. There were numerous power outages from trees and wires being downed. In Blandford, wires were down on Beech Hill Road, several trees were down on Blair Road, and a tree was down on Route 23. In Tolland, a tree and wires were down on River Road.

Chester was moderately impacted by the series of tropical and post-tropical storm systems that impacted Massachusetts in 2021. These storms occurred in July, August, and September 2021 as follows:

- T.S. Elsa - July 9, 2021
- T.S. Fred - August 19, 2021
- T.S. Henri - August 22-23, 2021
- T.D. Ida - September 1, 2021

Although Chester experienced precipitation impacts from these events, the HMPC noted that flooding did not result from any of the four named storms in 2021.

Impacts of the 2021 Hurricane Season on Massachusetts

T.S. Elsa crossed eastern Massachusetts on July 9, delivering wind and flooding rains while transitioning to an extratropical storm later that day. Approximately 2 to 4 inches of rain were recorded in many towns. MBTA commuter rail trains were delayed on the Worcester line due to flooding, and Route 146 was flooded. About 11,000 Eversource customers in Massachusetts lost power.

Extratropical Storm Fred crossed northern Massachusetts lengthwise on August 19 and 20, delivering flooding rains to parts of southern New England. Flooding in Massachusetts was worst in the Worcester area. Approximately 2 to 4 inches of rain were recorded in many towns.

T.D. Henri crossed eastern Massachusetts on August 24, delivering flooding rains to parts of southern New England. Prior to crossing Massachusetts, the storm looped through Connecticut and New York on August 22-24. The path and slow movement of the storm contributed to widespread flooding in all three states, made worse due to the conditions caused by storm Fred only a few days before. Approximately 1 to 4.5 inches of rain were recorded in many towns. About 12,000 Eversource customers in Massachusetts lost power.

Extratropical Storm Ida passed south of New England and crossed Nantucket on September 2, delivering flooding rains to parts of southern New England. The precipitation from Ida was more intense than expected, and it caused widespread flooding. Approximately 2 to 6 inches of rain were recorded in many towns. About 4,000 people in Massachusetts lost power.

Figure 20. Tracks for Tropical Storms that Impacted Massachusetts 2021.

Even without the presence of a catastrophic hurricane striking Chester recently, less severe tropical storms and remnants such as those described above have created disruptions and necessitated public expenditures to deal with outages and debris.

Extent

The Beaufort Wind Scale is reportedly one of the first scales to estimate and characterize wind speeds. It was developed in 1805 to help sailors estimate winds via visual observations. The scale ranges from zero (“seas like a mirror”) to 12 (“hurricane”). The Beaufort scale is still used today to estimate wind strengths, but is more common in coastal communities.

Hurricanes are measured according to the Saffir-Simpson scale, which categorizes or rates hurricanes from 1 (minimal) to 5 (catastrophic) based on their intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, inherently leaving out any measure of precipitation and flooding.

Table 27. Saffir-Simpson Scale.

Saffir-Simpson Hurricane Wind Scale

	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Damaging winds will produce some damage:** Well-constructed framed homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap, and shallow-rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Very strong, damaging winds will cause widespread damage:** Well-constructed framed homes could sustain major roof and siding damage. Many shallow-rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Dangerous winds will cause extensive damage:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Extremely dangerous winds will cause devastating damage:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center, NOAA

Tropical storms and tropical depressions, while generally less dangerous than hurricanes, can be deadly. The winds of tropical depressions and tropical storms are usually not the greatest threat; rather, the rains, flooding, and severe weather associated with the tropical storms are what customarily cause more significant problems. Nevertheless, serious power outages can also be associated with these types of events.

The NWS issues a hurricane warning when sustained winds of 74 mph or higher are expected in a specified area in association with a tropical, subtropical, or post-tropical cyclone. A warning is issued 36 hours in advance of the anticipated onset of tropical-storm-force winds. A hurricane watch is announced when sustained winds of 74 mph or higher are possible within the specified area in association with a tropical, subtropical, or post-tropical cyclone. A watch is issued 48 hours in advance of the anticipated onset of tropical-storm-force winds (NWS, 2013).

The Saffir-Simpson scale and the NWS watch/warning products are applicable to all tropical storms and hurricanes that may strike Chester, as they are used throughout Massachusetts on a routine basis and appropriately characterized the previous storms that posed risks to Chester.

Probability of Future Events

The ResilientMass Plan explains that Massachusetts experiences a tropical storm or hurricane about once every two years on average, with NOAA estimating the recurrence of any category hurricane between 13 to 30 years, and a Category 3 hurricane occurrence every 50 to 60 years.

Some researchers have suggested that the intensity of tropical cyclones has increased over the last 40 years, with some believing that there is a connection between this increase in intensity and climate change. While most climate simulations agree that greenhouse warming enhances the frequency and intensity of tropical storms, models of the climate system are still limited by resolution and computational ability. Given the history of major storms and the possibility of increased frequency and intensity of tropical storms due to climate change, it is prudent to expect that there will be hurricanes impacting Chester in the future that may be of greater frequency and intensity than in the past.

Vulnerability Assessment

Exposure

High winds and heavy rain and/or hail associated with hurricanes and tropical storms can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death. Other associated concerns are debris management issues including debris removal and identification of disposal sites. All assets in Chester should be considered exposed to high winds while specific areas are exposed to hurricane surge. Figure 21 shows the 100-year windspeeds identified in the ASCE 7-98 publication.

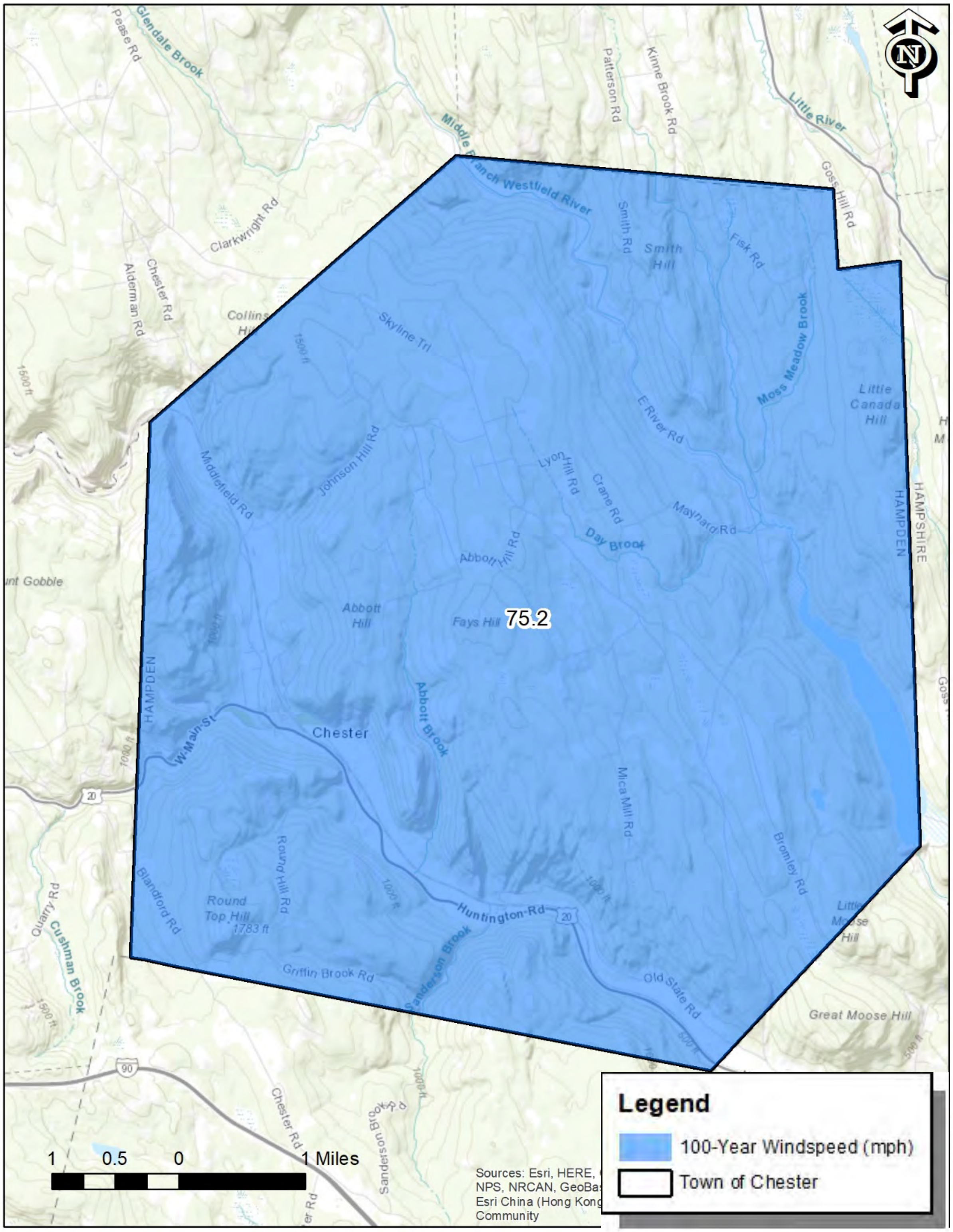


Figure 21. 100-Year Windspeeds (ASCE 7-98).

Built Environment Impacts

To identify built environment impacts to the Town resulting from wind damage, FEMA's risk assessment software, Hazus, was implemented. The economic loss results of the 500-year event are shown in Table 28 while the results for the 1000-year event are shown in Table 29. The Town's Average Annual Loss (AAL) is calculated to be $112,000.

Buildings that are permanently open with bays or open sides are susceptible to wind damage since the building envelope can't be maintained. Family lumber has an open wall, there is a pavilion on Mill Street, and the Town gazebo also has open walls and may be more susceptible to high winds.

Table 28. Building Losses Due to Wind for a 500-Year Scenario.

Loss Type	**Residential ($Million)**	**Commercial ($Million)**	**Other Occupancy ($Million)**	**Total ($Million)**
Building Loss	5.13	0.20	0.33	**5.66**
Content Loss	2.67	0.03	0.07	**2.77**
Business Inventory Loss	0.00	0.00	0.00	**0.00**
Business Income Loss	0.00	0.03	0.02	**0.05**
Business Relocation Loss	0.13	0.03	0.06	**0.22**
Rental Income Loss	0.06	0.01	0.01	**0.08**
Wage Loss	0.00	0.02	0.29	**0.31**
Total	**7.99**	**0.32**	**0.78**	**9.09**

Table 29. Building Losses Due to Wind for a 1000-Year Scenario.

Loss Type	**Residential ($Million)**	**Commercial ($Million)**	**Other Occupancy ($Million)**	**Total ($Million)**
Building Loss	7.58	0.33	0.55	**8.46**
Content Loss	3.84	0.06	0.13	**4.03**
Business Inventory Loss	0.00	0.01	0.01	**0.02**
Business Income Loss	0.00	0.04	0.03	**0.07**

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Business Relocation Loss	0.26	0.04	0.10	**0.40**
Rental Income Loss	0.11	0.02	0.02	**0.15**
Wage Loss	0.00	0.03	0.40	**0.43**
Total	**11.79**	**0.53**	**1.24**	**13.56**

Population Impacts

Populations considered most vulnerable to hurricane and tropical storm impacts in Chester are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. For high windspeeds, it's important to maintain the building envelope during the event. If a window or door fails, damage to the structure will be much greater. The senior and low-income populations in Chester are particularly susceptible to extreme winds and it should be noted that there may be overlap within the two categories. The Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

For the 500-year event, Hazus predicts that there will be no displaced households and nobody seeking public shelter from the high windspeeds. For the 1000-year event, Hazus predicts that there will be up to five displaced households and two people seeking public shelter from the high windspeeds.

Environment Impacts

Hurricanes can cause damage to parks and other natural areas. Some areas of the Town may be out of service until trees are removed.

Problem Statements for Hurricanes/Tropical Storms

Table 30. Problem Statements for Hurricanes/Tropical Storms.

Assets	Problems Associated with Hurricanes and Tropical Storms
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations may need to be evacuated and could be displaced from their homes.
Structures (including facilities, lifelines, and critical infrastructure)	• Wind may cause trees to fall onto structures and infrastructure, and roadways. • Wind damage to wind-susceptible buildings such as carports, greenhouses, pavilions, gazebos, and open-walled buildings. Additional damage to commercial buildings with HVAC located on roofs. • The electric grid may go down during high wind event.
Systems (including networks and capabilities)	• First responders may have difficulty reaching people if roads are closed due to tree debris.
Natural, historic, and cultural resources	• Historic buildings may experience damage during high wind events, especially the roofing and windows. Water entering these buildings could impact important historic and cultural artifacts.
Activities that have value to the community	• A severe hurricane wind and rain event could negatively impact outdoor activities in the Town.

Invasive Species

The ResilientMass Plan defines invasive species as non-native species that cause or are likely to cause harm to ecosystems, economies, and/or public health (USDA). The focus of this section is on invasive terrestrial plants, as this is the most studied and managed type of invasive; information for invasive aquatic flora and fauna is also provided when relevant.

Description

The Massachusetts Invasive Plant Advisory Group (MIPAG), a collaborative representing organizations and professionals concerned with the conservation of the Massachusetts landscape, is charged by EOEEA to provide recommendations to the Commonwealth to manage invasive species. MIPAG defines invasive plants as “non-native species that have spread into native or minimally managed plant systems in Massachusetts [causing] economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.” These species have biological traits that provide them with competitive advantages over native species, particularly because in a new habitat they are not restricted by the biological controls of their native habitat. As a result, these invasive species can monopolize natural communities, displacing many native species and causing widespread economic and environmental damage.

Some examples of invasive insect species include:

- Nantucket Pine Tip Moth (native pest) is a moth with heads, bodies, and appendages covered with gray scales with mottled rusty-red markings. Larvae cause damage to young trees (up to five years old) by feeding inside growing shoots, buds, and conelets. The preferred host is the loblolly pine.
- Bark Beetles (native pest) include more than 600 species of beetles which serve in important ecological roles in small numbers where they live in dead, weakened, and dying host conifer trees.
- Forest Tent Caterpillar (native pest) has the biggest footprint of any indigenous tent caterpillar in North America (Furniss and Carolin 1977) and is a major defoliator of a variety of deciduous hardwood trees. The caterpillars spin silken mats on the trunks and large branches of trees where they molt and feed. Forest Tent Caterpillars can reach outbreak proportions causing massive defoliation of host trees and becoming a nuisance to people.
- Pine Reproduction Weevils (native pest) is a very dark, elongate, oval insect up to 1/2 inch long with indistinct to distinct gray or pale orange spots of scales on the wings and thorax. They feed at night on the conifer seedlings or near the tips of branches of larger plants. Females lay their eggs on the roots of these trees. The weevils breed in all species of pines, hemlocks, junipers, spruces, firs, and cedars.
- Hardwood Borers (native pest) usually attack hardwoods experiencing some kind of stress although the clear-wing moths attack healthy trees. These insects attack the tree year after year and may eventually weaken it enough that it is prone to wind breakage. Some borers develop in the root system damaging young trees.
- Hemlock Wooly and Balsam Wooly Adelgid (non-native pest) is a very small, invasive, aphid-like insect that attacks North American hemlocks (Hemlock Wooly) and firs (Balsam Wooly). They can be identified by the white wooly masses that form on the underside of branches at the base of the tree’s needles. They stay at this location for the rest of their lives. Their feeding disrupts the flow of nutrients to the tree twigs and needles leading to a decline in tree health and mortality in 4 to 10 years.

- Gypsy Moth (non-native pest) is an insect which feeds on a large variety of tree leaves from oak, maple, apple, crabapple, hickory, basswood, aspen, willow, birch, pine, spruce, hemlock, and others. It does prefer oak tree leaves, however. Periodically, large populations can cause defoliation damaging and killing trees they are feeding on.
- Spotted Lanternfly (non-native pest) is an invasive insect first detected in the U.S. in 2014. It feeds on a variety of fruit, ornamental, and wood trees and could seriously impact the grape, orchard, and logging industries.

Location

The entire Commonwealth is vulnerable to invasive species. Types of species can vary by location, elevation, ecosystem, and habitat type, as well as land and water use. Furthermore, the ability of invasive species to travel distances (either via natural mechanisms or accidental human interference) allows these species to propagate rapidly over a large geographic area. Similarly, in open freshwater and marine ecosystems, invasive species can quickly spread once introduced, as there are generally no physical barriers to prevent establishment, outside of physiological tolerances, and multiple opportunities for transport to new locations (by boats, for example). The entire geographic area of Chester is believed at risk for invasive species propagation.

Previous Occurrences

Invasive species do not represent a singular event but rather an ongoing or emerging problem, so it is difficult to measure the frequency of occurrences. A comprehensive list of invasives can be found at https://www.massnrc.org/mipag/invasive.htm. Invasives of current concern to forest health (https://www.mass.gov/service-details/current-forest-health-threats) in Hampden County are reportedly:

- Gypsy Moth
- Spongy Moth
- Hemlock Woolly Adelgid
- Southern Pine Beetle
- Emerald Ash Borer
- White Pine Needlecast

The annual budget to address invasive species in Massachusetts has fluctuated over time but, in general, appears to have decreased. This likely implies a lack of resources rather than a decrease in risk. The following figures are from https://budget.digital.mass.gov/summary/fy22/enacted/energy-and-environmental-affairs/environmental-affairs/20000100.

Table 31. Statewide Budgets for Addressing Invasive Species.

FY Year	Budget
2022	$277,838
2021	$146,348
2020	$4,150,000
2019	$3,831,135
2018	$4,347,000
2017	$6,046,870

The Early Detection and Distribution Mapping System (EDDMaps) developed by the University of Georgia has invasives recorded in and around Chester including insects: borers, bark beetles, Gypsy Moth, Spotted Lanternfly, weevils; and plants: Japanese Knotweed, Reed Canarygrass, Japanese Barberry, Garlic Mustard, Buckthorn, Purple Loosestrife, Bittersweet, Coltsfoot, Common Selfheal, Multiflora Rose.

Over the course of the meetings held during the development of this plan, Town staff mentioned that Giant Hog Weed was an issue and could cause blisters and blindness in people exposed to it.

Extent

MIPAG recognizes 74 plant species as "Invasive," "Likely Invasive," or "Potentially Invasive." The criteria for an "Invasive" species are listed below; the other assigned categories are associated with lower scores on the criteria checklist. The criteria for invasive animal species are less well-defined, but many of the same characteristics (including a non-Massachusetts origin and the ability to out-compete native species) are similar. In order to be considered "Invasive" by MIPAG, a plant species must meet the following complex set of criteria:

1. Be nonindigenous to Massachusetts.
2. Have the biologic potential for rapid and widespread dispersion and establishment in minimally managed habitats.
3. Have the biologic potential for dispersing over spatial gaps away from the site of introduction.
4. Have the biologic potential for existing in high numbers away from intensively managed artificial habitats.

5. Be naturalized in Massachusetts (persists without cultivation in Massachusetts).

If a species meets criteria 1–4 and criterion 5, it may be considered “invasive” or “likely invasive” in Massachusetts. If it does not meet criterion 5, it may be considered “potentially invasive” if it meets criteria 13–15 below.

6. The species is widespread in Massachusetts, or common in a region or habitat type(s) in the state.
7. The species has many occurrences in Massachusetts that have high numbers of individuals in minimally managed habitats.
8. The species is able to outcompete other species in the same natural plant community.
9. The species has the potential for rapid growth, for high seed or propagule production and dissemination, and for establishment in natural plant communities.

If a species meets the initial five criteria and criteria 6–9 at this time, it may be considered a “likely invasive” species in Massachusetts if it also meets at least one of the following three criteria:

10. The species has at least one occurrence in Massachusetts that has high numbers of individuals forming dense stands in minimally managed habitats.
11. The species has the potential, based on its biology, colonization history outside its native range, and likelihood of range expansion or change in biologic potential from climate change predictions, to become invasive in Massachusetts.
12. The species is acknowledged to be invasive in nearby states, but its status in Massachusetts is unknown or unclear. This may result from lack of field experience with the species or from difficulty in species determination or taxonomy.

If the species meets the basic criteria for invasiveness (criteria 1–4) but is not naturalized in Massachusetts (criterion 5), the species may be considered “potentially invasive” in Massachusetts if it meets the following three criteria (criteria 13–15):

13. The species, if it becomes naturalized in Massachusetts, based on its biology and biologic potential, would pose an imminent threat to the biodiversity of Massachusetts and
14. Its naturalization in Massachusetts is anticipated, and
15. The species has a documented history of invasiveness in other areas outside its native range including expansion of range and/or change in biological potential from climate change predictions

The MIPAG has developed a list of Early Detection plant species according to an established set of criteria that includes MIPAG classification as an *invasive, likely invasive,* or *potentially invasive* ecological threat and one of these three criteria: *limited prevalence in Massachusetts, partial containment* *potential,* or *public health threat.* The Early Detection table includes the documented distribution of a species by county.

Table 32. Early Detection Information for Addressing Invasive Species.

Species	Common Name	Current County of Distribution (November 2010)	Notes
Arthraxon hispidus	Hairy joint grass; jointhead; small carpetgrass	Franklin (historically)	This species is not currently known in Massachusetts; it was last collected in Deerfield in 1973. This is an annual grass that co-occurs with Japanese stilt grass further south.
Butomus umbellatus	Flowering rush	Essex, Middlesex	*Butomus umbellatus* is an aquatic perennial herb which reproduces by seed dispersal or vegetatively by bulbils
Carex kobomugi	Japanese sedge; Asiatic sand sedge	Barnstable (historically)	Native to northeastern Asia, Carex kobomugi is an invasive plant that invades coastal sand dunes and can outcompete native dune-binding grasses. This species was last collected in 1973.
Egeria densa	Brazilian waterweed; Brazilian elodea	Essex, Middlesex, Norfolk, Plymouth, Worcester	This species is often confused with Hydrilla and native *Elodea* spp. but has larger, nickel-sized flowers. This is a submerged aquatic species whose rapid growth often leads to dense mats on the water surface, which crowds out native plants and damages fish and aquatic habitat. The mats can also impede boat traffic.
Glyceria maxima	Tall mannagrass; reed mannagrass	Essex	This perennial grass invades low shrub-swamps and other wetland

Species	Common Name	Current County of Distribution (November 2010)	Notes
Heracleum mantegazzianum	Giant hogweed	Berkshire, Franklin, Hampden, Hampshire, Middlesex, Norfolk, Suffolk, Worcester	Giant hogweed is a federal noxious weed that is currently being eradicated under the U.S. Department of Agriculture's authority. This is a perennial herb that can cause painful burns and permanent scarring to humans if they touch the plant.
Hydrilla verticillata	Hydrilla; water-thyme; Florida elodea	Barnstable, Plymouth, Worcester	Hydrilla is an invasive non-native submerged plant. This plant grows and reproduces rapidly, displacing native species, hampering recreational uses, and slowing water flow. Hydrilla, once established, can replace native vegetation and affect fish populations.
Myriophyllum aquaticum	Parrot-feather; water-feather; Brazilian watermilfoil	Norfolk	Parrot-feather is a perennial aquatic plant native to South America. This plant typically grows in freshwater, with a preference for areas with high nutrient contents. Parrot-feather has been introduced worldwide for use in indoor and outdoor aquaria.
Nymphoides peltata	Yellow floating heart	Hampden, Middlesex, Worcester	Yellow floating heart is native to Asia and now is found in over 15 states in the U.S. This plant forms dense mats on the water surface, restricting light penetration into the water and decreasing air exchange between the water's surface and the atmosphere. Algae can be shaded out by this plant, resulting in food chain disruptions for an entire lake.

Species	Common Name	Current County of Distribution (November 2010)	Notes
Persicaria perfoliata syn.: Polygonum perfoliatum	Mile-a-minute vine or weed; Asiatic tearthumb	Barnstable, Essex, Franklin, Norfolk, Plymouth, Suffolk	Mile-a-minute vine is a barbed vine that can grow up to 6 inches a day. This vine smothers other herbaceous plants, shrubs, and even trees by growing over them and blocking their access to sunlight.
Peuraria montana ssp. lobata	Kudzu; Japanese arrowroot	Barnstable, Bristol, Essex, Middlesex, Plymouth, County	Kudzu is native to Japan and southeast China and was introduced to the U.S. during the Philadelphia Centennial Exposition in 1876. Once established, kudzu can grow at a rate of a foot per day, with mature vines as long as 100 feet.
Senecio jacobaea	Tansy ragwort; stinking Willie; stinking Billy	Essex County Suffolk County Worcester County	This biennial herb is a weedy plant that infests woodlands, pastures, and hayfields. This plant is toxic to all classes of livestock but most toxic to cattle and horses. The plant can cause chronic liver disease, and affected animals usually die within a few weeks after ingesting it
Trapa natans	Water chestnut	Berkshire, Bristol, Essex, Franklin, Hamden, Hampshire, Middlesex, Suffolk, Worcester	Water chestnut is an annual aquatic species with both floating and submerged leaves.

The extent associated with Emerald ash borer, milfoil, Spotted lanternfly, Zebra mussels, and Japanese knotweed identified under Previous Occurrences are somewhat addressed by classification systems presented in this section. Of these species, the aquatic milfoil is most appropriately described by the MIPAG early detection resources. Massachusetts DCR maintains online resources and fact sheets for Emerald ash borer, milfoil, Spotted lanternfly, Zebra mussels, and Japanese knotweed, and these resources are appropriate for Chester.

Probability of Future Events

Once established, invasive species often escape notice for years or decades. Introduced species that initially escaped many decades ago are only now being recognized as invasives. Because these species can occur anywhere (on public or private property), new invasive species often escape notice until they are widespread, and eradication is impractical. As a result, early and coordinated action between public and private landholders is critical to preventing widespread damage from an invasive species.

The USDA Animal and Plant Health Inspection Service (APHIS) manages the Plant Protection and Quarantine (PPQ) Program which safeguards U.S. agriculture and natural resources from the introduction, establishment, and spread of plant pests and noxious weeds. PPQ is the lead federal agency for plant health emergencies and works closely with federal, state, and local agencies; universities; industries; and private entities in developing and implementing science-based framework designed to protect against invasive pests and diseases.

Massachusetts has a variety of laws and regulations in place that attempt to mitigate the impacts of these species. The Department of Agricultural Resources (DAR) maintains a list of prohibited plants for the state, which includes federally noxious weeds as well as invasive plants recommended by MIPAG and approved for listing by DAR. Species on the DAR list are regulated with prohibitions on importation, propagation, purchase, and sale in the Commonwealth. Additionally, the Massachusetts Wetlands Protection Act (310 CMR 10.00) includes language requiring all activities covered by the Act to account for, and take steps to prevent, the introduction or propagation of invasive species.

In 2002, Massachusetts passed an Aquatic Invasive Species Management Plan, making the Commonwealth eligible for federal funds to support and implement the plan through the federal Aquatic Nuisance Prevention and Control Act. MassDEP, DCR, CZM, and Massachusetts Institute of Technology Sea Grant College Program are part of the Northeast Aquatic Nuisance Species Panel, which was established under the federal Aquatic Nuisance Species Task Force. This panel allows managers and researchers to exchange information and coordinate efforts on the management of aquatic invasive species. The Commonwealth also has several resources pertaining to terrestrial invasive species, such as the Massachusetts Introduced Pest Outreach Project, although a strategic management plan has not yet been prepared for these species. All these efforts are aimed at reducing the probability of future occurrences.

Notwithstanding the above efforts, the presence of invasive species is ongoing, and it is difficult to quantify the future frequency of these occurrences. Increased rates of global trade and travel have created many new pathways for the dispersion of exotic species. As a result, the frequency with which these threats have been introduced has increased significantly. Increased international trade in ornamental plants is particularly concerning because many of the invasive plant species in the U.S. were originally imported as ornamentals. Furthermore, they are expected to be an increasing problem due to a changing climate and projected increases in non-native plant and animal infestations. For this reason and based on the fact invasive species are already an ongoing issue for the region, this hazard has been assigned a probability of highly likely.

Vulnerability Assessment

Exposure

The entire Town of Chester has the potential to be exposed to invasive pests. Climate change will make the area more attractive to pests who have not been found there traditionally.

Built Environment Impacts

Although the built environment is not as susceptible to pests as the natural environment, it can help spread the invasive species. This includes trains and vehicles that could move the species from one location to another. Trees, which are damaged or killed by invasive pests, can become hazards to people, property, utility lines, and roadways when they fall. Many dead trees in one area can also become fuel for wildfires interconnecting the two hazards.

Population Impacts

The direct population impacts are minimal. However, the indirect impacts could destroy livelihoods.

Environment Impacts

Most of the natural features in the Town have some susceptible pests including the parks and other forested areas. Trees that have been damaged by other events such as fire, wind, flooding, and animal browsing are more susceptible to diseases and pests. Certain species of trees are more susceptible based on the need of the damaging organism. Climate change will increase the probability of invasive pests which will pose increased environmental impacts in the future.

Problem Statements for Invasive Species

Table 33. Problem Statements for Invasive Species.

Assets	Problems Associated with Invasive Species
People (including underserved communities and socially vulnerable populations)	• Vector borne disease incidence may increase with climate change, adversely impacting vulnerable people.
Structures (including facilities, lifelines, and critical infrastructure)	• None apparent or projected.
Systems (including networks and capabilities)	• Additional DPW resources may be required in critical areas.
Natural, historic, and cultural resources	• Invasive species are problematic throughout the Town and have been verified at the John J. Kelly Wildlife Management Area, Chester-Blandford State Forest, and along the rail line.
Activities that have value to the community	• Recreational activities may be adversely impacted, depending on location, and especially in parks and natural areas.

Landslides

The term “landslide” includes a wide range of ground movements such as rock falls, deep failure of slopes, and shallow debris flows. The most common types of landslides in Massachusetts include translational debris slides, rotational slides, and debris flows. Most of these events are caused by a combination of unfavorable geologic conditions (silty clay or clay layers contained in glaciomarine, glaciolacustrine, or thick till deposits), steep slopes, and/or excessive wetness leading to excess pore pressures in the subsurface.

Description

Historical landslide data for the Commonwealth suggests that most landslides are preceded by two or more months of higher-than-normal precipitation, followed by a single, high-intensity rainfall of several inches or more (Mabee and Duncan, 2013). This precipitation can cause slopes to become saturated. Landslides associated with slope saturation occur predominantly in areas with steep slopes underlain by glacial till or bedrock. Bedrock is relatively impermeable relative to the unconsolidated material that overlies it. Similarly, glacial till is less permeable than the soil that forms above it. Thus, there is a permeability contrast between the overlying soil and the underlying, and less permeable, unweathered till and/or bedrock. Water accumulates on this less permeable layer, increasing the pore pressure at the interface, leading to a failure or slide.

Occasionally, landslides occur because of geologic conditions and/or slope saturation. Adverse geologic conditions exist wherever there are lacustrine or marine clays, as clays have relatively low strength. These clays often formed in the deepest parts of the glacial lakes that existed in Massachusetts following the last glaciation. These lakes include Bascom, Hitchcock, Nashua, Sudbury, Concord, and Merrimack, among many other unnamed glacial lakes. When oversteepened or exposed in excavations, these vulnerable areas often produce classic rotational landslides.

Landslides can also be caused by external forces, including both undercutting (due to flooding or wave action) and construction. Undercutting of slopes during flooding or coastal storm events is a major cause of property damage. Streams and waves erode the base of the slopes, causing them to oversteepen and eventually collapse.

USGS provides the following graphic to depict different types of landslides. The images on the left side represent starting conditions whereas the images on the right represent conditions at the end of the slide event. Numbers 1, 2, 3, and 8 are considered most frequent in Massachusetts.

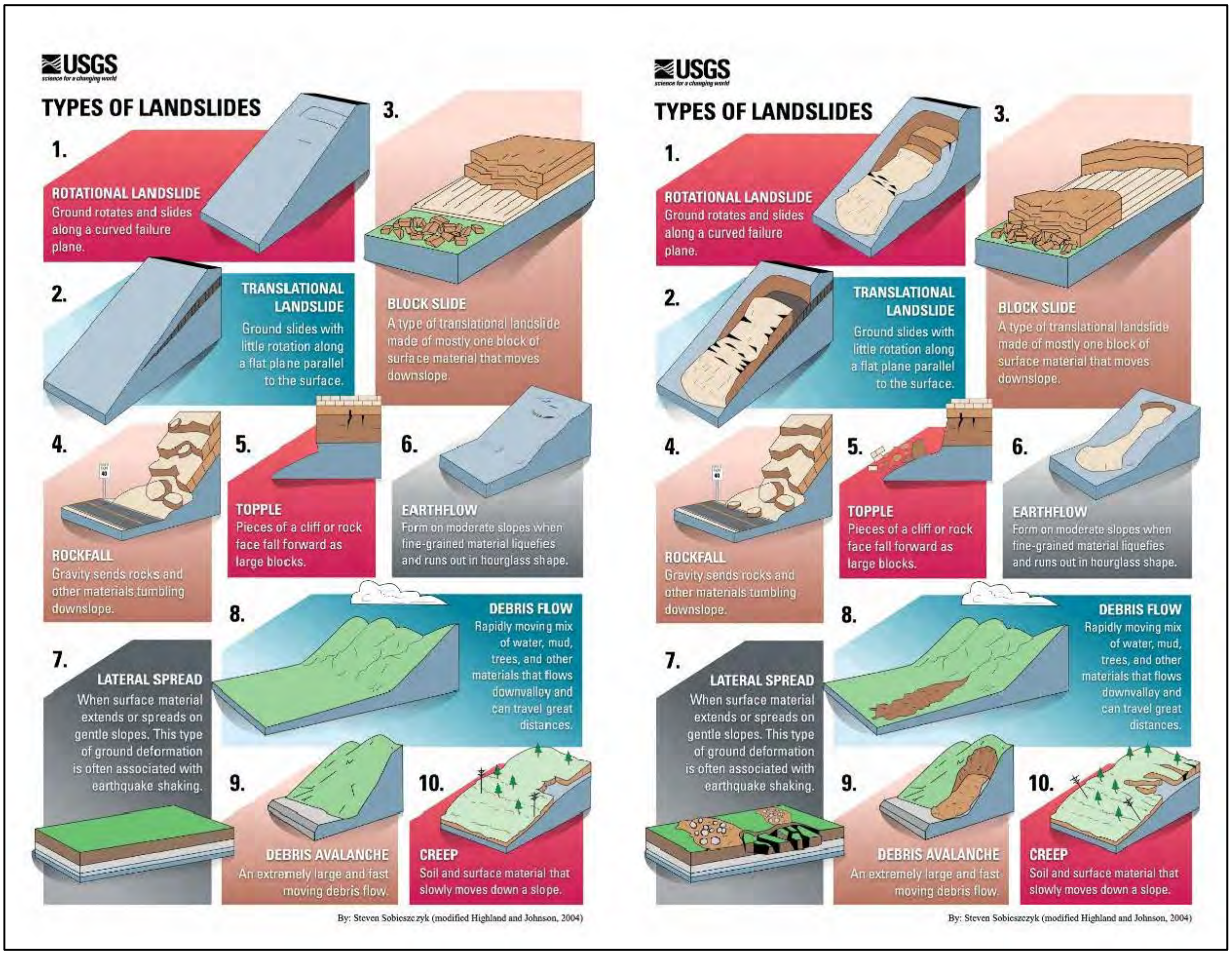


Figure 22. Types of Landslides.

Location

In 2013, the Massachusetts Geological Survey and University of Massachusetts Amherst published a Slope Stability Map of Massachusetts (Figure 23). This project, funded by the FEMA Hazard Mitigation Grant Program, was designed to provide statewide mapping and identification of landslide hazards that can be used for community level planning as well as prioritizing high-risk areas for mitigation. The maps produced from this project should be viewed as a first-order approximation of potential landslide hazards across the state.

The Slope Stability Map (below) categorizes areas of Massachusetts into stability zones, and the categorization is correlated to the probability of instability in each zone. The probability of instability metric indicates how likely each area is to be unstable, based on the parameters used in the analysis. According to the map, these unstable areas are located throughout the Commonwealth. Landslide risk is therefore assumed present in Chester.

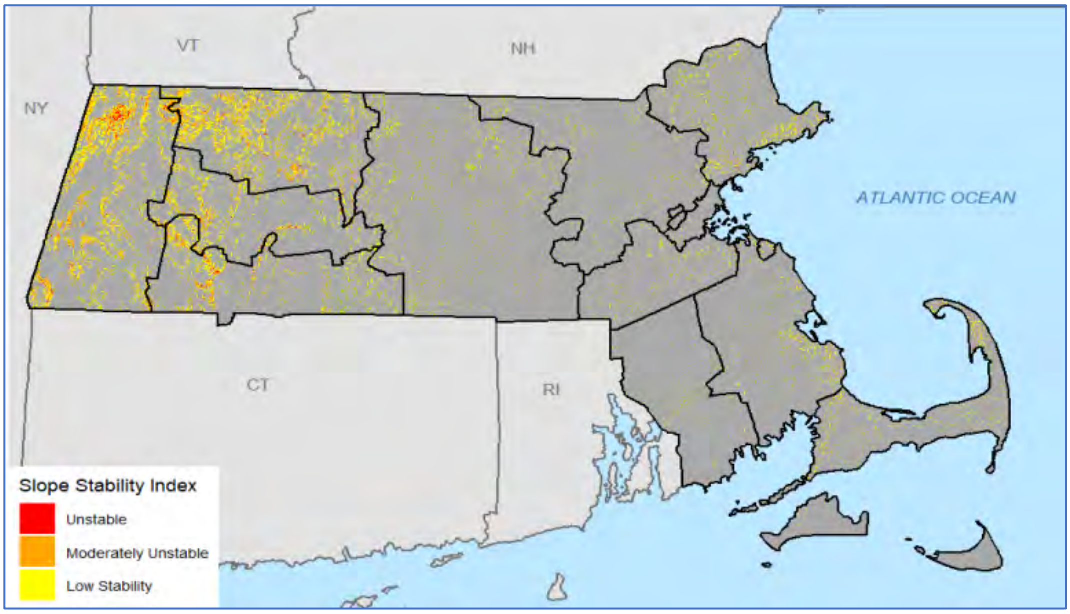


Figure 23. Slope Stability Map of Massachusetts (Created by ERG using data from Mabee & Duncan (2013)).

Previous Occurrences

Nationwide, landslides constitute a major geologic hazard because they are widespread, occur in all 50 states, and cause approximately $1 billion to $2 billion in damages and more than 25 fatalities on average each year. In Massachusetts, landslides tend to be more isolated in size and pose threats to highways and structures that support fisheries, tourism, and general transportation. According to the U.S. Landslide Inventory, there were 14 landslide incidents between 2008 and 2017. During this timeframe the Massachusetts Geological Survey reported three landslides or mudflows that resulted in infrastructural damage.

Landslides commonly occur shortly after other major natural disasters, such as earthquakes and floods, which can exacerbate relief and reconstruction efforts. Many landslide events may have occurred in remote areas, causing their existence or impact to go unnoticed. Expanded development and other land uses may contribute to the increased number of landslide incidences and/or the increased number of reported events in the recent record.

In Chester, there have been rockfalls along route 20 which is a safety hazard. Additionally, soil gets washed down the bank along Johnson Hill Road.

Extent

Variables that contribute to the extent of potential landslide activity in any area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, estimations of the potential severity of landslides are informed by previous occurrences as well as an examination of landslide susceptibility. Information about previous landslides, such as the information and images from landslides after Tropical Storm Irene can provide insight as to both where landslides may occur and what types of damage may result. It is important to note, however, that landslide susceptibility identifies only areas potentially affected and does not imply a time frame when a landslide might occur. The distribution of susceptibility across the Commonwealth is depicted on the Slope Stability Map (Figure 23, with areas of higher slope instability considered to also be more susceptible to the landslide hazard.

Characterizing the warning time before landslides can be challenging. Mass movements can occur suddenly or slowly. The velocity of movement may range from a slow creep of inches per year to many feet per second, depending on slope angle, material, and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to determine the areas that are at risk during general time periods. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides. The current standard operating procedure is to monitor situations on a case-by-case basis and respond after the event has occurred. Generally accepted warning signs for landslide activity include the following:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations
- Ancillary structures, such as decks and patios, tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken waterlines and other underground utilities
- Leaning telephone poles, trees, retaining walls, or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)
- Sudden decrease in creek water levels even though rain is still falling or has just recently stopped
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb

- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together

Rigorous landslide classification systems are not used in Chester and have only occasionally been used in Massachusetts. However, if a significant or damaging landslide occurred in Chester, the type of slide would be identified; and then consistency with the slope stability mapping for Massachusetts would be examined to determine if susceptibility identification tools are appropriate.

Probability of Future Events

The probability of future occurrences is generally defined by the number of events over a specified period of time. The ResilientMass Plan notes that between 2008 and 2017, there were at least 14 reported landslide occurrences. However, because many landslides are minor and occur unobserved in remote areas, the true number of landslide events is probably higher. Generally speaking, landslides are most likely to occur during periods of higher than average or extreme precipitation, particularly in areas that have experienced disturbance from wildfire, drought, invasive species, recent development, or vegetation or tree removal. For these reasons, the probability of future occurrence is believed moderate to high.

Vulnerability Assessment

Exposure

While landslides are rare, their impacts can be devastating, including loss of property, disruption to infrastructure, and injury and death. Continued development, particularly on steep slopes or unstable soils, increases the chances that landslides will be a danger. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

To help identify potential landslide areas for the Town, the slope stability index developed by the Massachusetts Geological Survey was used. The unstable and moderately unstable regions were queried out of the data and overlaid with the critical facilities and other buildings. There were no critical facilities found in the unstable or moderately unstable area.

The other building data was overlaid with the unstable and moderately unstable areas. There were eighteen buildings found in the moderately unstable area and no buildings found in the unstable areas. Table 34 shows the result of this analysis.

Table 34. Buildings in Moderately Unstable Area.

Building Type	Number of Buildings in Moderately Unstable Areas (Total in Town)	Building Value in Moderately Unstable Areas (Total in Town)
Single Family	23 (923)	$4,390,200 ($150,508,800)
Mobile Home	0 (15)	$0 ($1,427,500)
Multi-Family	0 (42)	$0 ($7,663,200)
Mixed-Use	5 (202)	$287,900 ($38,670,400)
Commercial	6 (52)	$2,027,700 ($15,574,300)
Agricultural	0 (29)	$0 ($533,500)
Educational	0 (1)	$0 ($4,900,000)
Government	0 (9)	$0 ($895,400)
Religious/Non-Profit	1 (26)	$500,000 ($5,143,900)
Industrial	0 (13)	$0 ($2,044,900)
Garage/Outbuilding	0 (22)	$0 ($259,450)
Vacant	1 (48)	$42,500 ($1,486,000)
Total	**36 (1,382)**	**$7,248,300 ($227,621,350)**

Figure 24 shows the landslide susceptibility map for the Town. The red and pink areas are more susceptible to landslides.

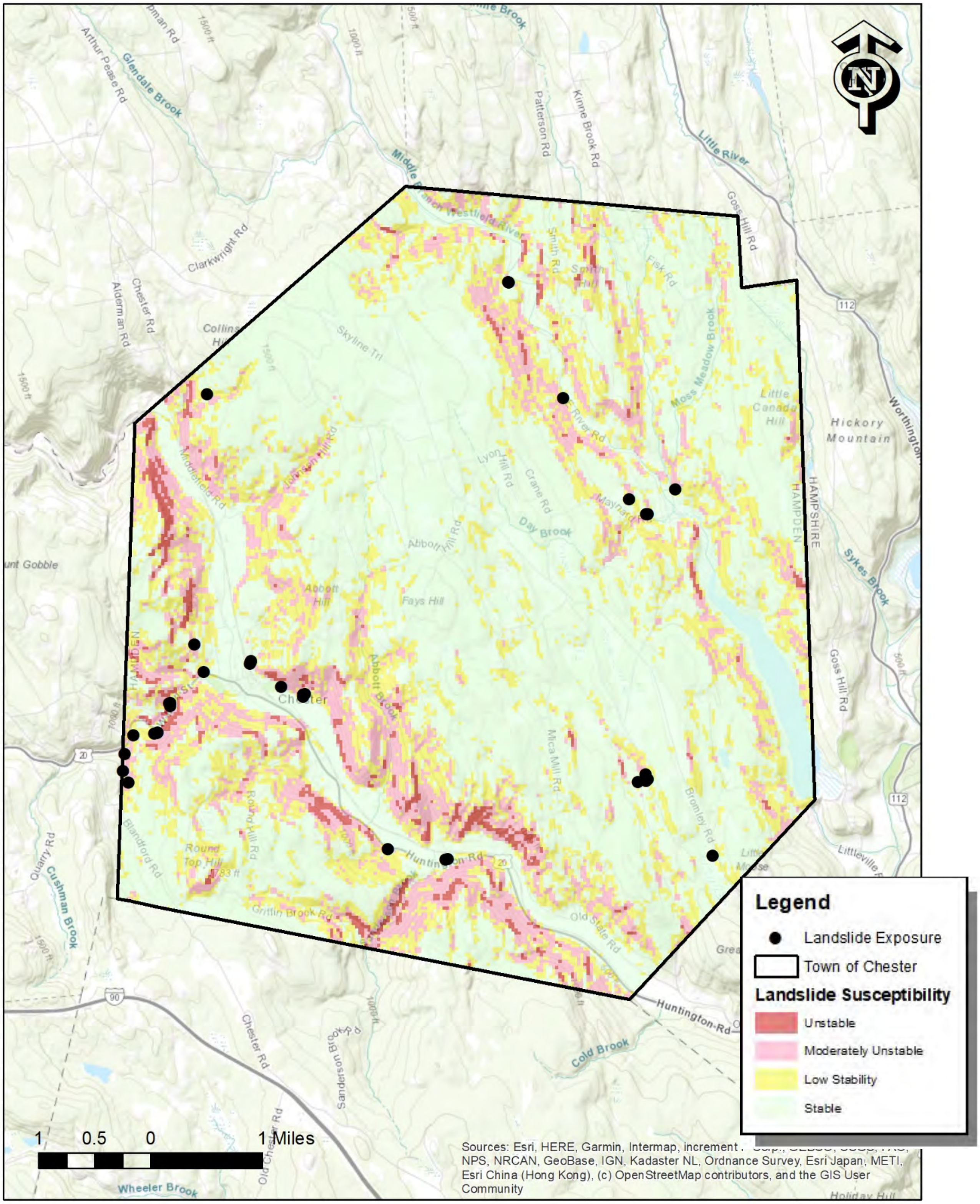


Figure 24. Landslide Map.

Built Environment Impacts

Historic data for landslide events indicate that between 1993 and 2022, no landslide events were recorded in Chester. However, there have been rockslides along Route 20. To model impacts to the built environment, a total loss for a building due to a 100-year landslide event is assumed, and the average value of a building in the moderately susceptible zone is $201,342, this would result in an AAL of $2,013.

The Town's water treatment plant is on a ledge along a narrow ravine and could be at risk to a landslide.

Population Impacts

Populations considered most vulnerable to landslide impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. The Town should be aware of the potential needs of residents within the elderly and low income population segments in the event of a hazard occurrence.

Environment Impacts

There are few unstable and moderately unstable areas around the transportation routes (roads and train tracks) used to move hazardous materials.

Problem Statements for Landslides

Table 35. Problem Statements for Landslides.

Assets	Problems Associated with Landslides
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations in isolated areas may be cut off if a landslide impacts specific roads.
Structures (including facilities, lifelines, and critical infrastructure)	• Some residential and other structures reside adjacent to moderately unstable areas and could be impacted. • Sediment may wash into the road causing lifeline impacts. • Route 20 is a major transportation route for the Town and a rockslide could cause casualties. Maynard Hill Road and Johnson Hill Road are at risk for landslides.

Assets	Problems Associated with Landslides
	• Water treatment plant exposed to landslide hazard along with road to plant.
Systems (including networks and capabilities)	• Roads and rail may be impacted and could cause a hazardous material spill.
Natural, historic, and cultural resources	• Parks and other natural areas reside in or adjacent to the unstable or moderately unstable areas. • Increased precipitation intensity and invasive species' impacts to forests may influence future landslide risks.
Activities that have value to the community	• None apparent or projected

Other Severe Weather

Several frequent natural hazards in Massachusetts – particularly strong winds and extreme precipitation events – occur outside of notable storm events. This section discusses the nature and impacts of these hazards, as well as ways in which they are likely to respond to climate change. Winter storms and tornadoes are addressed in later sections.

> The Town of Chester Community Resilience Building Workshop Summary of Findings (2021) lists "wind" as one of the top hazards of concern.

Description

Thunderstorms: A thunderstorm is a storm originating in a cumulonimbus cloud. Cumulonimbus clouds produce lightning, which locally heats the air to 50,000 degrees Celsius, which in turn produces an audible shock wave known as thunder. Frequently during thunderstorm events, heavy rain and gusty winds are present. Less frequently, hail is present, which can become very large in size. Tornadoes can also be generated during these events. An average thunderstorm is 15 miles across and lasts 30 minutes, but severe thunderstorms can be much larger and longer.

Three basic components are required for a thunderstorm to form: moisture, rising unstable air, and a lifting mechanism. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise, it will continue to rise as long as it weighs less and stays warmer than the air around it. As the warm surface air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool, releasing the heat, and the vapor condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice, and some of it turns into water droplets. Both have electrical charges. When a sufficient charge builds up, the energy is discharged in a bolt of lightning, which causes the sound waves we hear as thunder.

Downbursts: A downburst is a severe localized wind blasting down from a thunderstorm. They are more common than tornadoes. Depending on the size and location of downburst events, the destruction to property may be significant. Downbursts fall into two categories:

1. Microbursts affect an area less than 2.5 miles in diameter, last 5 to 15 minutes, and can cause damaging winds up to 168 mph.
2. Macrobursts affect an area at least 2.5 miles in diameter, last 5 to 30 minutes, and can cause damaging winds up to 134 mph.

An organized, fast-moving line of microbursts traveling across large areas is known as a “derecho.” These occasionally occur in Massachusetts. Downburst activity is, on occasion, mistaken for tornado activity. Both storms have very damaging winds (downburst wind speeds can exceed 165 mph) and are very loud. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris such that the best way to determine the damage source is to fly over the area.

Hail: Hailstones are chunks of ice that grow as updrafts in thunderstorms keep them in the atmosphere. Most hailstones are smaller in diameter than a dime, but stones weighing more than 1.5 pounds have been recorded. NOAA has estimates of the velocity of falling hail ranging from 9 meters per second (m/s) (20 mph) for a 1-centimeter (cm)-diameter hailstone to 48 m/s (107 mph) for an 8 cm, 0.7 kilogram stone.

Lightning: Lightning is a discharge of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. According to NOAA, the creation of lightning during a storm is a complicated process that is not fully understood. In the initial stages of development, air acts as an insulator between the positive and negative charges. However, when the potential between the positive and negative charges becomes too great, a discharge of electricity (lightning) occurs. In-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom. Cloud-to-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom of a second cloud. Cloud-to-ground lightning is the most dangerous. In summertime, most cloud-to-ground lightning occurs between the negative charges near the bottom of the cloud and positive charges on the ground.

Location

High wind events, thunderstorms, lightning, and hail can affect the entirety of Massachusetts, including the geographic extent of Chester.

Previous Occurrences

The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists numerous severe storms affecting the area of Chester from 2014 through 2023. The individual damage figures for these events appear nominal but given the frequency of events, the overall losses from severe storms are striking.

Table 36. NCEI Severe Storm Database Entries Covering Other Severe Storms in Chester.

Date	Description	Losses Reported
7/27/14	*Hail.* An upper level disturbance moving out of the Great Lakes initiated showers and thunderstorms over New York and New England. Enough instability was present in the region for some of these storms to become severe, producing strong to damaging winds and at least one funnel cloud.	---
8/13/16	*Thunderstorm Wind.* Heat, humidity, and a back door cold front all contributed to the development of showers and thunderstorms across southern New England. These storms resulted in damaging winds and localized flooding.	$5k property damage
9/11/16	*Thunderstorm Wind.* A cold front moved through during the morning hours, producing showers and thunderstorms. Some of these storms became strong enough to produce wind damage. A tree was downed onto Route 20 by thunderstorm winds. A tree was downed onto Skyline Trail by thunderstorm winds.	$10k property damage
8/8/19	*Thunderstorm Wind.* A cold front approaching the region created a line of severe thunderstorms in eastern New York that moved into western Massachusetts during the late afternoon and early evening. In Chester, a gust to 62 mph was recorded at a private backyard weather station. Amateur radio operators also reported trees and wires down on several streets in Chester.	$1k property damage

USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The line items for events related to severe winds and hail in Hampden County are listed below.

Table 37. USDA Disasters Events That Refer to Severe Storms.

Year	Event	Event "Begin Dates"
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016
2012	High Winds, excessive rains	8/10/2012

Extent

The strength of thunderstorms is typically measured in terms of its effects, namely the speed of the wind, the presence of significant lightning, and the size of hail. High winds are defined by the NWS as sustained non-convective winds of 35 knots (40 mph) or greater lasting for 1 hour or longer, or gusts of 50 knots (58 mph) or greater for any duration (NCDC, 2018). A thunderstorm is classified as "severe" when it produces damaging wind gusts in excess of 58 mph (50 knots), hail that is 1 inch in diameter or larger (quarter size), or a tornado (NWS, 2013).

Hailstorms are not typically characterized by intensity or duration; instead, the size of hailstones is described. NOAA provides a range from "bb" (<0.25 inch) to "softball" (4.5 inches) with common sizes reported in Massachusetts ranging from pea to nickel-sized (0.25 inch to 0.875 inch).

The NOAA/NWS classification systems coupled with the NWS warning systems are appropriate for severe storms and hail events in Chester, as they have been used for many of the severe storms that have occurred in Western Massachusetts. Severe storms have not occurred that are outside of these systems of classification.

Probability of Future Events

According to the NWS, an average of 100,000 thunderstorms per year occur in the United States. The ResilientMass Plan notes that over the 15-year period between January 1, 2008, and December 31, 2022, a total of 911 high wind events occurred in Massachusetts on 198 days, and an annual average of 61 events occurred per year. Southern New England typically experienced 10 to 15 days a year with severe thunderstorms, with Massachusetts experiencing between nine and 27 thunderstorm days per year. Climate models show projections that the frequency and intensity of severe thunderstorms (which include tornadoes, hail, and winds) will increase (USGCRP, 2017). Furthermore, the ResilientMass Plan reports that, according to the Localized Constructed Analog's climate change models, thunderstorm event frequency is expected to slightly increase as a result of climate change.

NOAA reports that there are ten downburst reports for every tornado report in the United States. This implies that there are approximately 10,000 downbursts reported in the United States each year and further implies that downbursts occur in approximately 10% of all thunderstorms in the United States annually. This figure suggests that downbursts are a relatively uncommon yet persistent hazard.

An average of 21 people per year died from lightning strikes in the United States from 2013 to 2023. Most lightning deaths and injuries occur outdoors, with 45% of lightning casualties occurring in open fields and ballparks, 23% under trees, and 14% involving water activities. The ResilientMass Plan notes that 8 fatalities and 148 injuries have occurred in Massachusetts as a result of lightning events between 1990 and 2022 (NOAA, 2022). Given that thunderstorm event frequency is expected to slightly increase as a result of climate change, it is likely that risks associated with lightning may increase.

According to NOAA's National Weather Service, hail caused two deaths and an average of 27 injuries per year in the United States from 2004 to 2013. Given that thunderstorm event frequency is expected to slightly increase as a result of climate change, it is likely that risks associated with hail may increase.

Vulnerability Assessment

Exposure

The entire built environment of Chester is vulnerable to the high winds and/or flooding from a severe weather event.

Built Environment Impacts

Severe thunderstorms, and their associated hail and lightning events, brought about property damage in Chester and adjacent towns in previous years. From 2014 until 2022, there was $1.597M in property damage to Chester and adjacent towns. This equates to an AAL of $177,444.

Population Impacts

Some traffic accidents associated with storm events include injuries and deaths. However, the number of injuries and deaths reported for accidents is generally low. Populations considered most vulnerable to tornado, microburst and thunderstorm impacts in Chester are identified based on a number of factors including their physical and financial ability to react or respond during a hazard. Senior and low-income populations in Chester are particularly susceptible to storms. The Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Environment Impacts

Thunderstorms and microbursts can cause damage to parks and other, natural areas. Some areas of the Town may be out of service until trees are removed.

Problem Statements for Other Severe Weather

Table 38. Problem Statements for Other Severe Weather.

Assets	Problems Associated with Other Severe Weather
People (including underserved communities and socially vulnerable populations)	• People in Chester have been disrupted by severe weather events and other more frequent wind and thunderstorm events. Vulnerable populations may be isolated if roads are closed.
Structures (including facilities, lifelines, and critical infrastructure)	• The individual damages for frequent severe weather events appear nominal but given the frequency of events in and around Chester, the impacts occur often and can occur anywhere in the Town.
Systems (including networks and capabilities)	• First responders may have difficulty reaching people if roads are closed due to tree debris.
Natural, historic, and cultural resources	• These can be adversely impacted depending on the specific locations of damage.
Activities that have value to the community	• These can be adversely impacted depending on the specific locations of damage.

Severe Winter Storms

The Town of Chester Community Resilience Building Workshop Summary of Findings (2021) lists "winter weather" as a top hazard of concern.

Severe winter storms include ice storms, nor'easters, heavy snow, blowing snow, and other extreme forms of winter precipitation. These are often accompanied by very low temperatures, which were previously addressed.

Description

<u>Blizzard</u>: A blizzard is a winter snowstorm with sustained or frequent wind gusts to 35 mph or more, accompanied by blowing snow that reduces visibility to or below a quarter of a mile (NWS, 2018). These conditions must be the predominant condition over a 3-

hour period. Extremely cold temperatures are often associated with blizzard conditions but are not a formal part of the definition. However, the hazard created by the combination of snow, wind, and low visibility increases significantly with temperatures below 20ºF. A severe blizzard is categorized as having temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced by snow to near zero.

Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions due to the blowing snow. Blowing snow is wind-driven snow that reduces visibility to 6 miles or less, causing significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.

Ice Storms: 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. These can cause severe damage to vegetation, utilities, and structures. 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. This may lead to dangerous walking or driving conditions and the pulling down of power lines and trees. Ice pellets are another form of freezing precipitation, formed when snowflakes melt into raindrops as they pass through a thin layer of warmer air. The raindrops then refreeze into particles of ice when they fall into a layer of subfreezing air near the surface of the earth. Finally, 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.

Nor'easters: A nor'easter is a storm that occurs along the East Coast of North America. A nor'easter is characterized by a large counterclockwise wind circulation around a low-pressure center that often results in heavy snow, high winds, and rain. A nor'easter gets its name from its continuously strong northeasterly winds blowing in from the ocean ahead of the storm and over the coastal areas.

Nor'easters are among winter's most ferocious storms. These winter weather events are notorious for producing heavy snow, rain, and oversized waves that crash onto Atlantic beaches, often causing beach erosion and structural damage. These storms occur most often in late fall and early winter. The storm radius is often as much as 100 miles, and nor'easters often sit stationary for several days, affecting multiple tide cycles and causing extended heavy precipitation. Sustained wind speeds of 20 to 40 mph are common during a nor'easter, with short-term wind speeds gusting up to 50 to 60 mph.

Location

Although the entire Commonwealth may be considered at risk to the hazard of severe winter storms, higher snow accumulations appear to be prevalent at higher elevations in Western and Central

Massachusetts, and along the coast where snowfall can be enhanced by additional ocean moisture. Ice storms occur most frequently in the higher-elevation portions of Western and Central Massachusetts. Coastal communities of the Commonwealth are more susceptible to the impacts of a Nor'easter, which can bring heavy snow. Overall, winter storms can affect the entirely of Massachusetts, including the geographic extent of Chester.

Previous Occurrences

Winter storms occur somewhat regularly in Massachusetts. Five of the disasters declared in Massachusetts from 2012 through 2022 were associated with winter storms, although only one covered Hampden County and therefore the Town of Chester:

- Massachusetts Severe Winter Storm, Snowstorm, and Flooding (DR-4110-MA)
  Incident Period: February 8, 2013 – February 9, 2013
  Public Assistance (PA) reimbursements eligible for entire state

The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists numerous severe winter storm events impacting Chester for the period 2014-2023. A selection of events is provided below. $321K in losses were reported for these incidents.

Table 39. NCEI Severe Storm Database Entries Covering Winter Storms in Chester.

Date	Description
1/18/15	A cold front approached southern New England bringing rain to the region. A low level jet brought warmer air into the area just above the surface and temperatures remained below freezing at the surface. This resulted in freezing rain occurring across much of western Massachusetts and northern Connecticut. Icing on the roads ended up resulting in many accidents. Thankfully, only one injury was reported. A car slid into a utility pole, downing the pole. The pole blocked Route 23, closing the road.
2/8/16	A very powerful low pressure system tracked up the east coast, passing southeast of Southern New England. This storm brought heavy snow and gusty winds, resulting in blizzard conditions along the Massachusetts east coast. Five to six inches of snow fell across western Hampden County.
12/29/16	Low pressure moved from Long Island across southeastern Massachusetts on the 29th and then rapidly deepened as it moved northeastward into the Gulf of Maine overnight on the 30th. Precipitation was mainly rain along the Boston-Providence corridor. However 3 to 6 inches of snow was common in western and central Massachusetts, with 5 to 7 inches in the slopes of the Berkshires and up to 8 to 11 inches in the higher terrain of northern

Date	Description
	Worcester County. Close to six inches of snow... 5.5 inches...was reported in Chester, MA in the slopes of the Berkshires.
12/23/17	A series of weak moved from the Ohio Valley across Southern New England. This drew warm air north over Southern New England even as colder air moved south at the surface. This brought a brief period of snow during the late afternoon of the 22nd, and freezing rain during the overnight and day of the 23rd. All of Southern New England was affected, with icy roads and downed trees and wires. A little over one-tenth inch of ice accumulation was reported in Chester.
3/13/18	Low pressure along the Carolina coast March 12 moved up the coast and passed offshore of Southern New England on March 13, moving off through the Maritimes on March 14. From nine to fourteen inches of snow fell on Western Hampden County.
3/4/19	A storm the developed over the southern states moved up the coast the night of the 3rd and passed offshore of Nantucket the morning of the 4th. The storm then moved off to the northeast. This brought heavy snow to much of Southern New England. Highest snowfall amounts occurred from Northeast Connecticut to Boston Massachusetts. Roughly five inches of snow fell on Western Hampden County.
12/16/20	A storm system produced heavy snow, strong to damaging winds, and minor coastal flooding in southern New England. This was a tough storm to forecast. Although it was not deep low pressure and although it passed just south of the 40N/70W benchmark, its precipitation shield was expansive because of a broad 700 mb low over southeast New England, abundant moisture, and a very cold air mass in place. By far, the heaviest snow fell to the north (Laconia, NH) and west (Binghamton, NY), where more than 3 feet fell. But amounts ranged from 10 to 20 inches across much of southern New England. There was some minor coastal flooding at the time of high tide and also a flash freeze in eastern Massachusetts as the storm pulled away to the northeast. While no reports were received from the hill towns in western Hampden County, per se, we are estimating that heavy snow on the order of 10 to 20 inches fell, based on reports from surrounding areas. Winds generally were gusting to 20 to 30 mph.
2/1/21	A mid level trough over the Appalachians produced a secondary surface low pressure near the mid-Atlantic coast. High pressure over Hudson Bay allowed low level cold air to stay in place initially. Most of the region received 8 to 12 inches of snow, but a coastal front kept accumulations down in southeast and extreme eastern Massachusetts. This storm also produced strong winds and minor coastal flooding. Snowfall amount generally ranged from 10 to 14 inches.

Date	Description
12/16/22	Low pressure intensified along the New Jersey coast on the 16th and moved northeast across southeast New England, reaching the Gulf of Maine on the 17th. The big impact was very heavy elevational snows, with a foot-and-a-half of snow in the east slopes of the Berkshires and 8 to 10 inches in the hills of northern Worcester County. Elsewhere there was a few inches of rain and gusty winds, both ahead of and behind the system. Heavy snow fell in western Hampden County. Warning criteria was reached as early as 630 AM EST on the 16th. The final total in Chester was 14.0 inches (amateur radio). In Granville at 716 AM EST on the 16th, police reported a tree down on wires from the weight of the snow (road unspecified). In Chester at 759 AM EST on the 16th, the public reported multiple trees down on Round Hill Road (report relayed by amateur radio).
2/27/23	A potent mid-level low/shortwave deamplified as it moved east-southeast from the Ohio Valley late on the 27th and early on the 28th. At the surface, while the parent low lifted across the Great Lakes, a secondary low developed over DelMarVa in response to height falls from approaching trough...then moved east, passing well south of southern New England. The result was a northwest-to-southeast oriented band of heavy snow from western MA to northern and eastern CT to southern RI. Six to nine inches of snow fell in those regions. There was a very sharp cutoff to the northeast, with only one to two inches falling in northeastern MA and Cape Cod. Snowfall totals ranged from approximately 6 to 8.5 inches in western Hampden County. The highest report -- 8.5 inches -- was from Chester.
3/3/23	Low pressure just south of the New England coast intensified early on March 4 and moved off the coast during the day. Heavy snow occurred in the higher terrain of northern and western MA, while mixed precipitation occurred elsewhere. Initial snow began before midnight on March 3. Then another round occurred with the comma head during the late morning/afternoon on March 4. Winds gusted to 45 to 55 mph near the coast, with a few higher gusts. The were a couple of reports of coastal flooding. Snowfall totals generally ranged from 7 to 8 inches in western Hampden County. In Chester, 8.0 inches was reported by an amateur radio operator.
3/13/23	Strong low pressure meandered just off the southeast coast of New England from late on the 13th to early on the 15th, before moving eastward and farther offshore. In its wake, it produced 2 to 3+ feet in northern and western MA. Lesser amounts of 6-12 were common over interior lower elevations. In eastern CT, RI and eastern MA, a coating to 2 inches were common, as precipitation type was mainly wet snow and rain. Snowfall amounts ranged from 16 to 32 inches in western Hampden County. Some specific amounts included: 32.0

Date	Description
	inches in Blandford, 29.0 inches in Chester, and 16.0 inches in Granville. In Blandford at 523 AM on the 14th, a tree was down on Russell Stage Road.

Extent

Snowfall is a component of multiple hazards, including nor'easters and severe winter storms. Two scores, the *Regional Snowfall Index (RSI) and the NESIS*, are described in this section.

Since 2005, the RSI has become the descriptor of choice for measuring winter events that impact the eastern two-thirds of the U.S. The RSI ranks snowstorm impacts on a scale system from 1 to 5. The RSI is like the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes, except that it includes an additional variable: population. The RSI is based on the spatial extent of the storm, the amount of snowfall, and population (NOAA, n.d.).

The RSI is a regional index. Each of the six climate regions (identified by the NOAA National Centers for Environmental Information) in the eastern two-thirds of the nation has a separate index. The RSI incorporated region-specific parameters and thresholds for calculating the index. The RSI is important because, with it, a storm event and its societal impacts can be assessed within the context of a region's historical events. Snowfall thresholds in Massachusetts (in the Northeast region) are 4, 10, 20, and 30 inches of snowfall, while thresholds in the Southeast U.S. are 2, 5, 10, and 15 inches.

Table 40. RSI Scale.

Category	RSI Value	Event Description
1	1 to 3	Notable
2	3 to 6	Significant
3	6 to 10	Major
4	10 to 18	Crippling
5	18+	Extreme

Source: NOAA

Prior to the use of the RSI, the Northeast Snowfall Impact Scale, developed by Paul Kocin of The Weather Channel and Louis Uccellini of the NWS, was used to characterize, and rank high- impact northeast snowstorms with large areas of 10-inch snowfall accumulations and greater. In contrast to the RSI, which is a regional index, NESIS is a quasi-national index that is calibrated to Northeast snowstorms.

NESIS has five categories. The RSI and NESIS approaches do not include separate scales for ice storms; in general, ice storm extent is expressed on a case-by-case basis, and forecasts will provide the information needed to determine how to prepare and respond.

Meteorologists can often predict the likelihood of a severe storm or nor'easter. This can give several days of warning time. The NOAA's NWS monitors potential events and provides extensive forecasts and information several days in advance of a winter storm to help the state to prepare for the incident.

The RSI and NESIS classification systems coupled with the NWS warning systems are appropriate for Chester, as they have been used for many of the severe winter storms that have occurred in the region and the community. Storms have not occurred that are outside of these systems of classification.

According to some resources, the Sperry-Piltz Ice Accumulation Index (SPIA® Index) is becoming a resource for addressing ice events. The index is a copyright product with controlled distribution, according to its developers (refer to https://spia-index.com/). The SPIA® Index is "a forward-looking, ice accumulation and ice damage prediction index that uses an algorithm of researched parameters that, when combined with National Weather Service forecast data, predicts the projected footprint, total ice accumulation, and resulting potential damage from approaching ice storms. It is a tool to be used for risk management and/or winter weather preparedness." The index ranges from 0 ("minimal risk of damage to exposure utility systems") to 5 ("catastrophic damage to entire exposure utility systems"). To date, this type of system has not been needed in Chester.

Probability of Future Events

The ResilientMass Plan notes that Massachusetts experiences high-impact snowstorms at approximately the rate of three per year over the past 50 years, although there is significant interannual variability in the frequency and severity of winter storms. The Town of Chester should assume that winter storms are likely, even if the impacts of climate change will shift the timing to a shorter winter season. Heavy wet snowfall may be more common in the future. The overall probability of winter storms of all kinds, including blizzards and ice storms, is believed high.

Vulnerability Assessment

Exposure

Heavy snowfall coupled with low temperatures often results in increases in traffic accidents; disruptions in transportation, commerce, government, and education; utility outages due to falling trees, branches, and other objects; personal injuries associated with slippery surfaces and freezing temperatures; and numerous other problems. Specific damages associated with severe winter storm (snow) events include:

- Injuries and fatalities associated with accidents, low temperatures, power loss, falling objects and accidents associated with frozen and slippery surfaces and snow accumulation
- Increases in the frequency and impact of traffic accidents, resulting in personal injuries
- Ice-related damage to trees, building and infrastructure inventory, and utilities (power lines, bridges, substations, etc.)
- Roads damaged through freeze and thaw processes
- Stress on the local shelters and emergency response infrastructure
- Lost productivity that occurs when people cannot go to work, school, or stores due to inclement conditions

The entire Town should be considered exposed to the severe winter storm hazard.

Built Environment Impacts

The entire built environment of Chester is vulnerable to a severe winter storm. New England's climate offers no immunity to the potential damaging effects of severe winter storms. Some minimum damage is anticipated annually, with potential extensive damage occurring about once every 10 years.

Since Hazus doesn't support severe winter storms and there aren't other readily available severe winter storm models, historical data was used to determine potential losses and probabilities. From 2014 until 2023, there was $321,000 in storm damage in and around Chester. This equates to an AAL of $35,667.

Population Impacts

As discussed above, some traffic accidents associated with storm events include injuries and in limited cases, deaths. However, the number of injuries and deaths reported for accidents is generally low. Populations considered most vulnerable to severe winter storm impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Senior and low-income populations in Chester are particularly susceptible and the Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Environment Impacts

Severe winter storms can cause damage to parks and other, natural areas. Some areas of the Town may be out of service until roads are cleared and trees are removed.

Problem Statements for Severe Winter Storms

Table 41. Problem Statements for Severe Winter Storms.

Assets	Problems Associated with Severe Winter Storms
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations may be stranded during a winter storm event and may not be able to travel to emergency services.
Structures (including facilities, lifelines, and critical infrastructure)	• Roof ice dams may cause damage to structures. • Severe winter storms comprised a substantial expenditure for Chester over the course of the last decade. • The electrical grid and roadways are susceptible to failure and loss of use during storms.
Systems (including networks and capabilities)	• First responders may have difficulty reaching people if roads are closed due to road closures.
Natural, historic, and cultural resources	• Severe storms may damage trees in natural areas, and historical and cultural sites.
Activities that have value to the community	• Outdoor activities may be adversely impacted by severe winter storms.

Tornadoes

Tornadoes are a relatively infrequent occurrence but can be very destructive when they occur. While small tornadoes in outlying areas cause little to no damage, larger tornadoes in populated sections of Massachusetts have historically caused significant damage, injury, and death through the destruction of trees, buildings, vehicles, and power lines.

The Town of Chester Community Resilience Building Workshop Summary of Findings (2021) lists "wind" as one of the top hazards of concern.

Description

A tornado is a narrow rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The observable aspect of a tornado is the rotating column of water droplets, dust, and debris caught in the column. Tornadoes are the most violent of all atmospheric storms.

Tornadoes can form from individual cells within severe thunderstorm squall lines. They can also form from an isolated supercell thunderstorm. They can be spawned by tropical cyclones or the remnants thereof, and weak tornadoes can even occur from little more than a rain shower if air is converging and spinning upward.

Most tornadoes occur in the late afternoon and evening hours when the heating is the greatest. The most common months for tornadoes to occur are June, July, and August, although the Great Barrington tornado occurred in May 1995 and caused extensive damage.

A waterspout is a rapidly rotating column of air extending from the cloud base (typically a cumulonimbus thunderstorm) to a water surface, such as a bay or the ocean. They can be formed in the same way as regular tornadoes or can form on a clear day with the right amount of instability and wind shear. Tornadic waterspouts can have wind speeds of 60 to 100 mph, but since they do not move very far, they can often be navigated around. They can become a threat to land if they drift onshore.

Location

The U.S. experiences an average of 1,230 tornadoes per year from 1991 to 2020, more than any other country (NOAA, n.d.). Because Massachusetts experiences fewer tornadoes than other parts of the country, residents may be less prepared to react to a tornado. The ResilientMass Plan notes that Massachusetts is located within the FEMA Wind Zone II, with Zone IV typically experiencing the greatest number and strongest tornadoes. According to the FEMA National Risk Index most of the state has a "relatively low" risk of strong wind, with the exception of Worcester County which has a "relatively moderate" risk. The ResilientMass Plan notes that the area at greatest risk for a tornado touchdown runs from central to northeastern Massachusetts.

Previous Occurrences

The most devastating tornado to occur in New England was the Worcester Tornado of July 9, 1953, a category F4 tornado. The tornado passed through Barre, Rutland, Holden, Worcester, Shrewsbury, Westborough, and Southborough causing 90 deaths and over 1,300 injured. Damage estimates were placed at more than $52 million. The National Storm Prediction Center has ranked this as one of the deadliest tornadoes in the nation's history.

The most recent severe tornado to impact Massachusetts occurred June 1, 2011, affecting communities in Hampden and Worcester Counties. The EF3 tornado touched down in Westfield and traveled through West Springfield, Springfield, Wilbraham, Monson, Brimfield, and Sturbridge. The tornado caused extensive property damage and resulted in a FEMA disaster declaration.

There have been 15 tornadoes that have occurred in Hampden County between 1950 and 2023. The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists one tornado for the period 2014-2023.

Table 42. NCEI Severe Storm Database Entries Covering Tornadoes in Hampden County.

Date	Description	Losses Reported
8/2/20	A National Weather Service survey team concluded that a weak, narrow, but relatively long tornado occurred during the evening on Sunday, August 2 in western Massachusetts. It began in the southeast part of Sandisfield (Berkshire County), moved northeast across northwest Tolland (Hampden County), and lifted in the southern portion of Blandford (Hampden County). Damage was mainly to trees, but some minor home damage occurred in Sandisfield. The EF-Scale rating was EF-0, with estimated maximum wind speeds of 80 mph. The tornado was on the ground in a mainly continuous path for a little more than 8 miles, with a maximum width of approximately 100 yards. The tornado began in Sandisfield, just west of South Main Street. Some tree damage was observed on Carpenter Lane and on South Main Street at and just north of the Mile 4 marker. A home there had its upper window blown in, shingles ripped off, and the portico was lifted upward, enabling the supporting post to be shifted outward. Some corn stalks were flattened, and a neighbor's fence was blown down. In Tolland, trees were observed to be blown down in various directions from East Otis Road to the west shore of Twining Pond, where drone footage provided by an amateur radio operator showed a couple of dozen trees blown down in a narrow swath. Continuing to the northeast, many trees were downed on Belden Road and on a narrow portion of Schoolhouse Road just north of Belden Road. The damage became sporadic as it ended with some wires downed in Blandford, just west of the north end of the Cobble Mountain Reservoir. One tree was observed down near the Blandford Highway Department on Otis Stage Road (Route 23).	$45K in property damage

There has not been a recorded tornado touchdown in Chester.

Extent

The NWS rates tornadoes using the Enhanced Fujita scale (EF scale), which does not directly measure wind speed but rather the amount of damage created. This scale derives 3-second gusts estimated at the point of damage based on the assignment of 1 out of 8 degrees of damage to a range of different structure types. These estimates vary with height and exposure. This method is considerably more sophisticated than the original Fujita scale, and it allows surveyors to create more precise assessments of tornado severity.

Table 43. Enhanced Fujita Scale.

EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

Source: National Weather Service

Tornado watches and warnings are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.

The EF scale and the NWS warning products are applicable to all tornadoes that may strike Chester, as they are used throughout Massachusetts on a routine basis and appropriately characterized the tornado that passed through Chester. Tornadoes have not occurred that are outside of the EF scale or the NWS watch/warning system.

Probability of Future Events

According to the ResilientMass Plan, the Commonwealth experienced 190 tornadoes from 1950 to 2021, or an average annual occurrence of 2.6 tornado events per year. From 1995 to 2021, the average frequency of these events has been 2.06 events per year (NOAA, 2018). Massachusetts experienced an average of 1.4 tornadoes per 10,000 square feet annually between 1991 and 2010, less than half of the national average of 3.5 tornadoes per 10,000 square feet per year (NOAA, n.d.). As highlighted in the National Climate Assessment, tornado activity in the U.S. has become more variable, and increasingly so in the last two decades. While the number of days per year that tornadoes occur has decreased, the number of tornadoes on these days has increased. Climate models show projections that the frequency and intensity of severe thunderstorms (which include tornadoes, hail, and winds) will increase (USGCRP, 2017). Overall, it is unclear if tornado frequency will increase with climate change given the difficulty to draw conclusions based on thunderstorm statistics and the difficulty in identifying long-term trends.

Vulnerability Assessment

Exposure

High winds, heavy rain, lightning and/or hail associated with tornados, thunderstorms and microbursts can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death. The entire Town should be considered exposed to the tornado hazard.

Built Environment Impacts

Since Hazus doesn’t support tornadoes and there aren’t other readily available tornado models, historical data will be used to determine potential losses and probabilities. From 1955 until 2023, there was no property damage to Chester due to tornadoes. However, there were 15 events in Hampden County which produced $228.253M in property damage, 3 deaths, and 201 injuries. The county’s average annual loss would be $3.3M.

Population Impacts

Populations considered most vulnerable to tornado impacts in Chester are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Senior and low-income populations in Chester. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However, the Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Environment Impacts

Tornadoes can cause damage to parks, and other, natural areas. Some areas of the Town may be out of service until trees are removed.

Problem Statements for Tornadoes

Table 44. Problem Statements for Tornadoes.

Assets	Problems Associated with Tornadoes
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations may need support seeking protected shelter. Those without cell phones may not get weather alerts. • People without basements are susceptible to tornado impacts.
Structures (including facilities, lifelines, and critical infrastructure)	• Structures and critical infrastructure can all be impacted by tornadoes. • Roadways may be blocked due to downed trees and other debris.
Systems (including networks and capabilities)	• The electric grid may be impacted by winds and downed trees.
Natural, historic, and cultural resources	• Historic and cultural resources may be impacted by tornado winds. • Winds may damage trees and cause natural areas to close for cleanup.
Activities that have value to the community	• Outdoor events could be impacted by potential tornado activity.

Wildfires/Brushfires

A wildfire can be defined as any non-structure fire that occurs in vegetative wildland that contains grass, shrub, leaf litter, and forested tree fuels. Wildfires in Massachusetts are caused by natural events, human activity, or prescribed fire. Wildfires often begin unnoticed but spread quickly, igniting brush, trees, and potentially homes.

Description

The wildfire season in Massachusetts usually begins in late March and typically culminates in early June, corresponding with the driest live fuel moisture periods of the year. April is historically the month in which wildfire risk is the highest. Drought, snowpack level, and local weather conditions can impact the length of the fire season.

According to the National Fire Protection Agency, several elements (known as the fire tetrahedron) must be present in order to have any type of fire:

- Fuel: Without fuel, a fire will stop. Fuel can be removed naturally (when the fire has consumed all burnable fuel) or manually by mechanically or chemically removing fuel from the fire. In structure fires, removal of fuel is not typically a viable method of fire suppression. Fuel separation is important in wildfire suppression and is the basis for controlling prescribed burns and suppressing other wildfires. The type of fuel present in an area can help determine overall susceptibility to wildfires. According to the Forest Encyclopedia Network, four types of fuel are present in wildfires:
    - Ground Fuels: organic soils, forest floor duff, stumps, dead roots, buried fuels
    - Surface Fuels: the litter layer, downed woody materials, dead and live plants to 2 meters tall
    - Ladder Fuels: vine and draped foliage fuels
    - Canopy Fuels: tree crowns
- Heat: Without sufficient heat, a fire cannot begin or continue. Heat can be removed through the application of a substance, such as water, powder, or certain gasses, that reduces the amount of heat available to the fire. Scraping embers from a burning structure also removes the heat source.
- Oxygen: Without oxygen, a fire cannot begin or continue. In most wildland fires, this is commonly the most abundant element of the fire triangle and is therefore not a major factor in suppressing wildfires.
- Uninhibited Chain Reaction: The chain reaction is the feedback of heat to the fuel to produce the gaseous fuel used in the flame. In other words, the chain reaction provides the sustained heat necessary to maintain the fire. Fire suppression techniques, such as dry chemical extinguishers, break up the uninhibited chain reaction of combustion to stop a fire.

Location

The ResilientMass Plan identified areas in Barnstable, Essex, and Plymouth counties with the highest wildfire potential in the state. The ecosystems that are most susceptible to the wildfire hazard Include pine barrens in the Connecticut River Valley, marshes inundated with *Phragmites*, pine barrens and maritime grasslands in Martha's Vineyard, Nantucket, and Cuttyhunk, and the Myles Standish State Forest. Other portions of the Commonwealth are also susceptible to wildfire, particularly at the urban-wildland interface. Notwithstanding the location of Chester in western Massachusetts, the presence of wildland interface and vast rural areas makes Chester a location with wildfire risk.

Previous Occurrences

Several notable wildfires have occurred in Massachusetts history, although none has ever resulted in a FEMA disaster declaration. Smaller fires such as brush fires are somewhat easier to characterize. According to statewide data sets (https://www.mass.gov/service-details/fire-data-and-statistics), the number of brush fire events per year from 2012 through 2019 ranged from about 3,000 in 2019 to almost 8,000 in the drought year of 2016.

Table 45. Statewide Brush Fire Counts.

Year	Total # of Events	Injuries/Deaths (civilians and fire service)	Losses
2019	2,974	12/0	$136,357
2018	3,253	1/5	$493,145
2017	4,206	20/0	$215,156
2016	7,834	40/0	$1,526,654
2015	6,962	35/0	$323,211
2014	4,627	25/0	$209,857
2013	4,968	31/3	$297,854
2012	5,857	38/0	$705,457

According to this statewide data set, fire event counts back to 2012 were as follows for Chester:

Table 46. Outdoor and Total Fire Event Figures for Chester.

Year	Total Outdoor Fires	Total Fire Events	Reported Losses for Outdoor Fires
2012	1	4	$8,750
2013	4	6	$204,667
2014	1	3	$0
2015	8	13	$100,308
2016	0	2	$0
2017	0	2	$0
2018	0	5	$0
2019	1	6	$5,000
2020	2	2	Not available
2021	2	11	Not available

Applying the fraction of outdoor fire incidents that are typically brush fires in Massachusetts (52%) and the fraction of fire losses that are typically from brush fires in Massachusetts (0.2%), an alternate set of figures for brush fires in Chester is presented below. The right hand side of the table lists the figures presented in the previous edition of this plan, for comparison.

Table 47. Estimated Brush Fire Event Figures for Chester.

Year	Estimated Brush Fires	Estimated Brush Fire Losses	Wildfires Listed in 2016 Hazard Mitigation Plan for Chester
2012	1	$1,750	1
2013	2	$40,933	4
2014	1	$0	--
2015	4	$20,062	--
2016	0	$0	--

Year	Estimated Brush Fires	Estimated Brush Fire Losses	Wildfires Listed in 2016 Hazard Mitigation Plan for Chester
2017	0	$0	--
2018	0	$0	--
2019	1	$1,000	--
2020	1	$1,040*	--
2021	1	$1,468*	--

*Estimated from Countywide figures

The above estimates compare reasonably well to the figures reported in the previous edition of this plan. Overall, Chester experiences a small number of brush fires and wildfires each year which usually occurs along the rail line.

USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The single line item related to wildfires in Hampden County is listed below; this line corresponds to the drought of 2016.

Table 48. USDA Disasters Events That Refer to Wildfires.

Year	Event	Event "Begin Dates"
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016

During the meetings that were convened for this plan update, Town staff noted that Chester has not experienced major wildfires. Brushfires along the rail line are common.

Extent

Unfragmented and heavily forested areas of the state are vulnerable to wildfires, particularly during droughts. The greatest potential for significant damage to life and property from fire exists in areas designated as wildland-urban interface areas. A wildland-urban interface area defines the conditions where highly flammable vegetation is adjacent to developed areas.

Fires can be classified by physical parameters such as their fireline intensity, or Byram's intensity, which is the rate of energy per unit length of the fire front (BTU [British thermal unit] per foot of fireline per second) (NPS, n.d.). Following a fire event, the severity of the fire can be measured by the extent of mortality and survival of plant and animal life aboveground and belowground and by the loss of organic matter (NPS, n.d.).

The National Wildfire Coordinating Group defines seven classes of wildfires:

- Class A: 0.25 acre or less
- Class B: more than 0.25 acre, but less than 10 acres
- Class C: 10 acres or more, but less than 100 acres
- Class D: 100 acres or more, but less than 300 acres
- Class E: 300 acres or more, but less than 1,000 acres
- Class F: 1,000 acres or more, but less than 5,000 acres
- Class G: 5,000 acres or more

Early detection of wildfires is a key part of the overall efforts of the Massachusetts Bureau of Forest Fire Control. Early detection is achieved by trained Bureau observers who staff 22 of the 42 operating fire towers statewide. During periods of high fire danger, the Bureau conducts county-based fire patrols in forested areas. These patrols assist cities and towns in prevention efforts and allow for the quick deployment of mobile equipment for suppression of fires during their initial stage. If a fire breaks out and spreads rapidly, residents may need to evacuate within days or hours. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

The various wildfire classification systems coupled with the detection and warning systems are believed appropriate for Chester, despite the fact that extensive wildfires have not occurred in the community. Wildfires have not occurred outside of these systems of classification.

Probability of Future Events

It is difficult to predict the likelihood of wildfires in a probabilistic manner because a number of factors affect fire potential and because some conditions (e.g., ongoing land use development patterns, location, and fuel sources) exert changing pressure on the wildland-urban interface zone. The Massachusetts Climate Change Assessment report suggests that wildfire risk will increase over time in association with extreme heat events and changing precipitation and droughts. The following discussion helps characterize the risk further for Chester.

Vulnerability Assessment

Exposure

To help identify potential wildfire areas for Chester, the U.S. Forest Service's Wildfire Risk to Communities spatial data was downloaded. This data was developed in 2020 using the vegetation and wildland fuels from the LANDFIRE 2014 model with the burn probability coming from the Forest Service Fire Simulation System (FSim). To create a product with a finer resolution, the data was upsampled to the native 30m resolution of the LANDFIRE fuel and vegetation data spreading the values of the modeled burn probability into developed areas represented in LANDFIRE fuels as non-burnable. The areas with a 0.02% annual probability of burning were identified and overlaid with the critical facilities and other buildings. There were no critical facilities found adjacent to the 0.02% burn probability areas and eleven buildings including single family homes and churches found there. Table 49 shows the result of this analysis.

Table 49. Buildings in 0.02% Annual Chance Area.

Building Type	Number of Buildings in 0.02% Annual Chance Area (Total in Town)	Building Value in 0.02% Annual Chance Area (Total in Town)
Single Family	8 (923)	$1,380,500 ($150,508,800)
Mobile Home	0 (15)	$0 ($1,427,500)
Multi-Family	0 (42)	$0 ($7,663,200)
Mixed-Use	0 (202)	$0 ($38,670,400)
Commercial	0 (52)	$0 ($15,574,300)
Agricultural	0 (29)	$0 ($533,500)
Educational	0 (1)	$0 ($4,900,000)
Government	0 (9)	$0 ($895,400)
Religious/Non-Profit	3 (26)	$678,900 ($5,143,900)
Industrial	0 (13)	$0 ($2,044,900)
Garage/Outbuilding	0 (22)	$0 ($259,450)
Vacant	0 (48)	$0 ($1,486,000)
Total	**11 (1,382)**	**$2,059,400 ($227,621,350)**

The population exposed to the 0.02% probability area is shown in Table 50. The column on the left shows the population in and around the 0.02% probability wildfire area (wherever the Census Block overlapped with the wildfire area) while the column on the right shows the total population numbers for the Town. There is an older population than the town average exposed to the wildfire hazard.

Table 50. Population Exposed to 0.02% Annual Chance Wildfire (2020 U.S. Census).

Demographics	Population in and Adjacent to Wildfire-Prone Areas	Total Population
Population	71	1,228
Households	38	622
White	67 (94.4%)	1,117 (91.0%)
Black	0 (0.0%)	3 (0.2%)
American Indian	0 (0.0%)	9 (0.7%)
Asian	1 (1.4%)	3 (0.2%)
Pacific Islander	0 (0.0%)	0 (0.0%)
Other Race	0 (0.0%)	19 (1.5%)
Two or More Races	3 (4.2%)	77 (6.4%)
Hispanic or Latino:	0 (0.0%)	51 (4.2%)
Population under 18:	17 (23.9%)	308 (25.1%)
Population over 64:	12 (16.9%)	193 (15.7%)
Annual Income < $30K/year	5 (13.2%)	96 (15.4%)
Population in EJ Zone*	0 (0.0%)	0 (0.0%)

**Massachusetts Office of Energy and Environmental Affairs, 2022*

Figure 25 shows the burn probability map from the USFS overlaid on the Town.

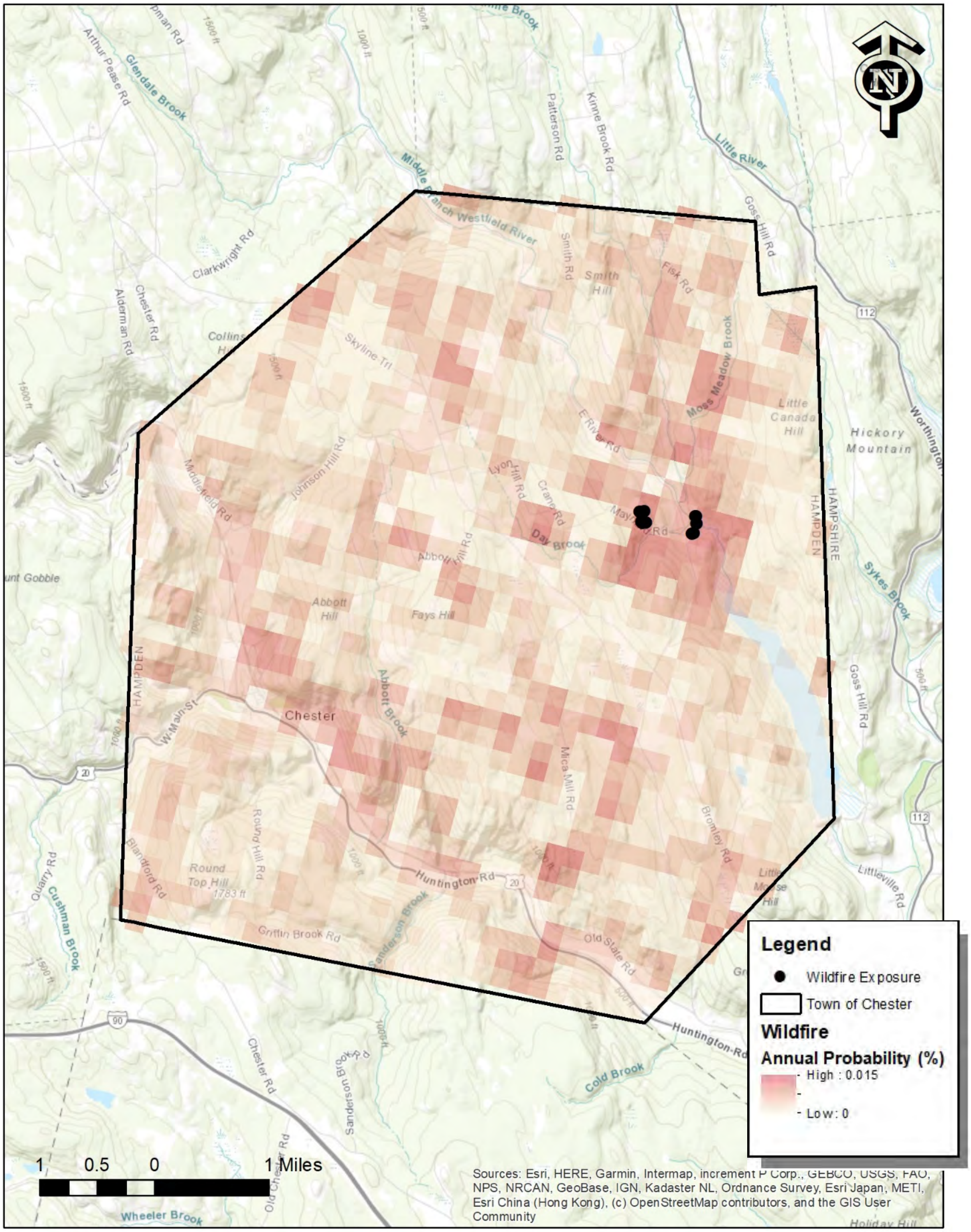


Figure 25. Wildfire Burn Probability Map.

Built Environment Impacts

A major out-of-control wildfire can damage property, utilities and forested land; create smoke that can cause breathing problems; and injure or kill people. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

No property damage, injuries or deaths have been recorded for the reported for major wildfires in Chester between 2004 and 2022. Using the wildfire probabilities and building values, a loss estimate was produced for the 0.02% scenario. The losses are $2,059,400 for the .02% event and the AAL will be $973.

Climate change will increase the probability of brushfires which could lead to additional property damage. Future development in forested and other high-fuel areas also could lead to additional increases in the probability of brushfires.

Population Impacts

Populations considered most vulnerable to wildfire impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Senior and low-income populations in Chester are particularly susceptible to wildfires. The Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

With the increased probability of brushfires outside of the Town in the future due to climate change, populations may be impacted more often due to air quality issues.

Environment Impacts

Many of the natural features in the Town are susceptible to wildfire, including the trees and parks.

Problem Statements for Wildfires

Table 51. Problem Statements for Wildfires.

Assets	Problems Associated with Wildfires
People (including underserved communities and socially vulnerable populations)	• Populations with severe asthma may be adversely impacted by wildfires in the vicinity.

Assets	Problems Associated with Wildfires
Structures (including facilities, lifelines, and critical infrastructure)	• Residential and church structures are found in the higher probability burn areas and areas. Structures without defensible zones are more susceptible to wildfires and brush fires. • Brush fires are a somewhat common occurrence around rail lines. Recently, brush has been cut along the rail lines and has not been removed creating a more hazardous condition.
Systems (including networks and capabilities)	• Wildfires often cause roads to be closed requiring detours impacting emergency services.
Natural, historic, and cultural resources	• Wildfires may adversely impact forested and other vegetated areas of Chester.
Activities that have value to the community	• Recreational activities may be adversely impacted by wildfires, depending on location.

National Flood Insurance Repetitive Loss Properties

B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

***REPETITIVE LOSS STRUCTURE** means a structure covered under an NFIP flood insurance policy that (1) has incurred flood-related damage on two occasions, in which the cost of repair, on average, equaled or exceeded 25% of the value of the structure at the time of each such flood event; and (2) at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.*

According to FEMA, repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. Severe repetitive loss properties are residential properties that have at least four NFIP payments over $5,000 each and the cumulative amount of such claims exceeds $20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building.

According to data provided by MEMA, two repetitive loss properties have experienced four loss events, with $25,769.42 total building payments and $0.00 total content payments. Both properties are single family homes. There are no severe repetitive loss properties at this time.

> ***SEVERE REPETITIVE LOSS** structure means a structure that is covered under an NFIP flood insurance policy and has incurred flood-related damage (1) for which four or more separate claims have been made under flood insurance coverage, with the amount of each claim (including building and contents payments) exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or (2) for which at least two separate flood insurance claims payments (building payments only) have been made, with cumulative amount of such claims exceeding the value of the insured structure.*

A summary of the Town's participation and compliance with the NFIP, including current policy and historical claims statistics, is provided in Table 7 of Chapter 5 (Capability Assessment).

Hazard Ranking

Ranking hazards helps the town set goals and mitigation priorities. To compare the risk of different hazards, and prioritize which are more significant, requires a scoring system for equalizing the units of analysis. As not all hazards assessed in this plan have precisely quantifiable probability or impact data, a scoring system based on multi-criteria decision analysis (MCDA) methodology was developed to rank all the hazards. This multi-criteria ranking analysis approach prioritizes hazard risk based on a blend of quantitative factors from the available data, such as historical data, local knowledge, public survey, and Hazus assessment. This hazard ranking analysis assigns varying degrees of risk to five categories for each of the hazards, including: probability (how often it can occur), impact (economic, social, and environmental loss), spatial extent (the size of the area affected), warning time (how long does a community have to prepare for the event), and duration. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor derived from a review of best practice plans. Some of these hazard characteristics, like probability and impact, are more important than others and are weighted more heavily.

To calculate a rank score value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories represents the final rank score, as demonstrated in the following equation:

Hazard Score Value = [(Probability x 30%) + (Impact x 30%) + (Spatial Extent x 20%) + (Warning Time x 10%) + (Duration x 10%)]

Table 52 provides the hazard characteristic, level description, level criteria, level index value, and weighting value.

Table 52: Hazard Ranking Criteria

Hazard Characteristic	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption to quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in the affected areas damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected areas damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	Long	More than 24 hours	1	10%
	Moderate	12 to 24 hours	2	
	Short	6 to 12 hours	3	
	Very short or no warning	less than 6 hours	4	
Duration	Very short	Less than 6 hours	1	10%
	Short	Less than 24 hours	2	
	Moderate	Less than one week	3	
	Long	More than one week	4	

Table 53 provides the final hazard ranking for Chester. Each hazard characteristic is assigned a value between 1 (lowest value) and 4 (highest value). When the risk values were calculated, if the value was greater than 2.6, it was assigned as a high risk hazard. If the value was greater than or equal to 2 and less than 2.7, it was assigned as a moderate risk. If the value was less than 2, it was assigned as a low risk hazard. The flood, severe winter storms, other severe weather, and wildfire/brushfire hazards were ranked highest. The average and extreme temperatures, hurricanes/tropical storms, invasive species, droughts, landslides, and tornadoes were all ranked as moderate. The earthquake hazard is ranked as low.

Table 53. Final Hazard Ranking of Hazards for Chester.

Hazards	Probability	Impact	Spatial Extent	Warning Time	Duration	Value	Rank
Flooding from Precipitation and Dam Overtopping	4	3	2	3	2	3	High
Severe Winter Storms	4	2	4	1	3	3	High
Other Severe Weather	3	3	4	2	1	2.9	High
Wildfires/Brushfires	2	3	3	3	3	2.7	High
Average and Extreme Temperatures	3	2	4	1	2	2.6	Mod.
Hurricanes/Tropical Storms	2	3	4	1	2	2.6	Mod.
Tornadoes	2	4	2	3	1	2.6	Mod.
Droughts	2	2	4	1	4	2.5	Mod.
Invasive Species	3	2	2	1	4	2.4	Mod.
Landslides	2	2	1	4	2	2	Mod.
Earthquakes	1	1	4	4	1	1.9	Low

The following table summarizes changes in population patterns and land use and development and how those impact hazards.

Table 54. Impacts from Population and Land Use.

Hazards	Changes in Population Patterns	Changes in Land Use and Development
Flooding from Precipitation and Dam Overtopping Including Dam Failures and Ice Jams	There is a growing elderly and low income population exposed to the floodplain: • West of Middlefield Rd. • North of Route 20.	Existing codes and regulations in the SFHA will help to keep flood impacts low. New development areas may produce additional flooding due to the addition of impervious surfaces.
Droughts	The Town's elderly population has increased 3.5% from 2010 to 2020. The number of people living below the poverty line has increased by 1.0% from 2010 to 2020.	All new developments will create more demand for limited water resources.
Landslides	There is a growing elderly population in North Chester and east of Route 20 exposed to moderate landslide susceptibility.	Existing land use regulations will help to keep development out of landslide-prone areas.
Extreme Temperatures	The Town's elderly population has increased 3.5% from 2010 to 2020. The number of people living below the poverty line has increased by 1.0% from 2010 to 2020.	All new developments will exacerbate heat island effect if the development includes tree removal and adding black surfaces such as asphalt and roofs.
Wildfires/ Brushfires	There is a growing elderly population north of Maynard Road with a moderate wildfire susceptibility.	Development in or adjacent to a forested or brushland area can lead to a higher risk of wildfire.
Invasive Species	Shouldn't be impacted by population changes.	Shouldn't be impacted by changes in land use and development.

Hazards	Changes in Population Patterns	Changes in Land Use and Development
Hurricanes and Tropical Storms	The Town's elderly population has increased 3.5% from 2010 to 2020. The number of people living below the poverty line has increased by 1.0% from 2010 to 2020.	Shouldn't be impacted by changes in land use and development.
Severe Winter Storms	The Town's elderly population has increased 3.5% from 2010 to 2020. The number of people living below the poverty line has increased by 1.0% from 2010 to 2020.	Shouldn't be impacted by changes in land use and development.
Tornadoes	The Town's elderly population has increased 3.5% from 2010 to 2020. The number of people living below the poverty line has increased by 1.0% from 2010 to 2020.	Shouldn't be impacted by changes in land use and development.
Other Severe Weather	The Town's elderly population has increased 3.5% from 2010 to 2020. The number of people living below the poverty line has increased by 1.0% from 2010 to 2020.	Shouldn't be impacted by changes in land use and development.
Earthquakes	Not considered.	Not considered.

Problem Statements Summary

The following problem statements reflect a summary of the problem statements included at the end of each hazard profile. They were designed to briefly summarize the key hazard risks and vulnerabilities to the community based on potential impacts and losses from future events. They are among the issues of greatest concern and were used to assist in the identification and analysis of potential mitigation actions for Chapter 6 (Mitigation Strategy). These problem statements will be reviewed and revised as needed during plan updates to reflect the most current information resulting from the risk assessment.

Table 55. Problem Statements Summary.

Hazard	Problem Summary
Flooding from Precipitation and Dam Overtopping	• Older populations in the floodplain may have difficulty evacuating. • The Village Center is exposed to the 100-year floodplain while the Elementary School and Town Hall have properties adjacent to the floodplain and operations may be impacted. Roads to and from the school could be impacted by flood water. • The fire station is exposed to the floodplain. • There are approximately 292 buildings in the floodplain including all building occupancies. • The railroad is exposed to the flood hazard and several roads experience flooding including Main Street, Middlefield Road, Johnson Hill Road, Abbot Road, Riverfront Road, Old State Road, Maple Avenue, Maple Street, and Andrews Avenue. There are several culverts which are older and undersized which can contribute to flood impacts. • Chester may experience flooding from a dam breach in Becket which could impact critical facilities and other structures down stream. • According to EPA's Toxic Release Inventory (TRI) database, there are some facilities which contain hazardous materials in the 100-year floodplain including Abrasive Industries Inc, Ritchie's Garage, and Lafond Construction Inc. • There are over 100 historic structures and sites listed on the National Register of Historic Places in the floodplain.
Severe Winter Storms	• Vulnerable populations may be stranded during a winter storm event and may not be able to travel to emergency services. • The electrical grid and roadways are susceptible to failure and loss of use during storms.

Hazard	Problem Summary
	• First responders may have difficulty reaching people if roads are closed due to road closures.
Other Severe Weather	• First responders may have difficulty reaching people if roads are closed due to tree debris. • Storm damage to wind-susceptible buildings such as carports, greenhouses, and open-walled buildings. Additional damage to commercial buildings with HVAC located on roofs. • The electric grid may go down during high wind event.
Wildfires/Brushfires	• Populations with severe asthma may be adversely impacted by wildfires in the vicinity. • Some residential and church structures are found in the higher probability burn areas as well as bordering specific areas. Structures without defensible zones are more susceptible to wildfires and brush fires. • Brush fires are a somewhat common occurrence around rail lines. Recently, brush has been cut along the rail lines and has not been removed creating a more hazardous condition. • Wildfires often cause roads to be closed requiring detours impacting emergency services. • Transmission of embers over long distances, especially under high-wind conditions, is a major source of wildfires.
Average and Extreme Temperatures	• Extreme heat will be a significant public health threat to all residents, but especially for vulnerable populations living in older homes or homes without air conditioning. • The electric grid may become stressed and fail during extreme heat events. • The elderly and those with mobility issues may not be able to leave their homes and travel safely.

Hazard	Problem Summary
	• People working in businesses without air conditioning may be at risk of heat illness. • Contributes to higher wildfire risk due to the drying of fuels in the forest including below-ground root dry out.
Droughts	• Vulnerable communities may have difficulty accessing potable water during an emergency drought event. • Water supply infrastructure may need to be shut down and water quality may become substandard. Businesses requiring water for daily operations may have their operations limited due to water restrictions. • Age and condition of pipe conduit connecting Horn Pond to Austin Brook Reservoir is a concern. • Outdoor water use restrictions and other water conservation measures during periods of extreme drought can be challenging to enforce, even when mandated through local declaration.
Tornadoes	• Vulnerable populations may need support seeking protected shelter. Those without cell phones may not get weather alerts. • Structures and critical infrastructure can all be impacted by tornadoes. • Roadways may be blocked due to downed trees and other debris. • The electric grid may be impacted by winds and downed trees.
Hurricanes/Tropical Storms	• Wind may cause trees to fall into structures and infrastructure, and roadways. • Wind damage to wind-susceptible buildings such as carports, greenhouses, and open-walled buildings. Additional damage to commercial buildings with HVAC located on roofs. • The electric grid may go down during high wind event.

Hazard	Problem Summary
Invasive Species	• Invasive species are problematic throughout the Town and have been verified at the John J. Kelly Wildlife Management Area, Chester-Blandford State Forest, and along the rail line. • Emerald ash borer continues to be a challenge for Chester. • Additional DPW resources may be required in critical areas. • Vector borne disease incidence may increase with climate change, adversely impacting vulnerable people.
Landslides	• Vulnerable populations in isolated areas may be cut off if a landslide impacts specific roads. • Some historical, residential, commercial, and other structures reside adjacent to moderately unstable areas and could be impacted. • Sediment may wash into the road causing lifeline impacts. • Route 20 is a major transportation route for the Town and a rockslide could cause casualties. Maynard Hill Road and Johnson Hill Road are at risk for landslides. • Water treatment plant exposed to landslide hazard along with road to plant. Roads and rail may be impacted and could cause a hazardous material spill.
Earthquakes	• Elderly population may fall during an event. • Unreinforced masonry and utility lifelines impacted.

Chapter 5: Capability Assessment

Overview

The capability assessment is an evaluation of the existing tools and resources available to the Town of Chester for increasing its resilience to hazards, with the primary purpose of identifying opportunities to improve or enhance these capabilities. Coupled with the risk assessment, the capability assessment serves as the foundation for designing an actionable and effective hazard mitigation strategy.

As in any planning process, it is important to establish which goals or actions are feasible based on the organizational capacity of those agencies or departments tasked with plan implementation. This capability assessment helps determine which types of mitigation actions are practical and likely to be completed over time based on Chester's existing authorities, policies, programs, and resources available to support them. It also helps identify any critical capability gaps or limitations to address through corrective actions, as well the key strengths or positive measures in place that should continue to be supported or expanded upon to improve local mitigation capabilities.

This capability assessment was completed to not only help establish the goals and actions for the Town of Chester's hazard mitigation plan, but to also help ensure that those goals and actions are realistically achievable under current local conditions. As highlighted in FEMA's 2022 Local Mitigation Planning Policy Guide, *"describing the current capabilities provides a rationale for which mitigation projects can be undertaken to address the vulnerabilities identified in the Risk Assessment."* [51]

The capability assessment for the Town of Chester includes a comprehensive examination of several components as summarized in Table 56. It was prepared using the latest guidance provided in FEMA's 2023 Local Mitigation Planning Handbook.[52]

Table 56. Capability Assessment Components.

Components	Description
Planning and Regulatory Capabilities	Local plans, policies, codes, and ordinances that are relevant to reducing the potential impacts of hazards.
Administrative and Technical Capabilities	Local human resources and their skills/tools that can be used to support mitigation activities.

[51] Local Mitigation Planning Policy Guide. FEMA. April 2022. P. 25.

[52] Local Mitigation Planning Handbook. FEMA. May 2023. PP. 79-92.

Financial Capabilities	Fiscal resources the community has access to for helping to fund hazard mitigation projects.
Education and Outreach Capabilities	Local programs and methods already in place that can be used to support mitigation activities.
NFIP Participation and Compliance	Summary of information relevant to the community's participation in the NFIP and continued compliance with NFIP requirements.

Review and Incorporation of Existing Plans, Studies, and Reports

A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))

The first step in completing the updated capability assessment was to gather and review any relevant local plans, studies, or reports completed or updated since the previous hazard mitigation plan was adopted in 2016. This information was used to help gain a current understanding of the Town's current ability to mitigate risk, and how local capabilities may have changed over the past eight years. The 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (the "ResilientMass" Plan), as well as other plans adopted by the Town of Chester in the recent past, were reviewed for consistency as well as opportunities for plan integration. The goal of this review was to support updates to this plan that easily align with and possibly incorporate key aspects of relevant plans at the state and local level.

Table 57 provides a summary of the most relevant plans, studies, reports, or sources of other technical information consulted as part of this process and how they were incorporated into this plan update.

Table 57. Relevant Plans, Studies, and Reports for Incorporation.

Plan / Study / Report	Summary Description / Incorporation
ResilientMass Plan: The Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2023)	The 2023 ResilientMass Plan is an update to the Commonwealth's innovative State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) that was developed in a highly collaborative manner to fully integrate a hazard mitigation plan and a climate change adaptation plan. The ResilientMass Plan identifies strategies and specific, measurable actions state agencies can take—individually or through interagency partnerships—to address risks to the human health and safety, communities, critical assets and infrastructure,

Plan / Study / Report	Summary Description / Incorporation
	natural resources, governance, and economy of the Commonwealth. The ResilientMass Plan aims to ensure the Commonwealth is prepared to withstand, rapidly recover from, adapt to, and mitigate natural hazard events. Through the ResilientMass Plan, the Commonwealth is advancing its mission to increase its capacity for addressing natural and other hazards and climate impacts through preparation, mitigation, adaptation, and risk reduction. The ResilientMass Plan includes six (6) overarching goals which were developed through a collaborative process involving the interagency ResilientMass Action Team (RMAT) and local, regional, and community partners. It also integrates the findings of the 2022 Climate Assessment with additional analysis on all current hazards that may impact the Commonwealth, as well as future risks that will increase the likelihood, frequency, and duration of hazards. Of perhaps most relevance to local communities, the ResilientMass Plan identifies the most urgent priority impacts of these risks to various regions across the Commonwealth. The ResilientMass Plan was incorporated as a key source of information for this plan update. This included the integration and consideration of the latest climate data and information for 15 hazards impacting the Commonwealth now and, in the future, with particular emphasis on those unique impacts determined for the Berkshires and Hilltowns region. In addition, the goals and actions included in Chapter 7 (State Strategy, Actions, and Implementation Plan) were reviewed and considered as part of the update process for Chester's Hazard Mitigation Plan to help ensure the Town's own goals and objectives are in alignment with and can be mutually supportive of the Commonwealth's overall strategy. As can be seen in Chapter 6 of this plan. several of the goals and actions identified for Chester's updated plan address the key themes identified in the ResilientMass Plan.
Town of Chester Municipal Vulnerability Preparedness (MVP) / Community Resilience Building (CRB) Summary of	The Commonwealth's Municipal Vulnerability Preparedness (MVP) program provides support for cities and towns in Massachusetts to plan for resiliency and implement key climate change adaptation actions for resiliency. In 2020, Chester was awarded an MVP Planning Grant to assess its vulnerability to and prepare for climate change impacts, build community resilience, and receive designation from the Executive Office of Energy and Environmental Affairs (EEA) as an MVP Community. Communities with this designation become

Plan / Study / Report	Summary Description / Incorporation
Findings Report (2021)	eligible for MVP Action Grant funding and other opportunities to support the implementation of priority climate adaptation actions. In completing the MVP planning process, the Town of Chester followed the Community Resilience Building (CRB) framework with technical assistance provided by a state-certified MVP Provider, the Pioneer Valley Planning Commission (PVPC). The CRB methodology is an “anywhere at any scale” format that draws on stakeholders’ wealth of information and experience to foster dialogue about a community’s strengths and vulnerabilities. The Town hosted two 2-hour virtual workshops (March 30 and April 6, 2021) and one three-hour virtual workshop (April 10, 2021)., with the following central objectives: 1. Affirm community consensus of the local meaning of extreme weather and local natural and climate-related hazards. 2. Identify existing and future vulnerabilities and strengths. 3. Develop and prioritize actions for the Town and a broad stakeholder network. 4. Identify opportunities for the community to advance actions to reduce risk and increase resilience. The resulting Summary of Findings Report and supporting materials served as a primary source of information and community-based input for incorporation into the update of this plan. These inputs include the identification of top climate-influenced hazards and vulnerable areas or community assets (infrastructural, societal, and environmental), current community concerns and challenges, current strengths and assets, and specific, prioritized recommendations to improve resilience in Chester. The top four hazards for the workshop as agreed upon by the CRB participants were: Extreme Heat (including temperature fluctuation), Intense Rainfall and Flooding (Localized & Riverine), Winter Weather, and Wind.
Beaver Assessment Technical Memorandum (2023)	In support of a regional MVP Action Grant focused on “Evaluating and Planning for Resilient Dirt Roads” in the Towns of Chester, Middlefield, and Blandford, beaver activity was assessed at key sites where impacts were identified by staff and project steering committee members from the Town of Chester. The primary goal of the overall project is to increase resilience to flooding, washouts, and storm damage along dirt roads throughout the three Towns. To that end, the beaver assessment component of the

Plan / Study / Report	Summary Description / Incorporation
	project sought to analyze beaver activity to determine where the nature of such activity may be supportive of greater resilience and where it may be threatening to dirt road infrastructure. The beaver assessment protocol is not meant to cover an exhaustive Town-wide assessment, but typically focuses on specific areas based on known areas of substantial beaver activity, historic or ongoing impacts, complaints, etc. This memorandum, prepared by consultants at Fuss & O'Neill, summarizes the methods and results of the beaver management field surveys and recommended management approaches based on field observations and the vulnerability assessment and prioritization process and presents a protocol for assessing new sites and assigning them to one of three management categories to guide selection of appropriate management strategies. It is intended to serve as an ongoing guidance document for future use by the Town, and to provide both recommendations for specific sites, as well as more general observations and a systematic, evidence-based process to guide management decision-making when new beaver activity or potential impacts are reported.
FEMA Flood Insurance Study for Hamden County (2023)	Last published by FEMA on June 7, 2023, this report constitutes the currently effective Flood Insurance Study (FIS) report for Hampden County. This latest FIS revises and updates information on the existence and severity of flood hazards for the study area, which includes the Town of Chester. The studies described in this report provide flood hazard data that are used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management. The FIS and accompanying Flood Insurance Rate Maps (FIRMs) include relevant data and information on flood hazards for Chester, including but not limited to descriptions of principal flood problems, flooding sources, FEMA flood zone designations, base flood elevations, and discharge rates of flooding sources. This data and information were reviewed and incorporated into the plan update process by informing the risk assessment, especially as it relates to the hazard profile and vulnerability assessment that was prepared for the flood hazard.

In addition to the above plans which were determined to be most relevant for incorporation into the hazard mitigation plan update, the following plans, studies, reports, and other technical documents were reviewed to gain a clearer understanding of local capabilities and their existing or potential effects on hazard risk reduction. More information on some of these documents is provided in Table 58 in the next section.

- ***Annual Town Report (2023)*** – The Annual Town Report contains updated facts and statistics for Chester and a series of informational reports from the Town's various departments, boards, commissions, and other officials.
- ***Comprehensive Emergency Management Plan (2022)*** – The Town's Comprehensive Emergency Management Plan (CEMP) provides a framework for a community-wide emergency management system to ensure a coordinated response to emergencies and coordinated support of certain pre-planned events. The CEMP addresses the roles and responsibilities of all community departments, agencies, government organizations, volunteers, and other community partners that may be involved in response operations, and identifies how regional, state, federal, private sector, and other resources may be activated to address disasters and emergencies in the community. Although the plan is focused on actions and activities in response to an emergency or disaster event, it does provide general guidance on the roles and responsibilities of Town departments and partners for the prevention and mitigation of anticipated incidents. The CEMP also includes a summary of a threat, hazard, and vulnerability analysis completed by Town that is reviewed and updated on a regular basis.
- ***Local Rapid Recovery Plan (2021)*** – The Local Rapid Recovery Plan (LRRP) was prepared for the Town of Chester as part of the Massachusetts Rapid Recovery Plan (RRP) Program. The RRP was intended to provide every municipality in Massachusetts the opportunity to develop actionable, project-based recovery plans tailored to the unique economic challenges and COVID-19 related impacts to downtowns, town centers, and commercial areas across the Commonwealth. The Chester LRRP examines market and physical conditions, as well as feedback from the business community, to identify strategic projects that support a sustainable and equitable recovery from the COVID-19 pandemic. While the report is primarily focused on the Village Center, several recommendations and proposed projects could apply to businesses throughout town.
- ***Chester Economic Development Presentation (2020)*** – This presentation outlines several goals and activities for the Town of Chester regarding economic development such as growing the tax base, adding new revenue generating sources, and reducing the property tax rate. It touches on capital planning initiatives and methods to promote business growth, Chester attractions, and residential development in addition to ongoing projects.
- ***Chester Village Infrastructure Improvement Planning Report (2006)*** – This report summarizes the results of a detailed infrastructure inventory and assessment of the Chester Village Water Service Area performed by Lenard Engineering, Inc. (LEI) in 2006. It includes an evaluation of existing infrastructure conditions, demand, use and capacity data, and recommendations for improvements at the time. In addition, the report provides a 10-Year Capital Improvement Plan

with opinions of probable costs, funding strategy recommendations, and a map of the projected infrastructure improvements.

Planning and Regulatory Capabilities

C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

Table 58 is based on Worksheet 4 from FEMA's Local Mitigation Planning Handbook. It was used by the HMPC to document and review the current planning and regulatory capabilities of the Town including local plans, policies, codes, and ordinances that are relevant to reducing the potential impacts of hazards. Some additional information on how effectively these plans and regulatory tools are being used for hazard mitigation purposes can be found under the Safe Growth Survey and NFIP Participation and Compliance sections of this chapter.

Table 58. Planning and Regulatory Findings.

Planning/Regulatory Tool	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Plans		
Master/Comprehensive Plan	No	No current plan, though back in the early 2000s the PVPC worked with the Town on a Community Development Plan that was funded by Massachusetts Executive Order 418, which offered municipalities funding to create local plans to address four principal areas including open space and resource protection, housing, economic development, and transportation. This plan is very outdated and not considered relevant for plan update purposes.
Open Space & Recreation Plan	No	No current plan but the Town is in the process of researching and preparing to develop an OSRP for approval by the Massachusetts EEA's Division of Conservation Services.

Planning/Regulatory Tool	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Climate Adaptation Plan	No	Although technically not a full climate adaptation plan per se, the Town's 2020 MVP Summary of Findings Report does include a basic assessment of key strengths and vulnerabilities and identifies a series of recommended actions to reduce the impacts of Chester's top climate hazards. See Table 57 for more details on the MVP report. Effective in terms of identifying and prioritizing actions to build community resilience for specific hazards through continued coordination and integration with this hazard mitigation plan.
Floodplain Management Plan	No	No stand-alone plan, but floodplain management is addressed as a key component of this Hazard Mitigation Plan.
Stormwater Management Plan	No	N/A
Capital Improvements Plan	No	The Town's Finance Committee handles capital needs/requests through its annual budget process (in which Town departments submit their own requests for the following year). A longer term plan would be very helpful, especially for larger / more costly capital projects. This was recommended in the previous Hazard Mitigation Plan and is still considered a current need by the HMPC.
Housing Production Plan	No	N/A
Transportation Plan	No	N/A
Economic Development Plan	No	No specific plan however the Town has established some goals and benchmarks in planning for its financial security (see *Chester Economic Development Presentation* as referenced below Table 57).
Historic Preservation Plan	No	No plan, but the Chester Historical Society is dedicated to the preservation of Chester's heritage and historical buildings. The society maintains numerous resources

Planning/Regulatory Tool	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
		for local history or genealogical research, as well as a large collection of items from Chester's industrial past.
Emergency Operations Plan	Yes	The Town's Comprehensive Emergency Management Plan (CEMP) is focused on actions and activities in response to an emergency or disaster event; however, it does provide general guidance on the roles and responsibilities of Town departments and partners for the prevention and mitigation of anticipated incidents. Not considered an effective plan for long-term risk reduction but should continue to cross-reference this hazard mitigation plan in future updates. More details on the CEMP are provided in the previous section following Table 57.
Continuity of Operations Plan	No	N/A
Community Wildfire Protection Plan	No	N/A
Building Code, Permitting, and Inspections		
Building Code	Yes	Version/Year: MA State Building Code (780 CMR), Ninth Edition, 2017
Special Permit / Site Plan Review Requirements	Yes	The Chester Planning Board serves as the special permit granting authority for all purposes in accordance with all applicable rules and regulations as cited in the Town's Zoning Bylaw. Special permits are intended to provide detailed review of certain uses and structures which may have substantial impact upon traffic and environment, health and safety, property values, utility systems, and the character of the Town among other things. The Special Permit review process is intended to ensure a harmonious relationship between proposed development and its surroundings, and ensure the proposals are consistent with the purpose and intent of the Bylaw. Site Plan Approval is also required for those uses cited in the Town's Site Plan Approval Bylaw.

Planning/Regulatory Tool	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Zoning, Land Use, and Development Regulations		
Zoning Bylaw	Yes	The purposes of the Zoning Bylaw are to promote the health, safety, and general welfare of the inhabitants of the Town of Chester; to protect and conserve the value of property within the Town; and to secure safely from fire, congestion, or confusion, all in accord with the General Laws of the Commonwealth of Massachusetts, Chapter 40A. Very effective for hazard risk reduction through numerous policies, procedures, and regulations as described elsewhere in this table.
Subdivision Regulations	Yes	Subdivision Regulations were enacted for the purpose of protecting the safety, convenience, and welfare of the inhabitants of the Town of Chester by regulating the laying out and construction of ways in subdivisions providing access to the several lots therein, but which have not become public ways, and ensuring sanitary conditions in subdivisions and in proper cases parks and open areas. Very effective in terms of promoting safety in the case of fire, flood, panic, and other emergencies in addition to securing adequate provisions for water, sewerage, drainage and other requirements where necessary.
Floodplain Regulations	Yes	Adopted and enforced per Section 4.0 (Floodplain and Westfield River Protection District) of the Town's Zoning Bylaw. Very effective regulations for protecting life, public safety, and property from flooding hazards, preserving the natural flood control and flood storage characteristics of the floodplain, and other purposes as cited in the Bylaw. These regulations are critical for reducing risk in high risk flood areas as depicted on FEMA Flood Insurance Rate Maps (FIRMs) in addition to other areas within the Westfield River Protection District (including the entire length of the West Branch of the Westfield River and that section from the Chester-Middlefield/Worthington town line to the

Planning/Regulatory Tool	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
		confluence with Kinne Brook of the middle Branch of the Westfield River within the Town of Chester.
Wetlands Protection Regulations	Yes	All development within the Town of Chester, including structural and non-structural activities, whether permitted as a right or by special permit, must be in compliance with the Massachusetts Wetlands Protection Act (WPA), Chapter 131, Section 40 of the Massachusetts General Laws. All new construction in Chester is subject to a site inspection by the Conservation Commission prior to obtaining a building permit. The purpose of the WPA is to provide a public review and decision-making process for projects that affect a resource area that is subject to protection, including any wetland, marsh, or swamp bordering on any river, stream, pond, lake, or certified vernal pool. Very effective tool for flood hazard risk reduction
Stormwater Management Regulations	Yes	Per the Town's Subdivision Regulations, all subdivision designs must meet nine stormwater management standards as specified in Section 4-2 (Storm Water Runoff Control). Effective for mitigating the effects of stormwater runoff but should be reviewed and updated based on current best practices for addressing future conditions through higher regulatory standards.

Massachusetts State Building Code

All municipalities in the state must adopt and enforce the current Massachusetts State Building Code (MSBC). The MSBC consists of a series of international model codes and any state-specific amendments adopted by the Board of Building Regulations and Standards (BBRS). The BBRS regularly updates the state building codes as new information and technology becomes available and change is warranted.

The MSBC is separated into two distinct volumes: The Residential volume regulates all one- and two-family structures and townhouses that are three stories or less, as well as their accessory structures. The Base volume regulates all structures that are not covered by the Residential regulations.

The current version of the MSBC is the Ninth Edition, which became effective on October 20, 2017. The Town of Chester began enforcing the Ninth Edition for all applicable projects as required by January 1, 2018. The Ninth Edition code is based on modified versions of the following 2015 codes as published by the International Code Council (ICC).*

- The International Building Code (IBC)
- International Residential Code (IRC)
- International Existing Building Code (IEBC)
- International Mechanical Code (IMC)
- International Energy Conservation Code (IECC)
- International Swimming Pool and Spa Code (ISPSC)
- Portions of the International Fire Code (IFC)

** Although the Ninth Edition of the code is still in effect, members of the BBRS have voted that the next edition of the MSBC will be based on modified versions of the 2021 International Codes. The content of these codes is still under review by the BBRS, but it is anticipated that the Tenth Edition of the code will be available for use in 2024.*

The Commonwealth of Massachusetts requires mandatory enforcement of the MSBC and does not allow local amendments to the residential code. In addition, the Commonwealth adopts a plumbing and electrical code. The Commonwealth also has a program in place for code official certification, which includes taking code classes prior to examination and certification, requires continuing education, and allows consumers to file complaints against inspectors. Massachusetts also requires licensing of general, plumbing, electrical, and roofing contractors; requires licensing candidates to pass an examination prior to licensing; and requires continuing education.

Massachusetts continues to perform well in terms of objective assessments of the MSBC. For example, in its most recent “Rating the States” report, the Insurance Institute for Business and Home Safety (IBHS) ranked Massachusetts 9th (scoring 78 out of a possible 100 points on the IBHS scale). Now in its fourth edition, IBHS’s 2021 report evaluates the 18 states along the Atlantic and Gulf coasts, all vulnerable to catastrophic hurricanes, based on building code adoption, enforcement, and contractor licensing.

Lastly, as noted in the table above, the MSBC contains a series of requirements for flood-resistant design and construction that are in accordance with the ASCE 24 standard, which incorporates—and in certain areas exceeds—FEMA’s NFIP construction standards. Highlights of ASCE 24 that complement the NFIP minimum requirements include requirements for building performance; flood-damage-resistant materials, utilities and service equipment, and siting considerations. Specific requirements for design flood elevations and the use of flood-resistant materials may be found in the ASCE Tables included in

780 CMR Section 1612.4. For example, a higher regulatory standard that affects development and redevelopment in the Town's mapped special flood hazard areas include a requirement that new or substantially improved buildings must be elevated so that the lowest floor surface is at least 1 foot above the FEMA base flood elevation.

Administrative and Technical Capabilities

Table 59 is based off Worksheet 4 from FEMA's Local Mitigation Planning Handbook. It was used by the HMPC to document and review the current administrative and technical capabilities of the Town. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions.

Table 59. Administrative and Technical Findings.

Administrative/Technical Resource	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Local Boards/Committees		
Planning Board	Yes	The Chester Planning Board serves as the special permit granting authority for all purposes under the Town's Zoning Bylaw and other applicable rules and regulations. It operates under the provisions of Massachusetts General Laws Chapter 40A and Chapter 41 with an overall purpose to guide the development of the town in the best interests of all residents. This includes dealing with zoning bylaw changes, subdivision responsibilities, site/design review, and project planning assistance which are all considered quite effective at reducing natural hazard risks associated with community growth and development.
Conservation Commission	Yes	The Conservation Commission is the official agency charged with the protection of the Town's natural resources, particularly Chester's wetland resource areas in accordance with the Massachusetts Wetlands Protection Act. The Commission also advises other Town officials and boards on conservation issues that

Administrative/Technical Resource	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
		relate to their areas of responsibility. Very effective in terms of flood hazard risk reduction.
Finance / Capital Planning Committee	Yes	The Town's Finance Committee handles capital needs/requests through its annual budget process (in which Town departments submit their own requests for the following year). Considered effective but would benefit from the development of a longer-term Capital Improvement Plan (CIP) for larger, more costly projects.
Climate Action Committee	No	N/A
Other relevant boards/committees?	Yes	Board of Health, Zoning Board of Appeals, Recreation Committee, Council on Aging
Staff		
Community Planner	No	Although not a local staff position, the Town does receive technical assistance and support from the professional planning staff at the Pioneer Valley Planning Commission (PVPC).
Chief Building Official	Yes	Part-time Building Inspector (shared with other towns). Supportive of hazard risk reduction in terms of code enforcement, but this remains a very limited capability in terms of an in-house resource for the Town (regular office hours provided for only 2 days/month).
Civil Engineer	No	N/A (engineering services are procured through private contractors as needed)
Emergency Manager	Yes	Performed as an auxiliary function by the Fire Chief.
Floodplain Administrator	Yes	Although not a formally designated position, the duties of floodplain management and implementation of the commitments and requirements of the NFIP are shared by the Town's Planning Board with input from the Building Inspector and support from the Conservation Commission.

Administrative/Technical Resource	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Sustainability/Climate Coordinator	No	N/A
GIS Coordinator	No	Not in place but this is an area the Town is currently working on (grant funded project to build GIS capabilities).
Public Information Officer/Specialist	No	N/A
Technical		
Grant writing	No	Although the Town has had some success with grant awards, additional capabilities/resources for identifying and pursuing external sources of funding are needed. Local staff dedicated to grant writing would be very helpful as the Town recognizes there are many more opportunities for funding than it can actively pursue. The Town can also look to PVPC for support with grant application and administration services, but a dedicated in-house resource is what is needed most.
GIS mapping and analysis	No	Not yet, but this is an area the Town is working on through a grant funded project to build GIS capabilities, in addition to some data collection efforts underway by the Water Department.
Hazard data and information	No	Not yet but could be incorporated into above efforts.
Maintenance programs to reduce risk *(e.g., tree trimming, drainage clearance)*	Yes	Routinely performed by the Chester Highway Department for infrastructure and Tree Warden for trees (or Eversource if contact with wires). The Town is also supported by Chester Municipal Electric Light Department (CMELD) and its contractors on the removal of large hazardous trees in addition to storm cleanup, line trimming, and replacing or installing new hardware on damaged poles. In addition, MassDOT conducts its own tree trimming along Route 20 in Chester.

Administrative/Technical Resource	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Acquisition of land for open space, recreation, and other public use	No	Very limited capabilities and resources for acquiring new lands for open space but this is an area of improvement the Town is focused on (ongoing preparation of Chester's Open Space and Recreation Plan and possible CPA funding effort as described in Table 60).
Warning systems/services *(e.g., Reverse 911, outdoor warning signs)*	No	The Town previously had a Reverse 911 system, but it became too costly and burdensome to maintain. The Fire Department is now looking into new software that will allow residents to sign up and provide information (i.e., special needs) for the Town to maintain in a new automated emergency notification system.
Mutual Aid Agreements	Yes	The Town of Chester is party to the following mutual aid agreements: Statewide Mutual Aid, DPW Mutual Aid, Local Mutual Aid Agreements, Fire Mobilization Agreement, and the Western Massachusetts Law Enforcement Council (WEMLEC).
Other relevant technical resources?	Yes	CMELD is a municipally owned utility that provides electricity to approximately 742 active customers.

Financial Capabilities

Table 60 is based on Worksheet 4 from FEMA's Local Mitigation Planning Handbook. It was used by the HMPC to identify and review the Town's eligibility and access to funding sources that can be used to support the implementation of hazard mitigation projects.

Table 60. Financial Findings.

Financial Tool/Source	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
General funds	Yes	Limited budget for Town operations and not historically used for hazard mitigation projects

Financial Tool/Source	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Capital Improvement Program (CIP) funding	Yes	Part of annual budget process, however, funding is generally very limited or not available – especially for larger, more costly projects.
Special purpose taxes	No	N/A
Fees for water, sewer, gas, or electric services	Yes	Water fees collected by Water Department but generally not available for supporting hazard mitigation projects.
Stormwater utility fee	No	N/A
Development impact fees	No	N/A
General obligation bonds and/or special purpose bonds	No	N/A
FEMA Hazard Mitigation Assistance (HMA) funds	Yes	FEMA's current HMA grant programs (BRIC, FMA, HMGP) remain a good source of external funding for implementing eligible and cost-effective mitigation projects in coordination with MEMA.
HUD Community Development Block Grant (CDBG) funds	Yes	The Town is eligible for HUD CDBG and CDBG-DR funding that could be used to support the implementation of hazard mitigation actions.
Other federal funding programs	Yes	NOAA, EPA, USACE, and other federal agencies do make grant funding available for a variety of resilience-themed projects and initiatives that the Town may be eligible to pursue in the future. This includes both pre- and post-disaster funding programs that can be very effective in supporting the implementation of cost-effective hazard mitigation projects, many of which are described in FEMA's Mitigation Resource Guide.[53]
Massachusetts Municipal Vulnerability Preparedness (MVP) Action Grant funds	Yes	The MVP Action Grant offers financial resources to communities that are seeking to advance priority climate adaptation actions to address climate change impacts resulting from extreme weather, sea level rise,

[53] Mitigation Resource Guide. FEMA. March 2021.

Financial Tool/Source	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
		inland and coastal flooding, severe heat, and other climate impacts. As a designated "MVP Community" the Town is eligible to apply for grants on its own, or as part of a regional partnership of multiple municipalities provided that the lead applicant is MVP-designated. The Town has been successful in leveraging MVP Action Grant funds this way with Middlefield and Blandford.
Massachusetts Community Preservation Act (CPA) funds	No	Not currently adopted by the Town, but this could be a potential source of funding to open space preservation and other strategies that support hazard risk reduction if Chester becomes a CPA community in the future. A proposal for the Town to bring the CPA to Town Meeting is currently being researched and considered by the Conservation Committee.
Other state funding programs	Yes	The Commonwealth makes a variety of funding programs available on a routine basis to support local risk reduction projects. Some of the most applicable opportunities for the Town include MVP Action Grants and other annual grant programs through EEA, such as the Culvert Replacement Municipal Assistance Grant Program. Others may include Community Compact grants, Green Communities grants, etc. depending on the scope and scale of specific projects.
Private or non-profit grants, loans or funding	No	N/A

Education and Outreach Capabilities

Table 61 is based on Worksheet 4 from FEMA's Local Mitigation Planning Handbook. It was used by the HMPC to identify and review existing education and outreach programs that can be used or expanded upon to support local mitigation activities.

Table 61. Education and Outreach Findings.

Education & Outreach Program/Method	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
Community newsletter(s)	No	N/A
Web-based / social media	Yes	Town website, Facebook Community Forum
Public Access TV, radio, etc.	No	N/A
Community gatherings, festivals, celebrations, or other events	Yes	Annual Trunk or Treat celebration (at Emery Field on Halloween), numerous movie nights both outdoors at Emery Field and indoors in the Chester Town Hall auditorium, Easter Egg Hunt at the Littleville Fair, and more. Many of these events are held with the cooperation of the Council on Aging, the Chester Fire Department, and the Chester Hill Association.
Hazard awareness campaigns *(e.g., Severe Weather Awareness Week)*	No	N/A
Organizations that represent, advocate for, or interact with underserved or vulnerable populations	Yes	Council on Aging, Veteran's Services
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, etc.	Yes	Wild & Scenic Westfield River Committee: https://westfieldriverwildscenic.org/ Berkshire Natural Resources Council: https://www.bnrc.org/
Ongoing public education or information program *(e.g., responsible water use, fire safety, household preparedness)*	Yes	The Fire Department and Hilltown Community Ambulance Association occasionally provide information and/or training to community members on a variety of emergency and safety-related topics. The Town's Council on Aging also provides ongoing educational opportunities on a wide variety of topics which could include those related to emergency preparedness and mitigation.
Natural disaster or safety-related school programs	Yes	The Gateway Regional School District has Emergency Preparedness and Safety Plans in place along with a

Education & Outreach Program/Method	In Place? *(Yes/No)*	General Description / Effectiveness for Hazard Risk Reduction
		very effective emergency alert/notification system with coverage in Chester; however, it does not routinely provide programming on natural hazard mitigation.
StormReady® certification	No	N/A
Firewise USA® certification	No	N/A
Public-private partnership initiatives addressing disaster-related issues	Yes	CMELD is a municipally owned utility that supports the Town with the removal of large hazardous trees, line trimming, and other mitigation activities in addition to storm cleanup duties following severe weather events.

National Flood Insurance Program (NFIP) Participation and Compliance

C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

The National Flood Insurance Program (NFIP) is a program created by the United States Congress in 1968. The NFIP has two purposes: to share the risk of flood losses through flood insurance and to reduce flood damages by restricting floodplain development. The program enables property owners in participating communities to purchase insurance protection, administered by the government, against losses from flooding, and requires flood insurance for all federally backed loans or lines of credit that are secured by existing buildings, manufactured homes, or buildings under construction, that are in FEMA-mapped special flood hazard areas in a community that participates in the NFIP. The availability of NFIP policy coverage is limited to communities that adopt adequate land use and control measures with effective enforcement provisions to reduce flood damages by restricting development in areas exposed to flooding. There are now more than 20,000 participating communities across the United States and its territories.

The Town of Chester has participated in the NFIP since 1984. As summarized in Table 62, the HMPC used Worksheet 5 from FEMA's *Local Mitigation Planning Handbook* to collect information regarding the Town's participation in and compliance with the NFIP. This worksheet, in addition to a separate *NFIP Survey* for Town staff, helped the HMPC to identify areas for improvement and other ideas that could be potential mitigation actions.

Table 62. NFIP Participation and Compliance Findings.

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	FEMA NFIP Services, Flood Insurance Data and Analytics; State NFIP Coordinator	As of March 31, 2024, a total of 29 NFIP policies are in force. The total premium is $60,526 for a total of $4,539,000 in coverage.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP Services, Flood Insurance Data and Analytics (HUDEX report)	There has been a total of 11 claims paid since 1984, totaling $57,189 in losses. There have been no claims paid for substantial damage.
How many structures are exposed to flood risk within the community?	GIS analysis (FEMA FIRMs + building footprint data)	It has been estimated that 308 structures are at risk to the 1-percent annual chance flood, and 312 are at risk to the 0.2 percent annual chance flood for a combined total of 620 structures exposed to flood risk.
Are there any repetitive or severe repetitive loss structures in the community?	MEMA / FEMA	Yes, there are two (2) repetitive loss properties located in Chester, with a combination of 4 total losses that amount to $25,769. These losses reportedly occurred during the 2005 floods and Tropical Storm Irene in 2011. See Chapter 4 for more details.
Describe any areas of flood risk with limited NFIP policy coverage	HMPC	No address-specific data has been made available by FEMA, but it is generally assumed that owners of property located in special flood hazard areas are underinsured when it comes to flood insurance coverage (based on only 29 current policies under the NFIP in comparison to 620

NFIP Topic	Source of Information	Comments
		structures estimated to be exposed to moderate to high flood risk).
Staff Resources		
Who is responsible for floodplain management in the community? Do they serve any roles other than Community Floodplain Administrator (FPA)?	Zoning Bylaw	The duties of floodplain management and implementation of the commitments and requirements of the NFIP are performed as an auxiliary function by the Town's Building Inspector with support from the Zoning Board of Appeals.
Is the Community FPA or NFIP Coordinator a Certified Floodplain Manager?	HMPC	No
Is floodplain management an auxiliary function?	HMPC	Yes, for the Building Inspector.
Explain NFIP administration services (e.g., permit review, GIS, inspections, engineering capability).	HMPC	All development in the Floodplain District, including structural and non-structural activities, are reviewed for compliance with the Town's Zoning Bylaws, the Massachusetts State Building Code, the Massachusetts Wetlands Protection Act, and other applicable rules and regulations. The Town complies with the NFIP by enforcing floodplain regulations, adopting the latest effective floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements. The Town maintains copies of FIRMs and other relevant information for those considering the purchase of flood insurance.
What are the barriers to running an effective NFIP program in the community, if any?	HMPC	No major barriers identified; however, local staffing and operational capacity to administer programs in the community is an ongoing issue for the Town.

NFIP Topic	Source of Information	Comments
Compliance History		
Is the community in good standing with the NFIP?	State NFIP Coordinator, FEMA	Yes
Are there any outstanding compliance issues (i.e., current violations)?	HMPC	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	State NFIP Coordinator, FEMA (CIS)	Last CAC was 0/30/2009 Last CAV was 9/15/1997
Is a CAV or CAC scheduled or needed?	HMPC	No, not at this time.
Regulation		
When did the community enter the NFIP?	State NFIP Coordinator, FEMA (CIS)	12/18/1984
Are the FIRMs digital or paper?	FEMA	Digital (updated as of July 16, 2023)
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Zoning Bylaw, Section 4.0	Floodplain regulations are administered through the enforcement of the Town's Zoning Bylaw which follows all current FEMA/NFIP minimum requirements. These regulations will be routinely updated as necessary to maintain compliance with existing NFIP and State minimum standards for floodplain management. As described earlier in this chapter, higher regulatory standards are also met through the Town's enforcement of the Massachusetts State Building Code (CMR 780). Other floodplain development requirements are included in the Town's administration of the

NFIP Topic	Source of Information	Comments
		Commonwealth's Wetlands Protection Act Regulations (310 CMR 10).
How does the community enforce local floodplain regulations and monitor compliance? Explain the permitting process.	Zoning Bylaw, Section 4.0	The Town requires a special permit for all development in the Floodplain District, including structural and non-structural activities, which must be in compliance with Section 4.0 and 6.5 of the Town's Zoning Bylaw, the Massachusetts Wetlands Protection Act (Chapter 131, Section 40 of the Massachusetts General Laws) and with the requirements of the Massachusetts State Building Code (780 CMR) pertaining to construction in the floodplain. Permit approval, enforcement, and other administrative procedures are outlined in Section 6 of the Town's Zoning Bylaw.
Community Rating System (CRS)		
Does the community participate in CRS? If so, what is the community's CRS Class?	FEMA	No
What categories and activities provide CRS points and how can the class be improved?	Insurance Services Office, Inc.	N/A
Does the plan include CRS planning requirements	Yes	Yes, many of the planning requirements under CRS Activity 510 are included in the plan update.

Table 63 provides some additional information in response to the updated requirements included in FEMA's 2022 Local Mitigation Planning Policy Guide (Element C2-a):[54]

[54] Local Mitigation Planning Policy Guide. FEMA. April 2022. P. 26.

Table 63. Additional NFIP Participation and Compliance Information.

Required Information	Response
Adoption of NFIP minimum floodplain management criteria via local regulation.	Zoning Bylaw, Section 4.0 - Floodplain and Westfield River Protection District.
Adoption of the latest effective Flood Insurance Rate Map (FIRM), if applicable.	The Town's Zoning Bylaw at Section 4.0.2 (District Delineation) establishes the Floodplain District as shown on the official Flood Insurance Rate Map (FIRM) for the Town of Chester.
Implementation and enforcement of local floodplain management regulations to regulate and permit development in SFHAs.	See explanation of the Town's permitting process provided in Table 62.
Appointment of a designee or agency to implement the addressed commitments and requirements of the NFIP.	The Town's Planning Board, with support from the Building Inspector and Conservation Commission, is tasked with implementing the commitments and requirements of the NFIP, making sure Chester remains in compliance with all relevant codes and standards for floodplain management.
Description of how participants implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.	The Town implements the SI/SD provisions of its floodplain management regulations as required per the NFIP (CFR Title 44, Parts 59 through 65) and Massachusetts State Building Code (780 CMR). The Town will also coordinate with State Flood Hazard Management Program staff to assure that proper practices are followed and that a post-disaster plan will be in place to implement all SI/SD provisions.

Summary and Conclusions

The Town of Chester is a small, rural community with limited capabilities and resources to support the implementation of hazard mitigation actions. This chapter provides documentation on the existing local authorities, policies, programs, and resources to support hazard mitigation.

Chester has most of the low cost hazard mitigation capabilities in place. Land use planning, zoning, subdivision regulations and an array of specific policies and local bylaws include hazard mitigation best practices, such as limitations on development in floodplains, wetlands protection, stormwater management and tree maintenance. Historically the Town has relied on the Pioneer Valley Planning Commission (PVPC) for many of its planning efforts, though most plans relevant to this effort are either not in place or considered outdated and in need of updates (i.e., Master Plan, Open Space and Recreation Plan, Capital Improvements Plan, etc.). In 2020, the Town collaborated with the PVPC to complete the Municipal Vulnerability Planning (MVP) planning process and has since been successful in leveraging funding for hazard and climate resilience through the Commonwealth's MVP Action Grant program in cooperation with neighboring communities.

As with most small towns, Chester struggles with limited administrative capacity, relying heavily on regional collaboration and the support of many local board/committee volunteers and other partners to get things done. Most Town departments include only one position with no backup support, resulting in many staff being overstretched with routine day-to-day functions and unable to take on new or additional responsibilities. Frequent staff turnover and the resulting loss of institutional knowledge also remains a constant internal challenge for the Town. Chester collaborates closely with PVPC and other organizations and surrounding communities in the region and actively participates in mutual aid agreements and similar programs that can help bolster its local capabilities to prepare for, mitigate against, respond to, and recover from hazard events.

The Town's financial capabilities to implement hazard mitigation projects are also limited due to its size and relatively small tax base to generate revenue. There is very little funding available through local monetary sources, and although Chester is eligible to pursue external grant funding sources, it is constrained by the lack of available resources that can dedicated to researching and preparing competitive grant applications. Grants that require a local cash match may also not be accessible to the Town, though Chester has had some success with those that require only in-kind contributions. As done with a recent regional MVP Action Grant for local roadway resilience, the Town's collaboration with the PVPC and neighboring towns provides opportunities to pursue more costly hazard mitigation and climate adaptation projects. The Town's capabilities to implement or encourage low-cost mitigation measures across the community are aided by its dedicated staff and volunteers noted above, though additional methods for conducting local outreach and educational activities with community residents and other stakeholders would be helpful.

Despite the gaps and limitations faced by the Town of Chester, when it comes to current hazard mitigation capabilities, it can expand and improve on the capabilities described in this chapter. Some general and specific opportunities to address existing gaps or limitations in local capabilities to reduce risk have been identified for each capability type and are further described below. Each of these opportunities were then considered by the HMPC during the plan update process as potential new mitigation actions to be included in the Mitigation Strategy.

Opportunities to Expand and Improve on Capabilities to Reduce Risk

Planning and Regulatory Capabilities

- Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.
- Conduct a comprehensive review and update of the Town's Zoning Bylaw and other regulations to require and/or promote hazard resistant, climate-adaptive, and sustainable development standards. Use existing methods or tools for incorporating green infrastructure, low impact development, and other nature-based solutions (such as Mass Audubon's Bylaw Review Tool).
- Develop a robust capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years. As part of this effort integrate hazard mitigation and climate resiliency criteria into the CIP project evaluation, selection, and prioritization process.
- Review and update the Town's floodplain management regulations (Zoning Bylaw, Section 4.0 - Floodplain and Westfield River Protection District) to be in alignment with the State's Model Floodplain Bylaw and other recommended best practices for floodplain management.
- Review and update the Town's existing stormwater management standards as specified in its Subdivision Regulations (Section 4-2: Storm Water Runoff Control) based on best practices that account for projected future conditions, including increased heavy precipitation events, and to promote green infrastructure and other nature-based solutions for flood risk management.
- Develop a Continuity of Operations Plan (COOP) for the Town that identifies mission-critical organizational functions that must continue when normal operations are disrupted and provides a framework for redundancy and the continued operation of these functions under all threats and conditions (loss of facilities, technology, personnel, etc.).
- Coordinate with the owners of high hazard dams located upstream from Chester on any planned water releases, Emergency Action Plan (EAP) updates, public outreach and notifications, and other efforts to prepare for, respond to, and mitigate the effects of potential dam failure events.

Administrative and Technical Capabilities

- Build local capacity for mitigation activities through increased training and professional development opportunities for Town staff and board/committee members that are tailored to specific hazard issues in Chester.
- Formally designate a local Floodplain Administrator.

- Develop systems or practices that can help the Town to better cope with staff turnover and the resulting loss of institutional knowledge, or other disruptions to routine government functions and duties that support risk reduction. This may include improved record keeping procedures and/or the use of information management software designed for local governments.
- Continue to build and maintain in-house GIS capabilities to support hazard mitigation and the Town's other community planning/project initiatives.
- Develop system/process for capturing and maintaining hazard impact/loss data and incorporate into efforts to enhance the Town's internal GIS capabilities.
- Provide additional support and resources to the Chester Highway Department, Tree Warden, and Chester Municipal Electric Light (CMELD) for more extensive tree trimming and drainage system maintenance as needed.
- Coordinate with the Wild & Scenic Westfield River Committee and other partners to develop a comprehensive inventory and condition assessment of all culverts, stormwater drains, and catch basins to assist with asset management and prioritizing maintenance/replacement projects (culvert improvements, stream crossing upgrades, etc.).

Financial Capabilities

- Maximize opportunities through the Town's annual budgeting process to help fund priority hazard mitigation and climate adaptation projects, especially when a local cost-share increases the Town's chances for a grant award.
- Continue exploring the Town's adoption of MA Community Preservation Act (CPA) to create a local funding source for additional protected open space acquisitions that support flood hazard mitigation and watershed management.
- Build internal staff capacity to identify and pursue external sources of grant funding through increased opportunities for training and professional development and the ability to invest more time on grant writing, grants management, and related administrative tasks.
- Consider the designation or hiring of a dedicated grant writer/administrator for the Town to provide support across multiple departments that pursue their own external funding opportunities.
- Continue to coordinate with the PVPC and neighboring communities to pursue and capture future grant funding for regional hazard risk reduction projects. This is particularly true for federal mitigation grants available through FEMA's HMA grant programs (BRIC, HMGP, FMA) as well as MVP Action Grants through the Massachusetts MVP program.

Education and Outreach Capabilities

- Leverage the Town's website, Facebook Community Forum, and community events (Trunk or Treat, movie nights, etc.) for risk communication and promotion of low-cost or do-it-yourself mitigation and preparedness activities.
- Identify and seek to address any unmet needs related to targeted outreach/education for the community's more vulnerable populations through existing mechanisms (Board of Health, Council on Aging, Veteran's Services, etc.).
- Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.
- Partner with the Gateway Regional School District, the Wild & Scenic Westfield River Committee, the Berkshire Natural Resources Council, and other organizations to help conduct outreach campaigns related to hazard mitigation, climate adaptation, and community resilience.
- Develop specific outreach methods to notify and increase public awareness of local cooling centers during periods of extreme heat (locations, hours, etc.) along with other precautions people should take to minimize their exposure and risk.

Possible New Actions Related to NFIP Participation and Compliance

- Adopt the State's latest (2020) Model Floodplain Bylaw.
- Promote the availability of flood insurance to all property owners and renters, especially those in areas of high to moderate flood risk.
- Develop a Post-Disaster Substantial Damage Plan
- Review the State's new guidance on higher standards for local floodplain management for possible zoning or administrative improvements, including those actions found in *Building Flood Resilience: A Local Action Guide for Promoting Flood-Smart Development.*

Chapter 6. Mitigation Strategy

The hazard mitigation strategy is the culmination of work presented in the planning area profile, risk assessment and capability assessment. It is also the result of multiple meetings and thorough public outreach. The work of the Hazard Mitigation Planning Committee (HMPC) was essential in developing the mitigation goals and actions included in this chapter. As described in Chapter 3 Planning Process, the HMPC worked in a consistent, coordinated manner to identify and prioritize the goals and mitigation actions for this Plan.

Mitigation Goals

C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

***GOALS** are broad, long-term policy and vision statements that explain what is to be achieved by implementing the mitigation strategy.*

Mitigation goals represent broad statements that are achieved through the implementation of more specific mitigation actions. These actions include both hazard mitigation policies (such as land use regulations) and hazard mitigation projects (such as structure or infrastructure projects). To develop goals for this Town of Chester, MA Hazard Mitigation Plan the HMPC reviewed the 2016 Chester Hazard Mitigation Plan Update goal statements, the Municipal Vulnerability Preparedness (MVP) Summary of Findings, 2021 goal statements, and the goals of the State's Hazard Mitigation and Climate Adaptation Plan (SHMCAP) 2023.

The HMPC developed the goal statements in the figure below to represent their vision and priorities for the Town of Chester in terms of hazard mitigation. All the hazards identified in this plan, while not named specifically in the goals, are implied and many are named specifically in the mitigation actions. When achieved by way of implementing the mitigation actions identified in this plan, the Town will mitigate risk posed by all identified hazards.

Save Lives and Property

- Reduce risk to people and property from natural hazards and climate change.

Infrastructure

- Mitigate risk to critical facilities and infrastructure from natural hazards and climate change.

Capacity

- Expand the Town's capacity to mitigate risk by adopting a culture of hazard mitigation through regulations, planning, and regional collaboration.

Natural Resources

- Implement actions that minimize risk from climate change and natural hazards to preserve or restore the functions of natural systems.

Education

- Educate all stakeholders about the value of hazard mitigation and how to implement it in their work, businesses, and homes.

Figure 26. Goal Statements.

The Chester Hazard Mitigation Plan Update 2016 included 16 mitigation actions. For the purposes of this plan, all the actions were reviewed for their status and relevance. The following table shows the previous plan's 16 mitigation actions and the status of each. In addition to their status, if an action was moved forward to this plan the final column (Updated Action Title) indicates the title of the new action.

> E2-b. Was the plan revised to reflect changes in priorities and progress in local mitigation efforts? (Requirement §201.6(d)(3))

Table 64. Status of Previous Plan's Mitigation Actions.

Action #	Action Description	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
1	Prioritize roads for paving, trap rock, and culvert replacement. Include East River Road, Johnson Hill, Abbott Hill, Maynard Street, Cooper Drive, Prospect Street, Round Hill Road for paving prioritization due to washouts. Assess the culvert on Old State Road and apply stream continuity standards in upgrade plans.	Partially Completed / In Progress	East River Road has been paved and is in pretty good condition. Still have minor issue with beaver activity. Beaver deceiver seems to be helping. Johnson Hill has had culverts replaced and guardrails installed. Overall, much better. Abbott Hill Road has had temporary culverts installed. These are helping to prevent washouts and flooding. A more permanent solution is underway via funding from the MA Division of Ecological Restoration (MA DER). Phase one has started, and we will be applying for a grant for Phase 2. Maynard Hill has been widened at the worst curve and more fill has been brought in. One culvert at bottom of the hill has been replaced. Prospect Street is undergoing major redo through grants from Pioneer Valley Planning Commission (PVPC). Round Hill Road is currently receiving no attention. Not sure why this road is here. Old State Road has had some culvert replacement done. Appears to be OK now.	YES - updated/revised description provided at right, if applicable	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
2	Work with Mass Wildlife and MassDOT to resume tree trimming along Route 20 to prevent power outages.	Partially Completed / In Progress	Ongoing process with majority of work being done by MassDOT as this is a state-owned road. This is a problem addressed by regular maintenance.	NO - explanation provided at left	
3	Develop a plan and seek implementation funding for tree trimming along the town's main	Partially Completed	Tree trimming is ongoing. Progress is being made but much more needs to be done.	NO - explanation provided at left	

Action #	Action Description	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
	arteries, including Skyline and Middlefield Roads, as well as other areas of concentrated population.	/ In Progress	Money is in current budget for continuing work.		
4	Work with U.S. Army Corps of Engineers to re-establish flow in Westfield River under Main Street bridge that is being blocked by storm debris.	Canceled	There is no debris under the bridge.	NO - explanation provided at left	
5	Set up partnership with CSX and other towns to prevent brush fires along tracks. Consider strategies such as placing rocks or removing leaves and brush along tracks.	Canceled	Current Town administration does not feel that CSX will respond to partnership efforts.	NO - explanation provided at left	
6	Coordinate with dam owners on waterways in and upstream of Chester to develop a plan or memorandum of understanding for coordinated dam releases in high rain events.	Delayed	The Town has been unclear if this is necessary so it was not acted on. There are upstream dams included in the plan update.	YES - updated/revised description provided at right, if applicable	Dam Risk Mitigation.
7	Identify, prioritize, and replace undersized culverts throughout town.	Partially Completed / In Progress	Ongoing. Many of the major issues have been remedied. Johnson Hill is done. Abbott Hill has temporary culvert but work is underway for permanent fix. Trout Unlimited has proposal to replace culvert on Kinnebrook Road.	YES - updated/revised description provided at right, if applicable	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
8	Extend the Town's three-phase power line from the post office on Rte 20 to the interconnection	Canceled	Nice idea, however way too costly.	NO - explanation provided at left	

Action #	Action Description	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
	point in order to provide better service and more capacity.				
9	Implement the Five-Year Action Plan strategies in the Chester Open Space and Recreation Plan in regards to the protection of forests and floodplains.	Canceled	The Town does not have an OSRP.	NO - explanation provided at left	
10	Investigate water system for leaks.	Partially Completed / In Progress	Town suffered major system failure secondary to leak in 2022. Prospect Street has mostly been mapped and repaired. System evaluation is ongoing.	YES - updated/revised description provided at right, if applicable	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
11	Develop water conservation plan, including plan for targeted public outreach.	Completed	Water department has plans for both.	NO - explanation provided at left	
12	In the Zoning regulations for Telecommunication Facilities, add safety and prevention of wind-related damage as a stated purpose.	Delayed	Updates to zoning regulations have been delayed due to changing members of the Planning Board and a lack of consistent knowledge regarding the need to make changes. The Planning Board is currently aware of what needs to be considered and committed to the process of updating regulations.	YES - updated/revised description provided at right, if applicable	Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.
13	Add specific impacts to address in the Special Permit process including topographic change, removal of cover vegetation, risk of erosion or siltation and increased stormwater runoff.	Delayed	Updates to zoning regulations have been delayed due to changing members of the Planning Board and a lack of consistent knowledge regarding the need to make changes. The Planning Board is currently aware of what needs to be considered and	YES - updated/revised description provided at right, if applicable	Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to

Action #	Action Description	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
			committed to the process of updating regulations.		require and promote hazard resistant, climate adaptive, and sustainable development standards.
14	Amend the Special Permit and Site Plan Approval Provisions in the Chester Zoning Bylaw by adding more specific requirements to address flood related Issues.	Completed	3. The Site Plan Approval bylaw, section 6.8.5, Require Site Plan Controls, item (4), already addresses flood prevention- no action required.	NO - explanation provided at left	
15	Add flood prevention and mitigation to the purpose section of the Subdivision Rules and Regulations.	Completed	4. The Subdivision bylaw, section 2.7, Special Flood Hazard Areas, already addresses flood prevention- no action necessary. 5. The term 'Design Impact Statement' is not used or defined in the Subdivision bylaw, but does contain Section IV, Design Standards, which meets the intent of a Design Impact Statement. Section 4.2, Storm Water Runoff Control, addresses flooding and runoff considerations- no action necessary.	NO - explanation provided at left	
16	Ensure that the Development Impact Statement identifies impacts of the proposed development could have on the potential for flooding, and include mitigation measures, if deemed necessary by the Planning Board.	Completed	6. Reviewed the following bylaws that impact town development for requirements to protect natural resources and open spaces and to minimize undesirable impacts to the community. Other than the first two comments above, the reviewed bylaws all contain the necessary requirements: Large-Scale Solar, Site Plan Approval,	NO - explanation provided at left	

Action #	Action Description	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
			Subdivision Regulations, Wireless Communications, Wind Energy Conversion Facilities, Residentially Scaled (Small) Wind Energy Conversion Facilities, and Special Permit (6.5) and Creative Development (5.3) sections of the Zoning Bylaw Revised 2005.		

The Town's Municipal Vulnerability Preparedness Plan (MVP) 2021 included 9 recommendations. The MVP is part of a Massachusetts state-wide initiative through the Executive Office of Energy and Environmental Affairs (EEA) to provide support to cities and towns to plan for resiliency and implement climate change adaptation actions. The recommendations identified in Chester's MVP were reviewed and considered when developing mitigation actions for this plan update. Below is the list of MVP Recommendations with notes regarding their status and relevance in the Hazard Mitigation Plan.

Table 65. Status comments on MVP recommendations.

2021 MVP Top Recommendations to Improve Resilience (Priority Actions) (NB) = Nature-based Solution	**Notes / Comments**
Highest Priority Actions *(as subsequently voted on by the Chester community at large)*	
(NB) Address undersized and/or blocked culverts and road-stream crossings and ensure pass ability during emergencies. • Institutionalize surveillance of culverts and associated waterways to locate and remove debris and downed trees, etc., to allow water to move more freely though the system and prevent roadway washout and damage associated with blocked culverts. Work with DER to learn more about the culvert replacement grant and the components of a competitive application. Ensure that when replacing culverts, to Town uses design standards to allow for wildlife passage and improved flow passage, which would lead to less flooding. • Around those road-stream crossings and culverts known to be prone to disrepair, flooding, and/or washouts (e.g., Abbot Brook Culvert, Abbot Hill Road, Taft Hill Road, Middlefield Road), the Town should assess existing trails and determine the feasibility of using and/or creating new trails for passage by ATV, horseback, by foot, etc. for alternative evacuation. Determine the Town's emergency response capacity with ATVs and consider acquiring some if there are none currently.	This is an ongoing process. Abbott Hill is currently under contract for initial field study to determine best option for crossing. Town does have one ATV. No study has been done to address new means of transportation out of these areas. The Highway Department is constantly monitoring all the culverts in Town and has replaced some of the more problematic crossings, such as Johnson Hill Road.
(NB) Conduct a regulatory review of all bylaws and regulations regulating development in Town to ensure protection of natural resource and ecosystem services and develop recommendations to curb any undesirable impacts of development such as from residential, commercial, and	This is a Planning Commission's activity, and regulatory bylaws will be addressed through mitigation actions.

2021 MVP Top Recommendations to Improve Resilience (Priority Actions) (NB) = Nature-based Solution	Notes / Comments
infrastructural (cell towers, windmills, solar arrays, etc.) development, on open space and natural resources.	
Renovate and preserve the old Chester Elementary School as a community building with shared use agreements for education, meetings, gatherings, and town offices, etc.	This project is being investigated now.
Ensure the town website is updated and that all depart ents and committees keep it updated with relevant news and information. Ensure residents know about and sign up for Code Red alerts. Outreach can include hosting a booth at Chester on Track (annual event) to ensure information about Code Red, elected officials, and events/initiatives is dispersed; using the "Watts News in the Hilltowns" newsletter that is included in energy bills to share information; and working the fifth grade classes to demonstrate how students can access information about their town.	Town website has been updated over the past year and will continue to be developed.
<u>Other Priority Actions</u>	
(NB) Address concerns regarding the flooding of the three downtown bridges by developing redesigns that consider the stability of the bridge in addition to the preservation and/or enhancement of the local riverine habitat. The redesigns should address best management practices for infrastructure maintenance and maintenance of the stream beds around the bridges. Submit a written request to the MA Department of Ecological Restoration (DER) for technical assistance in making river crossings more efficient for vehicular traffic and water passage, etc., and to determine the causes of sediment build-up and blockage. Additionally, consult with the MA Department of Transportation (MDOT) to ensure that Town can take advantage of all relevant programming and grant opportunities for roadway infrastructure improvements.	The downtown bridges are under the control of the Commonwealth of Massachusetts and as such it is up to the discretion of the MassDOT to determine replacement and repairs. Main Street bridge is being evaluated for replacement, probably in 2026.
Improve and ensure evacuation readiness by: • determining whether plans exist for evacuating via MA Route 20 when the bridges are impassible; • conducting a feasibility study for improving Cooper Road enough that it can be passable by All Terrain Vehicles (ATVs)/Emergency Response vehicles for transportation during emergencies; and • reviewing and assessing evacuation plans for all residents and include a public engagement component.	Cooper Road is not passable by any means and the Town is not able to change that status. The only possible change might be creation of a fire road.

2021 MVP Top Recommendations to Improve Resilience (Priority Actions) (NB) = Nature-based Solution	Notes / Comments
(NB) Conduct a multi-town watershed-wide assessment of flood storage capacity to reduce flood damage along the west branch of the Westfield River.	Chester is not able to take the lead on this activity.
(NB) Work with DER and other agencies to inventory potential invasive plant species in Town. Initiate a local volunteer program, including students, to implement potential control measures.	This has not taken place yet. The Town will address invasive species with a mitigation action.
• (NB) Build the local economy and protect natural resources simultaneously by investing in environmental education for both grade school students and at the community at large. Work with the high school administration to explore potential for collaboration with nearby school districts and developing a more robust cultural and environmental curriculum that capitalizes on Chester's / the Gateway Region's natural assets to retain and attract students. Develop the school district as an attractive alternative educational experience, such as including exchange student programming and outward-bound/ expeditionary learning curriculum for experiential learning. Engage with local and regional schools to ensure local environmental education around west branch of Westfield River and other wildlife areas. Celebrate unique geology and take advantage of unique conditions in town. • Develop inter-generational, community-based experiential learning and expeditionary style programming and place- based, natural environment learning in town for both residents and tourists. Consider creating a public, inter-generational hostel and developing programming such as Worldwide Opportunities on Organic Farms (WWOOF) which would attract international and national students to come participate in Chester's agricultural economy.	This has not taken place yet.

Comprehensive Range of Mitigation Actions

C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))

***A MITIGATION ACTION** is a measure, project, plan or activity proposed to reduce current and future vulnerabilities described in the risk assessment.*

Identifying a range of mitigation actions was a process that included identifying and analyzing problem statements developed in Chapter 4 (Risk Assessment) for each hazard profiled. The HMPC considered 5 key assets when defining problem statements for the Town of Chester. These are:

1. People (including underserved communities and socially vulnerable populations)
2. Structures (including facilities, lifelines, and critical infrastructure)
3. Systems (including networks and capabilities)
4. Natural, historic, and cultural resources
5. Activities that have value to the community

In addition to problem statements, Chapter 4 (Risk Assessment) considered Changes in Population Patterns and Changes in Land Use and Development for each hazard profiled.

Chapter 5 (Capability Assessment) included potential actions in each of FEMA's mitigation action categories (plans and regulations, structure and infrastructure, natural resources protection, and education and awareness).

The HMPC considered the problem statements, changes in population and land use, Capability Assessment recommendations and the status of previously identified mitigation actions and MVP recommendations to develop a list of mitigation actions for this plan update. The HMPC sought to solve problems identified with the mitigation actions.

This process is illustrated in the figure below. The first column Hazards, indicates the natural hazards considered in the plan in the order of High, Medium, or Low Risk, as reviewed in the Risk Assessment (Chapter 4). The second column, Problems to Assets, indicates that the hazards caused problems in the categories of people, structures, systems, natural, historic, and cultural resources, and activities that have value to the community. The third column, Mitigation Actions, shows the four categories of mitigation action.

Figure 27. Process of Identifying a Range of Mitigation Actions.

In addition to this quantitative approach to identifying mitigation actions, the HMPC took a qualitative approach through the public outreach and engagement process to identify mitigation actions. Mitigation actions supporting underserved communities and environmental justice communities were specifically considered by the HMPC. They also focused on actions to the built environment both buildings and infrastructure as well as future development or redevelopment. The resulting list of mitigation actions includes, at a minimum, one action for hazard identified. In several instances multiple actions address an identified hazard and problem. For instance, flooding is addressed through multiple actions. The HMPC and the public considered four mitigation action categories defined in Figure 28 below when considering solutions to identified problems.

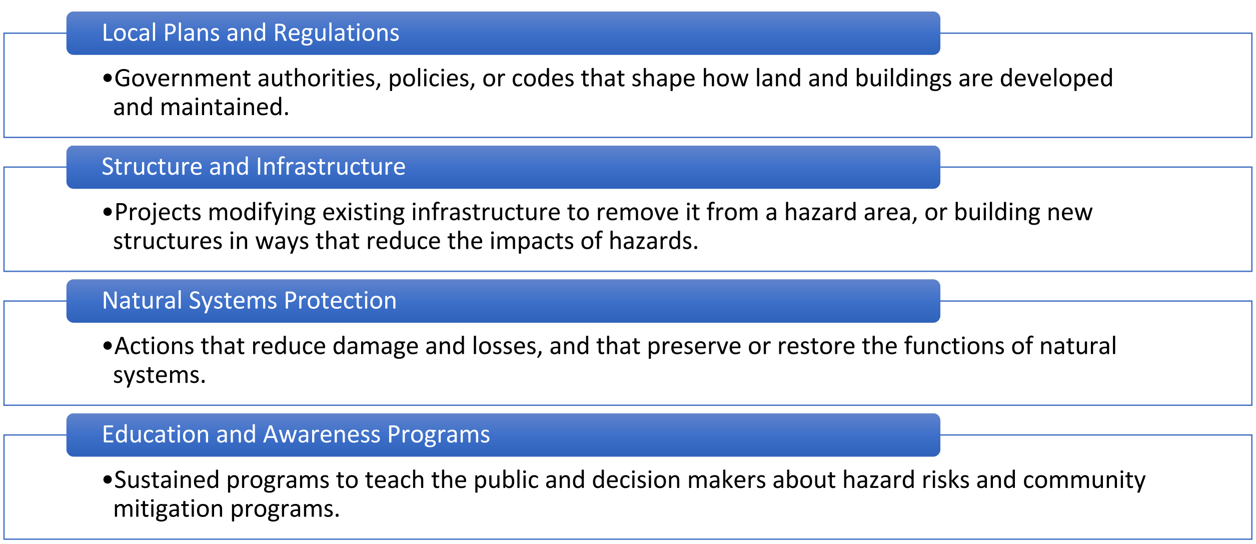


Figure 28. Four Types of Mitigation Actions.

Examples of actions in each of the above categories are shown in the table below.

Table 66. Examples of Mitigation Actions.

Mitigation Action Category	Examples of Mitigation Actions
Local Plans and Regulations	• Comprehensive plans • Land use ordinances • Subdivision regulations • Development review • Building codes and enforcement • NFIP Community Rating System • Capital improvement programs • Open space preservation • Stormwater management regulations and master plans
Structure and Infrastructure Projects	• Acquisitions and elevations of structures in flood-prone areas • Utility undergrounding • Structural retrofits • Floodwalls and retaining walls • Detention and retention structures • Culverts
Natural Systems Protection	• Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements • Wetland restoration and preservation
Education and Awareness Programs	• Radio or television spots • Websites with maps and information • Real estate disclosure • Presentations to school groups or neighborhood organizations • Mailings to residents in hazard-prone areas

Potential mitigation actions for each identified hazard and problem identified in the Risk Assessment are shown Table 67 below. Hazards are listed in order of risk. Some of these mitigation actions are included in the Action Plan; some were not included because of cost-benefit-analysis outcomes or inconsistency with Town priorities.

Table 67. Possible Mitigation Actions.

Hazard	Possible Mitigation Actions
Flooding from Precipitation and Dam Overtopping	Develop a non-zoning wetlands bylaw. Review and update the Town's stormwater management standards. Conduct dam risk mitigation.
Severe Winter Storms	Identify and prioritize roads for paving and culvert replacement.
Other Severe Weather	Consider adoption of the MA Community Preservation Act to protect open space and support flood hazard mitigation and watershed management.
Wildfires/Brushfires	Install and repair dry hydrants.
Average/Extreme Temperatures	Explore warning systems and a targeted messaging system to reach vulnerable populations or those with special needs.
Hurricanes/Tropical Storms	Conduct a town wide tree assessment and inventory.
Tornadoes	Increase capacity to secure grant funding.
Drought	Create and Open Space and Recreation Plan that includes identification of nature-based solutions to mitigate risk.
Invasive Species	Develop a system to monitor and remedy threats to surface water. Educate residents about how to identify and remove invasive species.
Landslides	Improve Maynard Brook Road to ensure it does not wash away or erode. Conduct a landslide study to identify high hazard areas and methods to reduce risk.
Earthquakes	Educate home and business owners about natural hazard risks and ways to mitigate risk to their properties.

Mitigation Action Plan

C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

The HMPC then had the job to create a cost-effective mitigation action plan that included projects to address the identified hazards, areas of risk and vulnerable assets. An online Mitigation Action Tracker was developed for the Town to track the implementation of each mitigation action. The Mitigation Action Tracker was an online spreadsheet with separate cells showing each action's essential details. These column labels (essential details) listed below are included to facilitate the Town's ability to sort through the actions as well as to apply for grant funding.

Table 68. Essential Details for Mitigation Actions.

Essential Details	Detail Description
Action Title	Typically, a short description of the mitigation action.
Action Description	A detailed description of the action that includes the purpose or what natural hazard or problem may be mitigated by implementing the mitigation action.
Action Lead	A position in Town government responsible for implementing the action.
Supporting Organizations	A possible list of supporting partners, these may be Town departments, regional organizations, state agencies or adjacent communities.
Potential Funding Source(s)	A list of possible grant sources or the location in the Town's budget for the funding necessary to implement the mitigation action.
Implementation Schedule	A timeline within 5 years (the life of the plan) that the Town hopes to implement the action.
Estimated Cost	An estimated cost designated as high, medium, or low. The Town considered these cost "buckets" because it is impossible to identify an exact cost for each mitigation action.
Hazard(s) Addressed	All the natural hazards that the action may mitigate are listed.

The priority order was chosen based on weighing costs versus benefits. It was imperative for the Town to determine if the costs associated with an action were reasonable compared to the corresponding benefits. To do this, the HMPC developed a prioritization table that included seven categories of criteria;

these are detailed in the able below. Each category was assigned points with priority criteria given the highest points. The most points an action could earn was 19. Actions that scored 17 points or higher were ranked as High priority. Actions that scored between 14-16 points were considered Medium, and actions that scored 13 points or less were considered low priority.

Table 69. Priority Ranking System.

	Criteria Category	Description	Detailed Ranking and Associated Points
1	Hazards Addressed	What level of hazards does the measure provide protection against?	High (Flooding from Precipitation and Dam Overtopping, Wildfires/Brushfires, Average and Extreme Temperatures, Hurricanes/Tropical Storms, Other Severe Weather) = 3 Medium (Severe Winter Storms, Tornadoes, Invasive Species, Droughts) = 2 Low (Earthquakes) = 1
2	Approximate Cost	How much will the measure cost to implement?	Low (Under \$10k) = 3 Medium (\$10k - \$100k) = 2 High over \$100k) = 1
3	Equity Focus	Does the measure provide support to Environmental Justice (EJ) and other Vulnerable Populations?	Direct Support = 3 Indirect Support = 2 No Support = 0
4	Protection of Lives	How effective is the measure in protecting lives and mitigating injuries resulting from the targeted hazard(s)?	Major Support = 3 Moderate Support = 2 Minor Support = 1 None = 0
5	Protection of Critical Facilities or Infrastructure	Does the measure provide protection of critical facilities and infrastructure?	Yes = 3 No = 0

	Criteria Category	Description	Detailed Ranking and Associated Points
6	Natural Resource Protection	Does the measure provide protection of natural resources?	Yes = 2 No = 0
7	Alignment with Objectives	Does the measure align with the HMP objectives?	Yes =2 No =0

All the actions are listed in **Error! Reference source not found.** in order of priority with the action's essential details.

Additional tables are included in Appendix B. The breakdown of priority ranking points for each action is included in Appendix B. Readers of this plan must understand that the mitigation action list is aspirational, it does not mean that the HMPC is confident that all actions may be implemented in the span of five years.

Table 70. Chester Hazard Mitigation Actions.

1	**Increase capacity to secure grant funding.**	
High	**Action Description**	The Town needs to explore opportunities to secure grant funds, these may include building internal staff capacity through new hires, training and professional development, designating or hiring a Resource Development Director or Grants Administrator, coordination with PVPC and neighboring communities to capture grant opportunities for regional risk reduction projects.
	Lead Position	Town Administrator
	Supporting Agencies	Selectboard
	Cost	Low
	Potential Funding Sources	Town Administrator's Budget
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides Earthquakes
	Implementation Schedule	2024-2029

2	**Develop a non-zoning wetlands bylaw.**	
High	**Action Description**	To protect water supplies and prevent flooding establish permanent no-disturb zones in sensitive areas (i.e. intermittent streams protected same as perennial streams under WPA, more control over local development decisions than DEP issuing superseding orders of conditions).
	Lead Position	Zoning Board of Appeals Chair
	Supporting Agencies	Planning Board
	Cost	Medium
	Potential Funding Sources	Massachusetts Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Hurricanes and Tropical Storms Other Severe Weather
	Implementation Schedule	2025-2026

3	**Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.**	
High	**Action Description**	Integrating the goals of the Hazard Mitigation Plan into other Town plans supports the priorities of climate resilience and hazard mitigation.
	Lead Position	Town Administrator
	Supporting Agencies	All Town Departments, Boards, and Commissions
	Cost	Low
	Potential Funding Sources	Massachusetts Executive Office of Housing and Livable Communities, Community Planning Grant
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides Earthquakes
	Implementation Schedule	2024-2029

4	**Develop a system to monitor and remedy threats to surface water.**	
High	**Action Description**	Climate change and increasing temperatures are raising the risk of algal blooms and other threats to surface water/drinking water. Chester uses two surface water ponds for drinking water.
	Lead Position	Board of Water Commissioners Chair
	Supporting Agencies	Conservation Commission
	Cost	Low
	Potential Funding Sources	Massachusetts Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant, MA Department of Environmental Protection, Statewide Water Management Act Grant
	Hazards	Extreme Temperatures Droughts Invasive Species Landslides
	Implementation Schedule	2025-2027

5	**Redo drainage and map water lines on Middlefield Road and remove lead pipes.**	
High	**Action Description**	The water system is very old and in need of remediation. The health and safety of the 250 homes and approximately 800 people who use the system is at risk. The Town needs to map and assess the water system and remediate areas with lead pipes or inadequate infrastructure.
	Lead Position	Highway Foreman
	Supporting Agencies	Water Department
	Cost	High
	Potential Funding Sources	MA Department of Environmental Protection (DEP): Drinking Water, State Revolving Fund (SRF) Loan Program
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Hurricanes and Tropical Storms Other Severe Weather
	Implementation Schedule	2026-2028

6	**Review and update the Town's existing stormwater management standards.**	
High	**Action Description**	Stormwater management standards will be reviewed and updated as specified in its Subdivision Regulations (Section 4-2: Storm Water Runoff Control) based on best practices that account for projected future conditions, including increased heavy precipitation events, and to promote green infrastructure and other nature-based solutions for flood risk management.
	Lead Position	Town Administrator
	Supporting Agencies	Zoning Board of Appeals, Planning Board
	Cost	Low
	Potential Funding Sources	Massachusetts Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Other Severe Weather
	Implementation Schedule	2025-2027

7	**Educate home and business owners about nature-based solutions for climate change and natural hazard risks.**	
Medium	**Action Description**	Town administration and key volunteers are interested in increasing awareness of nature-based solutions as a way to mitigate risk of natural hazards and climate change.
	Lead Position	Town Administrator
	Supporting Agencies	Building Inspector
	Cost	Low
	Potential Funding Sources	Massachusetts Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides
	Implementation Schedule	2024-2029

8	**Develop a collaborative with adjacent communities to hire grant writers for public education and outreach projects to conduct jointly.**	
Medium	**Action Description**	Chester is a very small community with limited staff, the Town relies on volunteer labor for many activities. Adjacent communities such as Huntington, Blandford, Becket, Middlefield and Worthington are in similar positions. A public education and outreach effort that works collaboratively is a way to achieve economies of scale and meet the needs of each community. This may include partnering with the Gateway Regional School District, the Wild & Scenic Westfield River Committee, the Berkshire Natural Resources Council, and other organizations to help conduct outreach campaigns related to hazard mitigation, climate adaptation, and community resilience.
	Lead Position	Town Administrator
	Supporting Agencies	Gateway Regional School District Wild & Scenic Westfield River Committee Berkshire Natural Resources Council Pioneer Valley Planning Commission
	Cost	Low
	Potential Funding Sources	MEMA Emergency Management Performance Grant (EMPG)
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides Earthquakes
	Implementation Schedule	2025-2029

9	**Educate Town staff and key volunteers, including board and committee members, on best practices in their field. In addition, develop a system of logging and maintaining essential records for all volunteer and paid staff positions to assist with business continuity when leadership roles turn-over.**	
Medium	**Action Description**	Provide training to Town employees, boards, & commissions including but not limited to: best practices, floodplain management, erosion controls, etc. A significant portion of the Town's leadership serve in a voluntary capacity, it is necessary to provide educational opportunities to these volunteers as well as staff.
	Lead Position	Town Administrator
	Supporting Agencies	Town Departments, Boards, and Committees
	Cost	Low
	Potential Funding Sources	MassWildlife Habitat Management Program Funding
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides Earthquakes
	Implementation Schedule	2025-2029

10	**Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.**	
Medium	**Action Description**	Include East River Road, Johnson Hill, Abbott Hill, Maynard Street, Prospect Street, Round Hill Road for paving prioritization due to washouts. Assess the culvert on Old State Road and apply stream continuity standards in upgrade plans.
	Lead Position	Highway Foreman
	Supporting Agencies	0
	Cost	High
	Potential Funding Sources	MA Division of Ecological Restoration (DER): Culvert Replacement Assistance Grant, MA Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant, FEMA BRIC
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Hurricanes and Tropical Storms Other Severe Weather
	Implementation Schedule	2024-2026

11	**Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.**	
Medium	**Action Description**	Old Abbott Hill Road has been closed since the flood of 1955 that washed out the road. Over 100 homes and Village businesses may become trapped during a train derailment, flood, or other disaster. Re-opening this road would allow first responders to access the area and allow for evacuations.
	Lead Position	Town Administrator
	Supporting Agencies	Fire Chief, Highway Foreman
	Cost	High
	Potential Funding Sources	FEMA Building Resilient Infrastructure and Communities (BRIC)
	Hazards	Flood, Severe Winter Storms, Extreme Temperatures, Hurricanes/Wind, Thunderstorms, Landslides, Wildfires, Tornadoes
	Implementation Schedule	2025-2029

12	**Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during periods of extreme temperatures.**	
Medium	**Action Description**	This includes expanding the Town's website with hazard mitigation and climate adaptation information and resources. It also includes information specifically about stormwater, hazardous trees, water usage, and flooding. It includes making the community aware of Community Development Block Grant home rehabilitation funds to assist low to moderate income homeowners in bringing homes up to code, including grandfathered mobile homes.
	Lead Position	Town Administrator
	Supporting Agencies	Board of Health, Fire Department, Gateway Regional School District
	Cost	Low
	Potential Funding Sources	FEMA Hazard Mitigation Assistance Grants
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides Earthquakes
	Implementation Schedule	2024-2029

13	**Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.**	
Medium	**Action Description**	In the event of high heat, power outage, or other disaster it is necessary to understand and meet the needs of the most vulnerable residents in Town. Identifying those residents and developing a system to assist them when necessary is imperative. The Town's elderly population and the number of people living below the poverty line has increased.
	Lead Position	Council on Aging Director
	Supporting Agencies	Veterans Agent, Fire Department Police Department Hilltown Community Ambulance Association
	Cost	Low
	Potential Funding Sources	Council on Aging Budget, Emergency Management Performance Grant (EMPG)
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides Earthquakes
	Implementation Schedule	2025-2026

14	**Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.**	
Medium	**Action Description**	A bridge collapse or flood in the Village would potentially trap multiple people, homes, and businesses. The Town needs to educate its residents about the risk and how be ready in case of a flood. Encourage State DOT to replace the Blandford Road Bridge and the Main Street Bridge, both are at risk of collapse. The Main Street Bridge is in such dire condition it is illegal to drive a firetruck over the bridge.
	Lead Position	Town Administrator
	Supporting Agencies	0
	Cost	Low
	Potential Funding Sources	Massachusetts Community Compact Grant
	Hazards	Flooding Including Dam Failures and Ice Jams
	Implementation Schedule	2024-2029

15	**Develop a more comprehensive capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years.**	
Medium	**Action Description**	The Town needs to set-aside funds for costly mitigation projects. In addition, integrating hazard mitigation and climate resiliency criteria into the CIP project evaluation, selection, and prioritization process is necessary.
	Lead Position	Town Administrator
	Supporting Agencies	Selectboard, Finance Committee
	Cost	High
	Potential Funding Sources	Town Administrator's Budget
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides Earthquakes
	Implementation Schedule	2025-2026

16	Dam Risk Mitigation.	
Medium	Action Description	Privately owned dams in the Town of Becket if breached would impact Chester. These dams do not seem to have Emergency Action Plans or maps of the dam breach areas. Chester will work with the Town of Becket to identify owners of the dams and encourage them to develop and exercise Emergency Action Plans and maps of the breach areas.
	Lead Position	Town Administrator
	Supporting Agencies	Fire Chief, Highway Foreman, Towns of Becket Town Administrator
	Cost	Low
	Potential Funding Sources	Town Administrator's Budget
	Hazards	Flooding Including Dam Failures and Ice Jams
	Implementation Schedule	2024-2029

17	Develop and implement a plan to monitor beaver activity that may impact roads.	
Medium	Action Description	The beaver deceiver along East River Road is working. Other areas such as Lyman Road may be impacted by beaver activity.
	Lead Position	Highway Foreman
	Supporting Agencies	Conservation Commission
	Cost	Low
	Potential Funding Sources	MA Community Compact Regionalization grant; MSPCA Beaver Funding Assistance
	Hazards	Flooding Including Dam Failures and Ice Jams Other Severe Weather
	Implementation Schedule	2027-2029

18	**To mitigate potential damage from an ice jam, identify potential ice jam locations and implement monitoring of these locations during the winter and spring for signs of ice jams.**	
Medium	**Action Description**	Ice jams along the two branches of the Westfield River could cause flooding and damages to homes and businesses in Chester. Identifying there potential and monitoring there formation is needed to mitigate risk.
	Lead Position	Highway Foreman
	Supporting Agencies	Westfield River Watershed Association (WRWA)
	Cost	Low
	Potential Funding Sources	FEMA Building Resilient Infrastructure and Communities (BRIC)
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Extreme Temperatures
	Implementation Schedule	2026-2029

19	**Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.**	
Low	**Action Description**	The Town has not maintained a consistent automated messaging system which puts residents at risk.
	Lead Position	Fire Chief
	Supporting Agencies	Police Department
	Cost	Medium
	Potential Funding Sources	Massachusetts Emergency Management Agency (MEMA), Emergency Management Performance Grant (EMPG)
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Hurricanes and Tropical Storms Other Severe Weather Tornadoes Landslides Earthquakes
	Implementation Schedule	2024-2026

20	**Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.**	
Low	**Action Description**	Use existing methods or tools for incorporating green infrastructure, low impact development, and other nature-based solutions (such as Mass Audubon's Bylaw Review Tool. The Zoning review and update will also include design requirements to prevent wind-related damages. The review and update must also address floodplain management regulations (Zoning Bylaw, Section 4.0 - Floodplain and Westfield River Protection District) to be in alignment with the State's Model Floodplain Bylaw.
	Lead Position	Planning Board Chair
	Supporting Agencies	Town Administrator
	Cost	Medium
	Potential Funding Sources	Massachusetts Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant, MA Executive Office of Housing and Livable Communities, Community Planning Grant
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Landslides Earthquakes
	Implementation Schedule	2026-2028

21	**Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.**	
Low	**Action Description**	This road is exceptionally steep and narrow. It is similar to Johnson Hill Road.
	Lead Position	Highway Foreman
	Supporting Agencies	Conservation Commission
	Cost	High
	Potential Funding Sources	MA Division of Ecological Restoration (DER): Culvert Replacement Assistance Grant, MA Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant, FEMA BRIC
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Hurricanes and Tropical Storms Other Severe Weather
	Implementation Schedule	2025-2026
22	**Conduct a Town Tree Assessment and inventory to identify hazardous trees and diseased trees on public lands and rights-of-way.**	
Low	**Action Description**	Skyline Trail, East River Road, Smith Road, Mica Mill, and Bromley Road are major concerns in terms of trees impacting roads. The Town needs to continue identifying problem areas as well as funds to manage the trees. The current Town budget is not sufficient.
	Lead Position	Highway Foreman
	Supporting Agencies	Conservation Commission, Chester Municipal Electric Light Department
	Cost	Medium
	Potential Funding Sources	USDA: Tree Assistance Program (TAP) Grant, MA Department of Conservation and Recreation: Urban and Community Forestry Grant
	Hazards	Severe Winter Storms Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species

	Implementation Schedule	2026-2028
23	**Install and repair dry hydrants.**	
Low	Action Description	The Town of Chester has identified several locations that would benefit from the installation of dry hydrants.
	Lead Position	Fire Chief
	Supporting Agencies	Selectboard
	Cost	Medium
	Potential Funding Sources	Massachusetts Department of Environmental Protection, Water Resources Grants, FEMA Assistance to Firefighters Grants
	Hazards	Wildfire/Brushfires
	Implementation Schedule	2025-2027
24	**Designate a Floodplain Administrator (FPA) and adopt the 2020 MA State Model Floodplain Bylaw to assure that the Town's current bylaws and ordinances contain the necessary and proper language for compliance with the National Flood Insurance Program and state requirements.**	
Low	Action Description	The designated Floodplain Administrator will work in conjunction with other outreach and engagement mitigation actions to promote the availability of flood insurance to property owners and renters in the Village and other areas of high to moderate flood risk.
	Lead Position	Town Administrator
	Supporting Agencies	Selectboard
	Cost	Low
	Potential Funding Sources	Massachusetts Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant
	Hazards	Flooding Including Dam Failures and Ice Jams
	Implementation Schedule	2025-2026

25	Develop an Open Space and Recreation Plan that includes hazard mitigation.	
Low	**Action Description**	The Town needs an Open Space and Recreation Plan (OSRP) to identify conservation and recreation resources and plans for their protection. The OSRP will include identification of areas where nature based solutions may be used to mitigate risk. A State-approved OSRP makes the Town eligible for Division of Conservation Services (DCS) grants.
	Lead Position	Conservation Commission Chair
	Supporting Agencies	Conservation Commission
	Cost	Medium
	Potential Funding Sources	MA Executive Office of Energy and Environmental Affairs (EEA), Office of Grants and Technical Assistance, Land and Recreation Grants & Loans, EEA MVP Action Grant
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Hurricanes and Tropical Storms Other Severe Weather Tornadoes Droughts Invasive Species Landslides
	Implementation Schedule	2025-2027

26	**Acquire funding for engineering (Phase 2) and construction (Phase 3) of the Abbott Brook reconstruction.**	
Low	**Action Description**	The Town installed temporary culverts and wing walls. Due to the time involved in getting grant funding the work had to be done. The Town will continue to seek grants for the remaining work.
	Lead Position	Highway Foreman
	Supporting Agencies	Selectboard
	Cost	High
	Potential Funding Sources	MA Division of Ecological Restoration (DER): Culvert Replacement Assistance Grant, MA Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant, FEMA BRIC
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Hurricanes and Tropical Storms Other Severe Weather
	Implementation Schedule	2025-2028

27	**Conduct landslide studies to identify high hazard areas and methods to reduce risk in these areas.**	
Low	**Action Description**	Much of the Town's road infrastructure and homes are in steep areas. A landslide could impact critical transportation routes especially east of Route 20.
	Lead Position	Town Administrator
	Supporting Agencies	Planning Board
	Cost	Medium
	Potential Funding Sources	FEMA Building Resilient Infrastructure and Communities (BRIC)
	Hazards	Landslides
	Implementation Schedule	2028-2029

28	**Consider adopting a Massachusetts Community Preservation Act.**	
Low	**Action Description**	Continue exploring the Town's adoption of MA Community Preservation Act (CPA) to create a local funding source for additional protected open space acquisitions that support flood hazard mitigation and watershed management.
	Lead Position	Conservation Commission Chair
	Supporting Agencies	Recreation Committee
	Cost	Low
	Potential Funding Sources	Massachusetts Executive Office of Energy and Environmental Affairs (EEA) MVP Action Grant
	Hazards	Flooding Including Dam Failures and Ice Jams Severe Winter Storms Wildfires/ Brushfires Extreme Temperatures Other Severe Weather Droughts Invasive Species
	Implementation Schedule	2025-2027

29	**Educate homeowners to identify Bittersweet and other invasive species and how to remove it responsibly.**	
Low	**Action Description**	The Town does not have the capacity to identify or mitigate the risk of invasive species on public lands. However, a basic education program for homeowners would help to reduce the risk in the Town as a whole.
	Lead Position	Conservation Commission Chair
	Supporting Agencies	Town Administrator
	Cost	Low
	Potential Funding Sources	Department of the Interior, Fish & Wildlife Service, Invasive Species Eradication Funding Opportunity
	Hazards	Invasive Species
	Implementation Schedule	2026-2028

Table 71 shows the mitigation actions that specifically target vulnerable populations and Table 72 shows the mitigation actions that specifically target buildings and infrastructure. Each table lists the actions in order of priority.

Table 71. Actions that Target Vulnerable Populations.

Action #	Action Title
1	Increase capacity to secure grant funding.
2	Develop a non-zoning wetlands bylaw.
3	Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.
4	Develop a system to monitor and remedy threats to surface water.
5	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
8	Develop a collaborative with adjacent communities to hire grant writers for public education and outreach projects to conduct jointly.
11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.
12	Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during periods of extreme t
13	Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.
14	Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.
19	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs

Table 72. Actions that Target Buildings and Infrastructure.

Action #	Action Title
5	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
10	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.
16	Dam Risk Mitigation.
17	Develop and implement a plan to monitor beaver activity that may impact roads.
18	To mitigate potential damage from an ice jam, identify potential ice jam locations and implement monitoring of these locations during the winter and spring for signs of ice jams.
19	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs
21	Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.
23	Install and repair dry hydrants.
26	Acquire funding for engineering (Phase 2) and construction (Phase 3) of the Abbott Brook reconstruction.

The Town has identified locations as possible sites for dry hydrants. The Town has two dry hydrants, but they are not in full working order. As reported by the Fire Chief, "Town fire trucks can pull a maximum of 29.9 in/mg. For every one foot of vertical lift, we lose 1 in/mg and for every 10ft of horizontal pull, we lose 1 in/mg, so in other words, 30ft is our maximum height we can pull. The Main Street bridge is the maximum we can pull from. We will have to take that into consideration when choosing hydrant sites." The list below corresponds with the locations indicated in the Figure below.

A. Swap across from 487 East River Road. We have drafted out of here before when 487 burned several years ago. This location is right next to the road and is easy access.

B. River across from 220 East River road. There is a deep pool pf slow moving water and the height from the road to the water is not super far. This location has easy access and would be good to service the fairgrounds and the other houses in the area.

C. Lyman Road swamp, just before 19 Lyman Road, there is a bridge. Again, this is right next to the road and is easy access for tankers and engines.

D. Existing dry hydrant location on upper East River Road. This hydrant has been out of service for several years now because of weed growth and the top was snapped off by the road side mower. There is a telephone pole marking its location with 3 reflectors.

E. Warren Flats across from 124 Skyline trail. This is an existing dry hydrant. We have trained on this hydrant, but last time it was used, it was showing signs of a leak and was sucking air making it hard to draft from.

F. The river across from 124 Old State Road. This location has a deep pool close to the road and the distance from the road to the water doesn't seem too far.

G. Wright's Bridge located on Route 20 pull off. We have drafted out of here before using portable pumps. This is easy access with a turnaround for tankers and engines.

H. Route 20 rest area. We have drafted from here before and this location allows for filling of tankers without disrupting the traffic on Route 20.

I. Main Street Bridge. This is about the maximum amount of height that the engine will draft from. When the bridge gets redone, a dry hydrant could be added at that time.

J. The old town yard from Walker brook. Easy access and has a safe area to park trucks at.

K. Johnson Hill bridge for Otis Waite Brook. There is a pull off here and this would service Lynes Road as well as lower Johnson Hill.

L. Abbot Brook from Abbott Hill Road. We have drafted out of here for previous fires which include the Taft Road Fire back in 2007 and the camp that burned in 2011.

M. The Beck residence. Tom Beck approached us about putting a dry hydrant in is pond. There is sufficient space, and his driveway is a U shape which allows us to move truck efficiently

N. Blandford Road Bridge for Walker Brook. We drafted from this spot for the house fire back in 2022 on Route 20.

Figure 29. Possible locations for dry hydrants.

Possible Funding Sources

All the mitigation actions included in this plan have identified one or more potential funding sources. The HMPC focused on projects eligible for MVP Grant funding and FEMA BRIC funding. Below is a list of some of the federal and state funding mechanisms that may assist in implementing mitigation actions.

Federal Emergency Management Agency (FEMA) Mitigation Grants

The Federal Emergency Management Agency (FEMA) makes grant funding available for a range of mitigation activities via several Hazard Mitigation Assistance (HMA) programs. These grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. They are not intended to fund repair, replacement, or deferred maintenance activities but are rather designed to assist in developing long-term, cost-effective improvements that will reduce risk to natural hazards.

- **Building Resilient Infrastructure and Communities (BRIC)**
  BRIC is a new FEMA hazard mitigation program designed to replace the agency's former HMA Pre-Disaster Mitigation (PDM) grant program, aiming to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. It is a result of recent amendments made to Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) by Section 1234 of the Disaster Recovery Reform Act of 2018 (DRRA). BRIC will support states, local communities, tribes, and territories as they undertake hazard mitigation projects reducing the risks they face from natural hazards. The BRIC program's guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

- **Hazard Mitigation Grant Program (HMGP)**
  The HMGP is authorized under Section 404 of the Stafford Act. The HMGP provides grants to states, tribes, and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not lost during the recovery and reconstruction process following a disaster. HMGP is typically available only in the months after a federal disaster declaration, as funding amounts are determined based on a percentage of the funds spent on FEMA's Public and Individual Assistance programs.

- **Flood Mitigation Assistance (FMA) Program**
  The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities. One limitation of the FMA program is that it is generally used to provide mitigation for structures that are insured or located in Special Flood Hazard Areas (SFHAs) as mapped by FEMA. Federal funding for this nationally competitive grant program is generally an annual allocation (subject to Congressional appropriation) and eligibility is linked to a community's good standing in the NFIP.

Municipal Vulnerability Preparedness Action Grants[55]

The MVP Action Grant offers financial resources to municipalities seeking to advance priority climate adaptation actions to address climate change impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate impacts.

Responses to the RFR may be submitted by municipalities who have received designation from the Executive Office of Energy and Environmental Affairs (EEA) as a Climate Change Municipal Vulnerability Preparedness (MVP) Community, or "MVP Community." All projects are required to provide monthly updates, project deliverables, a final project report, and a brief project summary communicating lessons learned. The municipality is also required to match 25% of total project cost using cash or in-kind contributions. All proposals must include the following:

- Completed application template
- Project budget and deliverables
- MVP yearly progress report describing any relevant work toward advancing community priorities since earning MVP designation
- Statement of match
- Letters of support from landowner (if applicable), partners, and the public

Project types include:

- ***Detailed Vulnerability and Risk Assessment*** – In-depth vulnerability or risk assessment of a particular sector, location, or other aspect of the municipality.
- ***Public Education and Communication*** – Projects that increase public understanding of climate change impacts within and beyond the community and foster effective partnerships to develop support.
- ***Local Bylaws, Ordinances, Plans, and other Management Measures*** – Projects to develop, amend, and implement local ordinances, bylaws, standards, plans, and other management measures to reduce risk and damages from extreme weather, heat, flooding, and other climate change impacts.
- ***Redesigns and Retrofits*** – Engineering and construction projects to redesign, plan, or retrofit vulnerable community facilities and infrastructure (e.g., wastewater treatment plants, culverts,

[55] State of Massachusetts. *MVP Action Grant.* https://www.mass.gov/service-details/mvp-action-grant.

and critical municipal roadways/evacuation routes) to function over the life of the infrastructure given projected climate change impacts.

- ***Energy Resilience Strategies*** — Projects that incorporate clean energy generation, such as micro grids, and that are paired with resilience enabling technology to maintain electrical and/or heating and cooling services at critical facilities.
- ***Chemical Safety and Climate Vulnerabilities*** — Projects that seek to engage the business and manufacturing community through assistance or training on identifying vulnerabilities to chemical releases due to severe weather events, reducing use of toxic or hazardous chemicals, outreach to improve operations and maintenance procedures to prevent chemical releases and accidents, outreach to improve emergency and contingency planning, and/or identifying existing contaminated sites that pose chemical dispersion risks during flood events.
- ***Nature-Based Storm-Damage Protection, Drought Mitigation, Water Quality, and Water Infiltration Techniques*** – Projects that utilize natural resources and pervious surfaces to manage coastal and inland flooding, erosion, and other storm damage, such as stormwater wetlands and bio-retention systems, and other Smart Growth and Low Impact Development techniques.
- ***Nature-Based, Infrastructure and Technology Solutions to Reduce Vulnerability to Extreme Heat and Poor Air Quality*** – Projects that utilize natural resources, vegetation, and increasing pervious surface to reduce ambient temperatures, provide shade, increase evapotranspiration, improve local air quality, and otherwise provide cooling services within the municipality.
- ***Nature-Based Solutions to Reduce Vulnerability to other Climate Change Impacts*** – Nature-based projects that address other impacts of climate change such as extreme weather, damaging wind and power outages, and increased incidence of pests and vector-borne illnesses and other public health issues.
- ***Acquisition of Land to Achieve a Resiliency Objective*** — Land purchases are eligible for grant funding if the parcel has been identified through a climate vulnerability assessment as an appropriate location for a specific eligible adaptation activity to occur, such as accommodating an infrastructure or facility redesign or retrofit project, providing natural flood storage to reduce downstream flooding, or removal of pavement and planting of trees to reduce flooding and heat island effects.
- ***Ecological Restoration and Habitat Management to Increase Resiliency*** — Projects that repair or improve natural systems for community and ecosystem adaptation, such as right-sizing culverts, dam removal, restoration of coastal wetlands, etc.

- ***Subsidized Low Income Housing Resilience Strategies*** — Investments in resiliency measures for affordable housing to protect vulnerable populations that may not have the resources to recover from an extreme climate event.

- ***Mosquito Control Districts*** — Projects to reduce the risk to public health from mosquito-borne illness and to increase mosquito surveillance and control capacity by incentivizing municipalities not in an organized mosquito control project or district to form a new mosquito control district or join an existing mosquito control district. Also funding for municipalities currently in a mosquito control district for new or proactive mosquito control measures.

Chapter 7. Plan Implementation and Maintenance

The Chair of the Selectboard led the effort to develop this plan and served as the primary point of contact for the Hazard Mitigation Planning Committee. However, the Town Administrator will be solely responsible for the implementation and maintenance of the Plan. The Hazard Mitigation Planning Committee (HMPC) will support this effort and the Chair of the Selectboard may be asked to lead certain mitigation actions or grant seeking efforts. The Town Administrator is responsible for ensuring the Town maintains and updates this plan according to the details described below.

The HMPC includes key stakeholders in the Town, who will use the plan's goals, as well as continued analysis of hazard risks and capabilities, to weigh the available resources against the costs and benefits for each mitigation action. The Town understands the value of this plan and its positive mitigation impact and intends to continue updating this plan and implementing its strategies.

Continued Public Participation

D1. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))

Public participation is an integral component of the mitigation planning process and will continue to be essential as this plan is implemented and updated over time. Based on the level of interest in the mitigation planning process and in the Municipal Vulnerability Preparedness project, Town residents and stakeholders are interested in hazard mitigation and climate adaptation. The Town Administrator, Selectboard, and the HMPC included several education and outreach mitigation actions designed to engage the public. The Town intends to involve the public throughout the five-year implementation of this plan, as well as in the reviewing and updating processes. The Town Administrator will take the lead in soliciting participation from the public with support from other Town staff and Town Committees. This participation will take multiple forms, including all of those outlined in the Chapter 3 (Planning Process) of this plan. Efforts to involve the public include:

- Advertising on the Town's website and through standard meeting laws.
- Posting news and announcements on Chester Massachusetts Community Forum on Facebook.
- Conducting outreach to local community organizations and businesses.
- Hosting public presentations and meetings throughout the plan's process to acquire feedback and input from stakeholders.

- Post copies of the plan on the Town's website and keep a hard copy at the Town Hall for public review.
- Continue to work with vulnerable populations, local organizations, private industry, regional agencies, and adjacent communities as this plan is implemented.

Method and Schedule for Keeping the Plan Current

D2. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))

The Town Administrator, HMPC and the Town Selectboard recognize the importance of keeping the mitigation plan up to date. The HMPC will meet twice a year for the purposes of implementing and maintaining the Hazard Mitigation Plan. This work includes monitoring, evaluating, and updating the plan over a five-year period. Overall, the responsibility for monitoring the Plan rests with the Town Administrator.

Process to Track Actions

***MONITORING** means tracking the implementation of the plan over time.*

The Town Administrator and the HMPC will maintain the Mitigation Action Tracker (a tool to record the status of each mitigation action). They will send a reminder email with a link to the web-based Mitigation Action Tracker on a semi-annual basis (January and July) to all Town staff and Town Committees responsible for a mitigation action. They may also distribute the Mitigation Action Progress Worksheet (shown in Appendix C) for those who prefer a form over a digital spreadsheet.

If the Town experiences a large-scale disaster, the Town Administrator will assemble a Selectboard Meeting and an HMPC meeting to update the list of mitigation actions and review their order based on current priorities.

Process to Evaluate Effectiveness of the Plan

***EVALUATING** means assessing the effectiveness of the plan at achieving its stated purpose and goals.*

The HMPC has agreed to meet on a bi-annual basis in conjunction with Selectboard meetings to review the implementation of the mitigation plan. The first meeting will take place in January; the second, in July.

At the first meeting (January 2025), the HMPC will review the effectiveness of the planning process, public and stakeholder engagement, risk analysis, and the mitigation strategy, including its implementation. It is recommended that the HMPC use the worksheet provided in Appendix C. Beyond considering the planning process, the HMPC will seek to answer the following questions to determine if the plan is effective at mitigating risk to Town residents, the built environment, and the natural environment.

- Can the HMPC identify success stories of losses avoided because of hazard mitigation measures implemented? Can the HMPC identify political, social, and economic successes?
- Have the mitigation actions implemented achieved benefits beyond the cost of mitigation?
- Have the implemented mitigation actions saved lives or protected property?
- Does the list of mitigation actions coincide with the Town's priorities? Do additional actions need to be added?

Process to Update the Plan

***UPDATING** means reviewing and revising the plan at least once every five years.*

At each semi-annual meeting, the Selectboard and the HMPC will review the plan's goal statements and mitigation action status. If necessary, the goal statements and mitigation actions may be revised to reflect current Town priorities. In addition, the HMPC will discuss methods for continuing to integrate the mitigation plan with other plans, processes, and projects in the Town.

They will post any significant updates to the Plan to the Town's website. The HMPC recognizes the value in keeping the public and key stakeholders informed about the implementation and status of the mitigation plan.

HMPC members will continue to participate in regional and state-based meetings to stay current with best risk-mitigation practices. Such meetings may include the Massachusetts Emergency Management Agency (MEMA) and the Pioneer Valley Planning Commission (PVPC). The HMPC will also participate in land use planning and mitigation planning meetings with their neighbors, the Towns of Worthington, Huntington, Blandford, Becket, and Middlefield.

The Town of Chester agrees to update and adopt this mitigation plan on a five-year basis. The update will include a comprehensive review and planning process like the one used to develop this mitigation plan update. It will update the mitigation action list, current land use practices, collect and review best available data, review the capability assessment, and engage the public and stakeholders. This process will occur according to FEMA guidelines. The HMPC will seek funding for the development of the plan update **two years** before the plan expires. The plan update process gives the Town the chance to add and/or re-prioritize mitigation actions based on current risk, capabilities, and public/stakeholder suggestions. The Town Administrator will serve as the Project Manager for the update process, unless they choose to delegate the responsibility to someone else. The figure below illustrates the update timeline.

Year 1	Year 2	Year 3	Year 4	Year 5
•Seek grant funding for mitigation actions •Gather the HMPC in January and July	•Seek grant funding for mitigation actions •Gather the HMPC in January and July	•Seek FEMA BRIC funding for plan update •Seek grant funding for mitigation actions •Gather the HMPC in January and July	•Begin the plan update process •Seek grant funding for mitigation actions •Gather the HMPC in January and July	•Complete the plan update process - adopt the new plan •Seek grant funding for mitigation actions •Gather the HMPC in January and July

Figure 20. Plan Update and Implementation Schedule.

The National Dam Safety Program Act has authorized FEMA to provide High Hazard Potential Dams (HHPD) Rehabilitation Grant Program assistance for the rehabilitation of dams that do not meet minimum safety standards and pose substantial risk to life and property.[56] Towns interested in accessing the HHPD grant must have an approved local hazard mitigation plan and meet criteria outlined in Element G: High Hazard Potential Dams. Element G is optional for local governments. While this Plan update did not address Element G requirements, the Town of Chester will consider adding Element G during the next Plan update. Meeting the requirements of Element G include answering the following questions:

- Did the plan describe the incorporation of existing plans, studies, reports, and technical information for HHPDs?
- Did the plan address HHPDs in the risk assessment?
- Did the plan include mitigation goals to reduce long-term vulnerabilities from HHPDs?

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[56] Local Mitigation Planning Policy Guide, FEMA, Effective April 19, 2023, p.32.

- Did the plan include actions that address HHPDs, and prioritize mitigation actions to reduce vulnerabilities from HHPDs?

Responsible Parties for Plan Implementation and Maintenance

Chester, MA

Donald F. Humason, Jr., Town Administrator

Town of Chester

15 Middlefield Road, Chester, MA 01011

Phone: 413-354-7760

Email: TownAdministrator@TownofChester.net

For State resources:

Massachusetts Emergency Management Agency:

Address: 400 Worcester Road, Framingham, MA 01702-5399

Phone: 508-820-2000 (MEMA Headquarters and Communications Center)

or 978-328-1500 (MEMA Region 1 Office)

Website: https://www.mass.gov/orgs/massachusetts-emergency-management-agency

For Federal resources:

Federal Emergency Management Agency:

Address: 220 Binney Street, Cambridge, MA 02142

Phone: 877-336-2734

Email: fema-r1-info@fema.dhs.gov

Website: https://www.fema.gov/region-i-ct-me-ma-nh-ri-vt

System to Integrate this Plan with Existing Planning Mechanisms

D3. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))

> ***INTEGRATE** means to include hazard mitigation principles, vulnerability information and mitigation actions into other existing community planning to leverage activities that have co-benefits, reduce risk and increase resilience.*

For the Town of Chester to succeed in reducing hazard risks over the long term, the information, ideas, conclusions, and strategic recommendations of this hazard mitigation plan should be integrated throughout government operations. Effective integration means to include mitigation principles, vulnerability information, and mitigation actions into other existing community planning mechanisms to leverage activities that have co-benefits, reduce risk, and increase resilience. Many other local plans and processes will present opportunities to address hazard mitigation in a way that can support multiple community objectives, so an important part of maintaining and implementing this hazard mitigation plan will be to identify and capitalize on these opportunities to leverage activities that have co-benefits (including but not limited to risk reduction). The Town's ongoing efforts to create an updated Open Space and Recreation Plan is an example opportunity for this type of integration by preserving the natural and beneficial functions of sensitive lands for climate resilience and addressing other multi-objective strategies across various elements of this separate planning document.

The HMPC will remain tasked with helping to ensure that all new or updated local plans and regulations are informed by and consistent with the goals and actions of this hazard mitigation plan and will not contribute to increased hazard vulnerability in Chester. Specifically, this includes but is not limited to the implementation or future updates to the following local plans and regulatory measures as identified and further described in Chapter 5 (Capability Assessment):

- Municipal Vulnerability Preparedness / Community Resilience Building Summary of Findings Report
- Open Space and Recreation Plan
- Master Plan
- Zoning Bylaw, especially the following sections:
    - General Use Regulations (Section 3)
    - Floodplain and Westfield River Protection District (Section 4.0)
    - Creative Development (Section 5.3)
    - Special Permits (Section 6.5)
- Site Plan Approval Bylaw
- Subdivision Regulations

Additional opportunities to integrate the requirements of this plan into other local planning mechanisms shall continue to be identified through future meetings of the HMPC and through the five-year review process described in this chapter. Other planning mechanisms include local regulations and existing code enforcement procedures (i.e., zoning bylaws, site plan review, etc.), internal municipal policies, special projects or initiatives, and other routine government or community decision-making activities such as capital improvement planning and the Town's annual budget process. Emphasis for identifying these integration opportunities will be placed on those governance structures used to manage local land use and community development in both the pre-disaster and post-disaster environment. Also, as it relates to implementing specific mitigation actions identified in this plan, it will be the responsibility of each assigned lead department to determine additional measures that can support action completion or enhancement. This includes integrating mitigation actions from this plan into other local planning documents, processes, or mechanisms as deemed appropriate and most effective.

***PLANNING MECHANISMS** refers to the governance structures used to manage local land use development and community decision-making, such as budgets, comprehensive plans, capital improvement plans, economic development strategies, climate action plans or other long-range plans.*

While it is recognized that there are many possible benefits to integrating components of this plan into other local planning mechanisms, the routine maintenance of this stand-alone plan is considered by the Town to be the most effective and appropriate method to identify, prioritize, and implement local hazard mitigation actions. In moving forward, however, the Town will consider the incorporation of some other plan documents into the hazard mitigation plan, such as any future iterations of the Town's MVP Plan, MVP-funded studies or reports (such as the 2023 Beaver Assessment Technical Memorandum), or related climate adaptation planning efforts.

Acronyms

AAL	Average Annual Loss
APHIS	Animal and Plant Health Inspection Service
ASCE	American Society of Civil Engineers
BBRS	Board of Building Regulations and Standards
BRIC	Building Resilient Infrastructure and Communities
BTU	British Thermal Unit
C2ES	Center for Climate and Energy Solutions
CAV	Community Assistance Visit
CAC	Community Assistance Contact
CDBG	Community Development Block Grant
CDC	Centers for Disease Control and Prevention
CDD	Consecutive Dry Days
CEMP	Comprehensive Emergency Management Plan
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
CIP	Capital Improvement Program
CIS	Community Information System
CMELD	Chester Municipal Electric Light Department
CMR	Code of Massachusetts Regulations
COOP	Continuity of Operations Plan
CPA	Community Preservation Act
CRB	Community Resilience Building
CRS	Community Rating System
CZM	Coastal Zone Management
DAR	Department of Agricultural Resources
DCR	Department of Conservation and Recreation
DCS	Division of Conservation Services
DEP	Department of Environmental Protection
DER	Division of Ecological Restoration
DMA	Disaster Mitigation Act
DMP	Drought Management Plan
DMTF	Drought Management Task Force
DOT	Department of Transportation
DPW	Department of Public Works
DRRA	Disaster Recovery Reform Act
DWR	Days Without Rain
EAP	Emergency Action Plan

EDDMaps	Early Detection and Distribution Mapping System
EEA	Energy and Environmental Affairs
EF	Enhanced Fujita
EJ	Environmental Justice
EMPG	Emergency Management Performance Grant
EOC	Emergency Operations Center
EOEEA	Executive Office of Energy and Environmental Affairs
EPA	Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flooding Insurance Study
FMA	Flooding Mitigation Assistance
FPA	Floodplain Administrator
FSim	Forest Service Fire Simulation System
GHG	Greenhouse Gas
GIS	Geographic Information Systems
HHPD	High Hazard Potential Dam
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMPC	Hazard Mitigation Planning Committee
HUD	Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IBC	International Building Code
IBHS	Insurance Institute for Business and Home Safety
ICC	International Code Council
IEBC	International Existing Building Code
IECC	International Energy Conservation Code
IFC	International Fire Code
IMC	International Mechanical Code
IRC	International Residential Code
ISPSC	International Swimming Pool and Spa Code
LEI	Lenard Engineering, Inc.
LRRP	Local Rapid Recovery Plan
MCDA	Multi-Criteria Decision Analysis
MEMA	Massachusetts Emergency Management Agency
MGL	Massachusetts General Law
MGD	Million Gallons Per Day
MIPAG	Massachusetts Invasive Plant Advisory Group

MPH	Miles Per Hour
MSBC	Massachusetts State Building Code
MSPCA	Massachusetts Society for the Prevention of Cruelty to Animals
MVP	Municipal Vulnerability Preparedness Plan
NCDC	National Climatic Data Center
NCEI	National Centers for Environmental Information
NE CASC	Northeast Climate Adaptation Science Center
NESIS	Northeast Snowfall Impact Scale
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWS	National Weather Service
OSRP	Open Space and Recreation Plan
PA	Public Assistance
PDM	Pre-Disaster Mitigation
PPQ	Plant Protection and Quarantine
PVPC	Pioneer Valley Planning Commission
PWS	Public Water Systems
RMAT	ResilientMass Action Team
RRP	Rapid Recovery Plan
RSI	Regional Snowfall Index
SFHA	Special Flood Hazard Areas
SHMCAP	State Hazard Mitigation and Adaptation Plan
SI/SD	Substantial Improvement/Substantial Damage
SPIA	Sperry-Pitz Ice Accumulation Index
SRF	State Revolving Fund
TAP	Tree Assistance Program
TRI	Toxic Release Inventory
US	United States
USACE	United States Army Corps of Engineers
USC	U.S. Code
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USGCRP	U.S. Global Change Research Program
WEMLEC	Western Massachusetts Law Enforcement Council
WPA	Wetlands Protection Act
WRWA	Westfield River Watershed Association

Appendix A. Planning Process Supporting Materials

Hazard Mitigation Planning Committee Meetings

HMPC Meeting Participants

First Name	Last Name	Title	Affiliation	Phone	Email	KICK-OFF MEETING 3/8/2024	HMPC #1 4/11/2024	HMPC #2 5/2/2024	HMPC #3 7/9/2024	HMPC #4 8/13/2024
Nate	Bolduc	Fire Chief	Town of Chester					☐	☑	☑
Bob	Daley	Water Department	Town of Chester	413-354-7760	rdchester@comcast.net	☐	☑	☑	☑	☐
Charles (Chip)	Dazelle	Highway Superintendent/Emergency Management Director	Town of Chester	413-354-2276	highwaysuper@townofchester.net	☑	☑	☑	☑	☐
Jennifer	Dubiel	Chief of Police	Town of Chester	413-207-2397		☐	☐	☑	☐	☐
Henry	Fristik	Fire Chief (Former)	Town of Chester	413-354-7810	chiefhfristik@chesterfd.com	☑	☐	☑	☐	☐
Muriel	Hall	Planning Board	Town of Chester	413-207-3198	lovehall4ever@gmail.com	☐	☐	☑	☑	☑
Diane	Hall	Manager	Chester Municipal Electric Light Department	413-354-7811	cmeldmgr@townofchester.net	☐	☐	☑	☐	☐
Donald F.	Humason Jr.	Town Administrator	Town of Chester	413-354-7760	townadministrator@townofchester.net	☑	☑	☑	☑	☑
Bailey	Jones	Service Director	Hilltown Community Ambulance Association	413-667-3277	Bailey@hilltownambulance.org	☐	☑	☐	☐	☐
Liz	Massa	Board of Health	Town of Chester	413-354-7781	boardofhealth@townofchester.net	☑	☑	☐	☐	☐
Ed	Quinn	Facilities Director	Gateway Regional School District	413-685-1006	district. equinn@grsd.org	☐	☑	☑	☐	☐
Jade	Rice	Chief Financial Officer	Hilltown Community Ambulance Association	413-667-3277	Jade@hilltownambulance.org	☐	☑	☑	☐	☐
Richard (Andy)	Sutton	Selectman	Town of Chester	413-667-4611	suttonrichard367@gmail.com	☑	☑	☑	☑	☐
Lora	Wade	Conservation Commission	Town of Chester	413-354-7760	lorawade76@gmail.com	☐	☑	☑	☑	☑

HMPC Meeting Agendas

HMPC MEETING #1 AGENDA

TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

DATE: THURSDAY, APRIL 11, 2024

TIME: 10:00 AM - 11:30 AM

ZOOM:
https://us02web.zoom.us/j/87820610841?pwd=VTlIdWk5VE5mVEU1dGdPdnEzd2lHdz09
MEETING ID: 878 2061 0841
PASSCODE: 977150

AGENDA ITEMS

I. **Introductions**

II. **Introduction to Hazard Mitigation Planning**
   i. What's in a Hazard Mitigation Plan?
   ii. Project Timeline
   iii. HMPC Responsibilities

III. Plan Development
   i. Plans and Policies
   ii. Public and Stakeholder Engagement
   iii. Hazard Identification
   iv. Critical Facilities
   v. Capability Assessment
   vi. Mitigation Strategy

ACTION ITEMS

I. Capability Assessment Surveys

II. Mitigation Action Tracker Finalize Status of Old Actions

III. Pictures

HMPC MEETING #2 AGENDA

TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

DATE: THURSDAY, MAY 2, 2024

TIME: 10:00 AM - 11:30 AM

ZOOM:

https://us02web.zoom.us/j/87168212038?pwd=R1BPZzE4bCtwVmh0bE8wQ1A3bmE5dz09
MEETING ID: 871 6821 2038
PASSCODE: 673441

AGENDA ITEMS

1. **Project Update**
2. **Capability Assessment**
   a. Key Plans Reviewed
   b. Status of Surveys
   c. Where are Strengths and Challenges?
3. **Risk Assessment**
   a. Hazards and Critical Facilities
   b. Hazus Impacts
   c. Problems Identified and High Hazard Areas
4. **Public Meeting Schedule and Outreach**
5. **New Mitigation Actions**

ACTION ITEMS

1. Public Meeting Outreach
2. New Mitigation Actions
3. Pictures

HMPC MEETING #3 AGENDA

TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

DATE:	7/9/2024
TIME:	10:00-11:30AM
ZOOM:	https://us02web.zoom.us/j/86860623423?pwd=L2N4akNtOXRaUzZoQ0Z0ZllUbkdOZz09 Meeting ID: 868 6062 3423 Passcode: 409395

AGENDA ITEMS

I. **Project Update**

II. **Risk Assessment**
   - i. Risk Ranking
   - ii. Problem Statements

III. **Capability Assessment Update**
   - i. Opportunities Identified

IV. **Public Meeting**
   - i. Outreach Efforts

V. **Mitigation Strategy**
   - i. Discuss New Actions

VI. **Plan Implementation**

ACTION ITEMS

I. Public Meeting Outreach

II. HMPC #4 Date

III. New Mitigation Actions

Public Outreach

PUBLIC MEETING #1 AGENDA

TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

DATE: MONDAY, JULY 15, 2024

TIME: 6:00-7:00PM

IN-PERSON: Town Hall, 15 Middlefield Road, Chester, MA 01011

ZOOM: https://us02web.zoom.us/j/85701269866?pwd=PNiDgPbgjE1zCh6W9fMu3lfU5yHidn.1

Meeting ID: 857 0126 9866

Passcode: 352998

AGENDA ITEMS

1. **Introductions**
2. **What is Hazard Mitigation? What is a Hazard Mitigation Plan?**
3. **Identify Natural Hazards and High Hazard Areas**
4. **Identify Critical Facilities**
5. **Brainstorm Possible Mitigation Actions**
6. **Next Steps**

TOWN OF CHESTER, MA

PUBLIC MEETING

SHARE YOUR IDEAS FOR REDUCING RISK TO NATURAL HAZARDS AND CLIMATE CHANGE

Do you wonder if Chester can flood, experience a tornado, or have an earthquake? What can prevent those natural hazards and climate change from wreaking havoc in our community?

Join the meeting to learn about this important project and to share your ideas for making Chester more resilient to natural hazards and climate change.

Chester has formed a Hazard Mitigation Planning Committee to identify risks and projects to mitigate those risks. The Hazard Mitigation Plan will be approved by the Federal Emergency Management Agency and adopted by the Town. This plan allows Chester to apply for pre- and post-disaster mitigation funds.

7/15/2024

6:00 pm – 7:00 pm
Town Hall or Zoom
Details on the Town Website

HTTPS://TOWNOFCHESTER.NET FOR MEETING DETAILS OR CONTACT DON HUMASON, TOWN ADMINISTRATOR 413-354-7760 OR TOWNADMINISTRATOR@TOWNOFCHESTER.NET

PUBLIC MEETING

TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

JULY 16, 2024 (6:00-7:00PM)

SIGN-IN SHEET:

Name (First & Last)	Affiliation with the Town (e.g., Resident, Selectman, etc.)
Tamarin Laurel	Middlefield Selectbd &
Craig Gauthier	Chester Selectman
Jane Sutton	Resident
Amy Myers	Chester Finance Comm.
Bob Daley	Chester Water Dept
Katherine Warden	Becket Town Admin.
Kristopher Severy	Property Manager for Hilltown CDC, owners 1 School Street
Muriel J. Hall	Member. HMP Comm.
Adam Wade	Resident
Lora Wade	ConCom Volunteer
Melissa McAuliffe	Resident
Nate Bolduc	Fire Chief
Richard	Planning Board
Chip [illegible]	Highway Supt
Don Humason	Town Admin

- Mimi Kaplan – Pioneer Valley Planning Commission (on Zoom)
- Jim Zimmerman - Resident (on Zoom)
- Liz Massa – HMPC Member (on Zoom)

PUBLIC MEETING #2 AGENDA

TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

DATE: TUESDAY, AUGUST 20, 2024

TIME: 6:00PM - 7:00PM

IN-PERSON: FIRE DEPARTMENT HEADQUARTERS, CHESTER, MA 01011

ZOOM: https://us02web.zoom.us/j/81753220628?pwd=oTKdUElUk5ZCo6H0bTejzvUE9KJuiF.1

Meeting ID: 817 5322 0628

Passcode: 377496

AGENDA ITEMS

I. **Introductions**

II. **What is Hazard Mitigation?**

  i. Benefits of Hazard Mitigation

  ii. Who Developed the Hazard Mitigation Plan

III. **Natural Hazards and Critical Facilities**

  i. Hazards and Critical Facilities Identified

  ii. Hazard Impacts and Problem Statements

  iii. What Are Your Biggest Concerns?

IV. **Mitigation Goals and Mitigation Actions**

  i. Types of Mitigation Actions

  ii. What are Your Recommendations for Hazard Mitigation?

  iii. Review of Actions

V. **Plan Review**

  i. What to Expect and How to Review

VI. **Questions**

TOWN OF CHESTER, MA

PUBLIC MEETING

SHARE YOUR IDEAS FOR REDUCING RISK TO NATURAL HAZARDS AND CLIMATE CHANGE

Do you wonder if Chester can flood, experience a tornado, or have an earthquake? What can prevent those natural hazards and climate change from wreaking havoc in our community?

Join the **second public meeting** to learn about this important project and to share your ideas for making Chester more resilient to natural hazards and climate change.

Chester has formed a Hazard Mitigation Planning Committee to identify risks and projects to mitigate those risks. The Hazard Mitigation Plan will be approved by the Federal Emergency Management Agency and adopted by the Town. This plan allows Chester to apply for pre- and post-disaster mitigation funds.

8/20/2024

6:00 pm – 7:00 pm

Fire Dept. HQ & Zoom

Details on the Town Website

HTTPS://TOWNOFCHESTER.NET FOR MEETING DETAILS OR CONTACT DON HUMASON JR., TOWN ADMINISTRATOR 413-354-7760 OR TOWNADMINISTRATOR@TOWNOFCHESTER.NET

PUBLIC MEETING #2

TOWN OF CHESTER, MA HAZARD MITIGATION PLAN UPDATE

AUGUST 20, 2024 (6:00-7:00PM)

SIGN-IN SHEET:

Name (First & Last)	Affiliation with the Town (e.g., Resident, Selectman, etc.)
Nate Bolduc	Fire Chief
Andy Sutton	Select Board
Craig Gauthier	Selectman
Chip DAZelle	Highway SUPT. EMD
Don Humason Jr.	Town Administrator
Muriel N. Hall	Planning Board
Rich Smith	ASST FIRE CHIEF
Emilee Silvagni	resident/scout

FOR IMMEDIATE RELEASE
Chester, Massachusetts – August 30, 2024

The Town of Chester Invites Community Input on Hazard Mitigation Plan Update!

The Hazard Mitigation Planning Committee of Chester has developed a comprehensive Hazard Mitigation Plan Update that identifies and prioritizes strategies to mitigate the impacts of natural hazards and climate change on our community.

Engage with the Draft Plan:

- Online Access: Visit the Town's website at https://townofchester.net/ to review the draft plan.
- In-Person Review: Hard copies are available for review at the Town Hall located at 15 Middlefield Road, Chester, MA 01011.

Commentary Period: August 30, 2024 – September 13, 2024

How to Provide Feedback:

- Complete the Google Form provided on the Town's website and available in hard copy at the designated viewing locations.

Chester's Hazard Mitigation Planning Committee has developed this plan as a strategy for our Town against existing and future natural hazard threats and the evolving challenges posed by climate change. Implementation of this plan will significantly enhance our resilience to hazards such as flooding, snowstorms, high winds, and extreme temperatures.

Town officials and local stakeholders developed this plan with funding support from the Massachusetts Emergency Management Agency. Federal Emergency Management Agency (FEMA) approval, and Town adoption, of the Hazard Mitigation Plan Update allows the Town to pursue pre- and post-disaster hazard mitigation grant opportunities.

For Further Inquiries:

- **Donald F. Humason, Jr., Town Administrator**
- **Phone:** 413-354-7760
- **Email:** townadministrator@townofchester.net

Public engagement lies at the core of our Hazard Mitigation Plan Update. It is imperative that this plan reflects the diverse perspectives and priorities of our community members as we move to mitigate risks posed by natural hazards and climate change.

The Town looks forward to a collaborative effort in building a resilient and secure future!
###

THE TOWN OF CHESTER WELCOMES COMMUNITY INPUT ON HAZARD MITIGATION PLAN UPDATE

Join Us in Building a Resilient Future for Chester, MA!

WHAT?

Review and provide feedback on the Hazard Mitigation Plan Update drafted by Chester's Hazard Mitigation Planning Committee.

HOW?

- For Online Access: https://townofchester.net/ to read the draft plan.
- In-Person Viewing: Hard copies available at the Town Hall.
- Complete the Google Form on the Town's website or at designated locations to provide feedback.

WHEN?

- Commentary Period: **August 30, 2024 – September 13, 2024**

WHY?

- Strengthen our community's resilience to natural hazards and climate change impacts, such as flooding, snowstorms, high winds, and extreme temperatures.

CONTACT FOR INQUIRIES

- Donald F. Humason, Jr., Town Administrator
- Phone: 413-354-7760
- Email: townadministrator@townofchester.net

TOWN OF CHESTER, MA
HAZARD MITIGATION PLAN UPDATE
AUGUST 2024

Town of Chester
15 Middlefield Road
Chester, MA 01011

Appendix B. Mitigation Actions.

Priority Ranking Points

Table 73. Priority Ranking Points for Each Action.

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
1	Increase capacity to secure grant funding.	3	3	3	3	3	2	2	19	High
2	Develop a non-zoning wetlands bylaw.	3	2	3	3	3	2	2	18	High
3	Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.	3	3	3	2	3	2	2	18	High

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
4	Develop a system to monitor and remedy threats to surface water.	2	3	3	3	3	2	2	18	High
5	Redo drainage and map water lines on Middlefield Road and remove lead pipes.	3	1	3	3	3	2	2	17	High
6	Review and update the Town's existing stormwater management standards.	3	3	2	2	3	2	2	17	High
7	Educate home and business owners about nature-based solutions for climate change and natural hazard risks.	3	3	2	3	0	2	2	15	Medium
8	Develop a collaborative with adjacent communities to hire grant writers for public	3	3	3	2	0	2	2	15	Medium

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
	education and outreach projects to conduct jointly.									
9	Educate Town staff and key volunteers, including board and committee members, on best practices in their field. In addition, develop a system of logging and maintaining essential records for all volunteer and paid staff positions to assist with business continuity when leadership roles turn-over.	3	3	0	2	3	2	2	15	Medium
10	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road	3	1	2	2	3	2	2	15	Medium

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
	washouts are a huge risk throughout the Town.									
11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.	3	1	3	3	3	0	2	15	Medium
12	Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during	3	3	3	3	0	0	2	14	Medium

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
	periods of extreme temperatures.									
13	Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.	3	3	3	3	0	0	2	14	Medium
14	Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.	3	3	3	3	0	0	2	14	Medium

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
15	Develop a more comprehensive capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years.	3	1	2	3	3	0	2	14	Medium
16	Dam Risk Mitigation.	3	3	2	2	0	2	2	14	Medium
17	Develop and implement a plan to monitor beaver activity that may impact roads.	3	3	0	1	3	2	2	14	Medium
18	To mitigate potential damage from an ice jam, identify potential ice jam locations	3	3	0	1	3	2	2	14	Medium

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
	and implement monitoring of these locations during the winter and spring for signs of ice jams.									
19	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.	3	2	3	3	0	0	2	13	Low
20	Conduct a comprehensive review and update of the Town's	3	2	2	2	0	2	2	13	Low

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
	Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.									
21	Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.	3	1	0	2	3	2	2	13	Low
22	Conduct a Town Tree Assessment and inventory to identify hazardous trees and diseased trees on public lands and rights-of-way.	3	2	0	1	3	2	2	13	Low
23	Install and repair dry hydrants.	1	2	0	3	3	2	2	13	Low

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
24	Designate a Floodplain Administrator (FPA) and adopt the 2020 MA State Model Floodplain Bylaw to assure that the Town's current bylaws and ordinances contain the necessary and proper language for compliance with the National Flood Insurance Program and state requirements.	3	3	2	2	0	0	2	12	Low
25	Develop an Open Space and Recreation Plan that includes hazard mitigation.	3	2	2	1	0	2	2	12	Low
26	Acquire funding for engineering (Phase 2) and construction (Phase 3) of the	3	1	0	1	3	2	2	12	Low

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total	Priority
	Abbott Brook reconstruction.									
27	Conduct landslide studies to identify high hazard areas and methods to reduce risk in these areas.	2	2	0	1	3	2	2	12	Low
28	Consider adopting a Massachusetts Community Preservation Act.	3	3	0	1	0	2	2	11	Low
29	Educate homeowners to identify Bittersweet and other invasive species and how to remove it responsibly.	2	3	0	0	0	2	2	9	Low

Types of Mitigation Actions

Table 74. Mitigation Actions Sorted by Type.

Mitigation Category	Action #	Action Title
Local Plans & Regulations	1	Increase capacity to secure grant funding.
	2	Develop a non-zoning wetlands bylaw.
	3	Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.
	6	Review and update the Town's existing stormwater management standards.
	13	Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.
	15	Develop a more comprehensive capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years.
	20	Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.
	24	Designate a Floodplain Administrator (FPA) and adopt the 2020 MA State Model Floodplain Bylaw to assure that the Town's current bylaws and ordinances contain the necessary and proper language for compliance with the National Flood Insurance Program and state requirements.
	25	Develop an Open Space and Recreation Plan that includes hazard mitigation.
	28	Consider adopting a Massachusetts Community Preservation Act.
Structure & Infrastructure	5	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
	10	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
	11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.
	16	Dam Risk Mitigation.

Mitigation Category	Action #	Action Title
	17	Develop and implement a plan to monitor beaver activity that may impact roads.
	18	To mitigate potential damage from an ice jam, identify potential ice jam locations and implement monitoring of these locations during the winter and spring for signs of ice jams.
	19	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.
	21	Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.
	23	Install and repair dry hydrants.
	26	Acquire funding for engineering (Phase 2) and construction (Phase 3) of the Abbott Brook reconstruction.
Natural Systems Protection	4	Develop a system to monitor and remedy threats to surface water.
	22	Conduct a Town Tree Assessment and inventory to identify hazardous trees and diseased trees on public lands and rights-of-way.
	27	Conduct landslide studies to identify high hazard areas and methods to reduce risk in these areas.
Education & Awareness Programs	7	Educate home and business owners about nature-based solutions for climate change and natural hazard risks.
	8	Develop a collaborative with adjacent communities to hire grant writers for public education and outreach projects to conduct jointly.
	9	Educate Town staff and key volunteers, including board and committee members, on best practices in their field. In addition, develop a system of logging and maintaining essential records for all volunteer and paid staff positions to assist with business continuity when leadership roles turn-over.
	12	Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during periods of extreme temperatures.
	14	Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.

Mitigation Category	Action #	Action Title
	29	Educate homeowners to identify Bittersweet and other invasive species and how to remove it responsibly.

Actions Sorted by Goal Statement

Table 75. Mitigation Actions Sorted by Goal Statement and Priority.

Goal	Action #	Action Title
Save Lives and Property	13	Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.
	19	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.
	23	Install and repair dry hydrants.
	24	Designate a Floodplain Administrator (FPA) and adopt the 2020 MA State Model Floodplain Bylaw to assure that the Town's current bylaws and ordinances contain the necessary and proper language for compliance with the National Flood Insurance Program and state requirements.
Infrastructure	5	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
	6	Review and update the Town's existing stormwater management standards.
	10	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
	11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.
	17	Develop and implement a plan to monitor beaver activity that may impact roads.
	18	To mitigate potential damage from an ice jam, identify potential ice jam locations and implement monitoring of these locations during the winter and spring for signs of ice jams.
	21	Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.
	26	Acquire funding for engineering (Phase 2) and construction (Phase 3) of the Abbott Brook reconstruction.
Capacity	1	Increase capacity to secure grant funding.
	3	Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.
	8	Develop a collaborative with adjacent communities to hire grant writers for public education and outreach projects to conduct jointly.

Goal	Action #	Action Title
	9	Educate Town staff and key volunteers, including board and committee members, on best practices in their field. In addition, develop a system of logging and maintaining essential records for all volunteer and paid staff positions to assist with business continuity when leadership roles turn-over.
	15	Develop a more comprehensive capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years.
	16	Dam Risk Mitigation.
	20	Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.
	28	Consider adopting a Massachusetts Community Preservation Act.
Natural Resources	2	Develop a non-zoning wetlands bylaw.
	4	Develop a system to monitor and remedy threats to surface water.
	22	Conduct a Town Tree Assessment and inventory to identify hazardous trees and diseased trees on public lands and rights-of-way.
	25	Develop an Open Space and Recreation Plan that includes hazard mitigation.
	27	Conduct landslide studies to identify high hazard areas and methods to reduce risk in these areas.
	29	Educate homeowners to identify Bittersweet and other invasive species and how to remove it responsibly.
Education	7	Educate home and business owners about nature-based solutions for climate change and natural hazard risks.
	12	Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during periods of extreme temperatures.
	14	Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.

Actions Sorted by Hazard

Table 76. Mitigation Actions Sorted by Hazard.

Specific Hazards Addressed	Action #	Action Title
Extreme Temperatures **Droughts** **Invasive Species** **Landslides**	4	Develop a system to monitor and remedy threats to surface water.
Flooding Including Dam Failures and Ice Jams	14	Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.
	16	Dam Risk Mitigation.
	24	Designate a Floodplain Administrator (FPA) and adopt the 2020 MA State Model Floodplain Bylaw to assure that the Town's current bylaws and ordinances contain the necessary and proper language for compliance with the National Flood Insurance Program and state requirements.
Flooding Including Dam Failures and Ice Jams **Other Severe Weather**	17	Develop and implement a plan to monitor beaver activity that may impact roads.
Flooding Including Dam Failures and Ice Jams **Severe Winter Storms** **Extreme Temperatures**	18	To mitigate potential damage from an ice jam, identify potential ice jam locations and implement monitoring of these locations during the winter and spring for signs of ice jams.
Flooding Including Dam Failures and Ice Jams **Severe Winter Storms** **Hurricanes and Tropical Storms** **Other Severe Weather**	2	Develop a non-zoning wetlands bylaw.
	5	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
	10	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
	21	Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.
	26	Acquire funding for engineering (Phase 2) and construction (Phase 3) of the Abbott Brook reconstruction.
Flooding Including Dam Failures and Ice Jams **Severe Winter Storms** **Other Severe Weather**	6	Review and update the Town’s existing stormwater management standards.
Flooding Including Dam Failures and Ice Jams	7	Educate home and business owners about nature-based solutions for climate change and natural hazard risks.

Specific Hazards Addressed	Action #	Action Title
Severe Winter Storms **Wildfires/ Brushfires** **Extreme Temperatures** **Hurricanes and Tropical Storms** **Other Severe Weather** **Tornadoes** **Droughts** **Invasive Species** **Landslides**	25	Develop an Open Space and Recreation Plan that includes hazard mitigation.
Flooding Including Dam Failures and Ice Jams **Severe Winter Storms** **Wildfires/ Brushfires** **Extreme Temperatures** **Hurricanes and Tropical Storms** **Other Severe Weather** **Tornadoes** **Droughts** **Invasive Species** **Landslides** **Earthquakes**	1	Increase capacity to secure grant funding.
	3	Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.
	8	Develop a collaborative with adjacent communities to hire grant writers for public education and outreach projects to conduct jointly.
	9	Educate Town staff and key volunteers, including board and committee members, on best practices in their field. In addition, develop a system of logging and maintaining essential records for all volunteer and paid staff positions to assist with business continuity when leadership roles turn-over.
	12	Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during periods of extreme temperatures.
	13	Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.
	15	Develop a more comprehensive capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years.
Flooding Including Dam Failures and Ice Jams **Severe Winter Storms** **Wildfires/ Brushfires** **Extreme Temperatures** **Hurricanes and Tropical Storms**	20	Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.

Specific Hazards Addressed	Action #	Action Title
Other Severe Weather **Tornadoes** **Droughts** **Landslides** **Earthquakes**		
Flooding Including Dam Failures and Ice Jams **Severe Winter Storms** **Wildfires/ Brushfires** **Extreme Temperatures** **Other Severe Weather** **Droughts** **Invasive Species**	28	Consider adopting a Massachusetts Community Preservation Act.
Flooding Including Dam Failures and Ice Jams **Severe Winter Storms** **Wildfires/ Brushfires** **Hurricanes and Tropical Storms** **Other Severe Weather** **Tornadoes** **Landslides** **Earthquakes**	19	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.
Invasive Species	29	Educate homeowners to identify Bittersweet and other invasive species and how to remove it responsibly.
Landslides	27	Conduct landslide studies to identify high hazard areas and methods to reduce risk in these areas.
Severe Winter Storms **Extreme Temperatures** **Hurricanes and Tropical Storms** **Other Severe Weather** **Tornadoes** **Droughts** **Invasive Species**	22	Conduct a Town Tree Assessment and inventory to identify hazardous trees and diseased trees on public lands and rights-of-way.
Wildfire/Brushfires	23	Install and repair dry hydrants.
Flood, Severe Winter Storms, Extreme Temperatures, Hurricanes/Wind, Thunderstorms,	11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.

Specific Hazards Addressed	Action #	Action Title
Landslides, Wildfires, Tornadoes		

Actions Sorted by Lead Position

Table 77. Mitigation Actions Sorted by Action Lead.

Action Lead	Action #	Action Title
Town Administrator	**1**	Increase capacity to secure grant funding.
	3	Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.
	6	Review and update the Town's existing stormwater management standards.
	7	Educate home and business owners about nature-based solutions for climate change and natural hazard risks.
	8	Develop a collaborative with adjacent communities to hire grant writers for public education and outreach projects to conduct jointly.
	9	Educate Town staff and key volunteers, including board and committee members, on best practices in their field. In addition, develop a system of logging and maintaining essential records for all volunteer and paid staff positions to assist with business continuity when leadership roles turn-over.
	11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.
	12	Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during periods of extreme temperatures.
	14	Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.
	15	Develop a more comprehensive capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years.
	16	Dam Risk Mitigation.
	24	Designate a Floodplain Administrator (FPA) and adopt the 2020 MA State Model Floodplain Bylaw to assure that the Town's current bylaws and ordinances contain the necessary and proper language for compliance with the National Flood Insurance Program and state requirements.
	27	Conduct landslide studies to identify high hazard areas and methods to reduce risk in these areas.

Action Lead	Action #	Action Title
Zoning Board of Appeals Chair	**2**	Develop a non-zoning wetlands bylaw.
Board of Water Commissioners Chair	**4**	Develop a system to monitor and remedy threats to surface water.
Highway Foreman	**5**	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
	10	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
	17	Develop and implement a plan to monitor beaver activity that may impact roads.
	18	To mitigate potential damage from an ice jam, identify potential ice jam locations and implement monitoring of these locations during the winter and spring for signs of ice jams.
	21	Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.
	22	Conduct a Town Tree Assessment and inventory to identify hazardous trees and diseased trees on public lands and rights-of-way.
	26	Acquire funding for engineering (Phase 2) and construction (Phase 3) of the Abbott Brook reconstruction.
Council on Aging Director	**13**	Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.
Fire Chief	**19**	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.
	23	Install and repair dry hydrants.
Planning Board Chair	**20**	Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.
Conservation Commission Chair	**25**	Develop an Open Space and Recreation Plan that includes hazard mitigation.
	28	Consider adopting a Massachusetts Community Preservation Act.
	29	Educate homeowners to identify Bittersweet and other invasive species and how to remove it responsibly.

Actions Sorted by Implementation Schedule

Table 78. Mitigation Actions Sorted by Implementation Schedule.

Implementation Schedule	Action #	Action Title
2024-2026	10	Identify and prioritize roads for paving, trap rock, and culvert replacement. Flooding and road washouts are a huge risk throughout the Town.
	19	Continue exploring new automated emergency warning systems/services and more actively promote these systems to residents to improve outreach during hazard events, including targeted messages for more vulnerable populations such as those with special needs, etc.
2024-2029	1	Increase capacity to secure grant funding.
	3	Integrate hazard mitigation and climate resilience into future updates of key plans (Open Space and Recreation Plan, Master Plan, etc.) in alignment with the Hazard Mitigation Plan and the Town's MVP Summary of Findings Report.
	7	Educate home and business owners about nature-based solutions for climate change and natural hazard risks.
	12	Develop a Town-wide educational program focused on self-reliance, community resilience, and hazard mitigation. This will include outreach and notification methods to increase public awareness of local cooling or warming centers during periods of extreme temperatures.
	14	Educate residents and business owners about the risk of a bridge collapse or flood that may impact the Village area. Education should include mitigating risk to their properties and preparing for evacuation.
	16	Dam Risk Mitigation.
2025-2026	2	Develop a non-zoning wetlands bylaw.
	13	Through the Council on Aging, Hilltown Ambulance, Fire Department and Police Department develop a list of vulnerable persons and establish modes of communication for emergencies.
	15	Develop a more comprehensive capital improvement program that includes the preparation of a long-term Capital Improvements Plan (CIP) to support larger and more costly projects for implementation over the next 5-10 years.
	21	Improve Maynard Brook Road to ensure it does not wash away. This project includes widening a steep hillside.
	24	Designate a Floodplain Administrator (FPA) and adopt the 2020 MA State Model Floodplain Bylaw to assure that the Town's current bylaws and ordinances contain the necessary and proper language

Implementation Schedule	Action #	Action Title
		for compliance with the National Flood Insurance Program and state requirements.
2025-2027	4	Develop a system to monitor and remedy threats to surface water.
	6	Review and update the Town's existing stormwater management standards.
	23	Install and repair dry hydrants.
	25	Develop an Open Space and Recreation Plan that includes hazard mitigation.
	28	Consider adopting a Massachusetts Community Preservation Act.
2025-2028	26	Acquire funding for engineering (Phase 2) and construction (Phase 3) of the Abbott Brook reconstruction.
2025-2029	8	Develop a collaborative with adjacent communities to hire grant writers for public education and outreach projects to conduct jointly.
	9	Educate Town staff and key volunteers, including board and committee members, on best practices in their field. In addition, develop a system of logging and maintaining essential records for all volunteer and paid staff positions to assist with business continuity when leadership roles turn-over.
	11	Reopen Old Abbott Hill Road and Cooper Road to allow evacuations from the Village and access for first responders.
2026-2028	5	Redo drainage and map water lines on Middlefield Road and remove lead pipes.
	20	Conduct a comprehensive review and update of the Town's Zoning Bylaws and other regulations to require and promote hazard resistant, climate adaptive, and sustainable development standards.
	22	Conduct a Town Tree Assessment and inventory to identify hazardous trees and diseased trees on public lands and rights-of-way.
	29	Educate homeowners to identify Bittersweet and other invasive species and how to remove it responsibly.
2026-2029	18	To mitigate potential damage from an ice jam, identify potential ice jam locations and implement monitoring of these locations during the winter and spring for signs of ice jams.
2027-2029	17	Develop and implement a plan to monitor beaver activity that may impact roads.
2028-2029	27	Conduct landslide studies to identify high hazard areas and methods to reduce risk in these areas.

Appendix C. Plan Implementation and Review Supporting Materials.

Plan Update Evaluation Worksheet

Table 79. Plan Update Evaluation Worksheet.

Plan Section	Considerations	Explanation
Planning Process	Should the town invite any additional stakeholders to participate in the planning process? What public outreach activities have occurred? How can public involvement be improved?	
Risk Assessment	What disasters has the town, or the region experienced? Should the list of hazards be modified? Are new data sources, maps or studies available? If so, what have they revealed, and should the information be incorporated into the plan update? Has development in the region occurred and could it create or reduce risk?	
Capability Assessment	Has the town adopted new policies, plans, regulations, or reports that could be incorporated into this plan? Are there different or additional administrative, human, technical, and financial resources available for mitigation planning? Are there different or new education and outreach programs and resources available for mitigation activities?	
Mitigation Strategy	Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimate accurate? Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or removed from the plan? Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update? Are there new funding sources to consider? Have elements of the plan been incorporated into other planning mechanisms?	
Implementation Plan	Was the plan monitored and evaluated as anticipated?	

	What are needed improvements to the plan implementation procedures?	

Mitigation Action Progress Worksheet

Table 80. Mitigation Action Progress Worksheet.

Mitigation Action Progress Worksheet				
Progress Report Period	From Date		To Date	
Action/Project Title				
Responsible Department				
Contact Name				
Contact Phone/Email				
Project Description				
Project Goal				
Project Objective				
Project Cost				
Project Status				
Date of Project Approval	Date of Project Start	Anticipated Date of Completion	Project Canceled	Project Delayed
Explanation of Delay or Cost Overruns				
Project Report Summary				
What was accomplished for this project during this reporting period?				
What obstacles, problems, or delays did the project encounter?				
Plans for next reporting period.				

Appendix D. Hazus Reports

Hazus: Flood Global Risk Report

Region Name: Chester_Flood

Flood Scenario: 100year

Print Date: Thursday, April 25, 2024

Table of Contents

General Description of the Region

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

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Massachusetts

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

The geographical size of the region is approximately 1 square miles and contains 67 census blocks. The region contains over 1 thousand households and has a total population of 1,223 people. The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 504 buildings in the region with a total building replacement value (excluding contents) of 202 million dollars. Approximately 87.70% of the buildings (and 62.70% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 504 buildings in the region which have an aggregate total replacement value of 202 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	126,692	62.7%
Commercial	23,563	11.7%
Industrial	13,368	6.6%
Agricultural	2,219	1.1%
Religion	15,650	7.7%
Government	15,490	7.7%
Education	5,085	2.5%
Total	**202,067**	**100%**

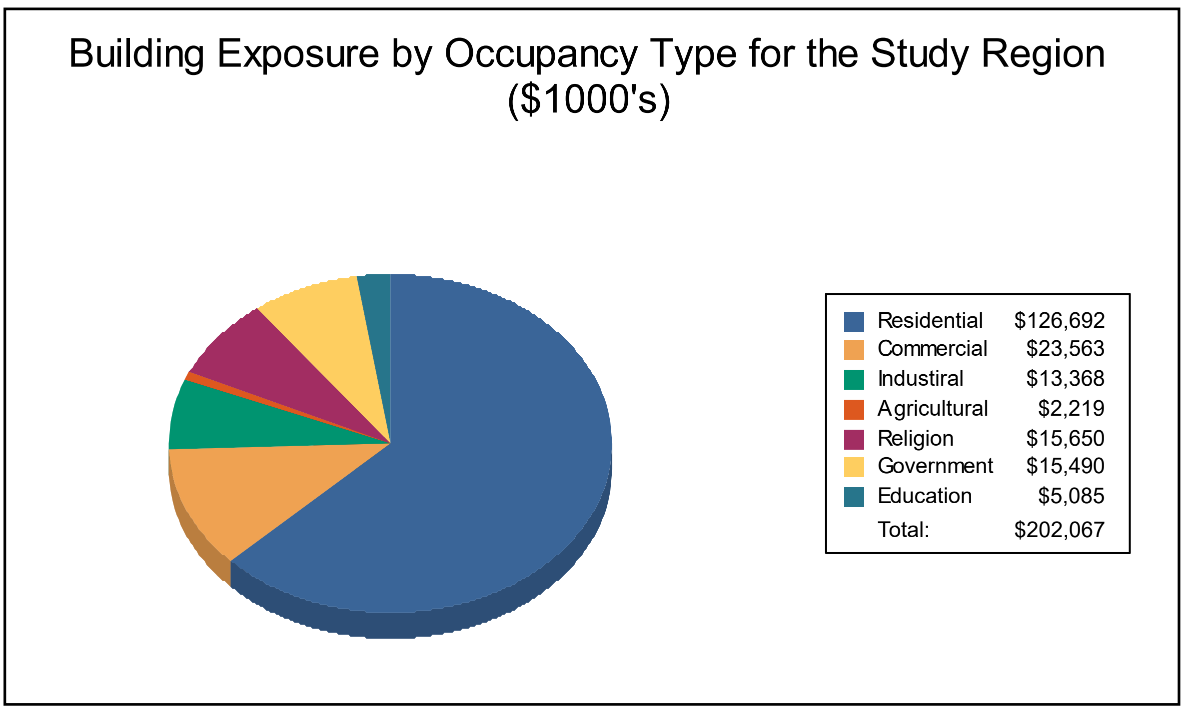
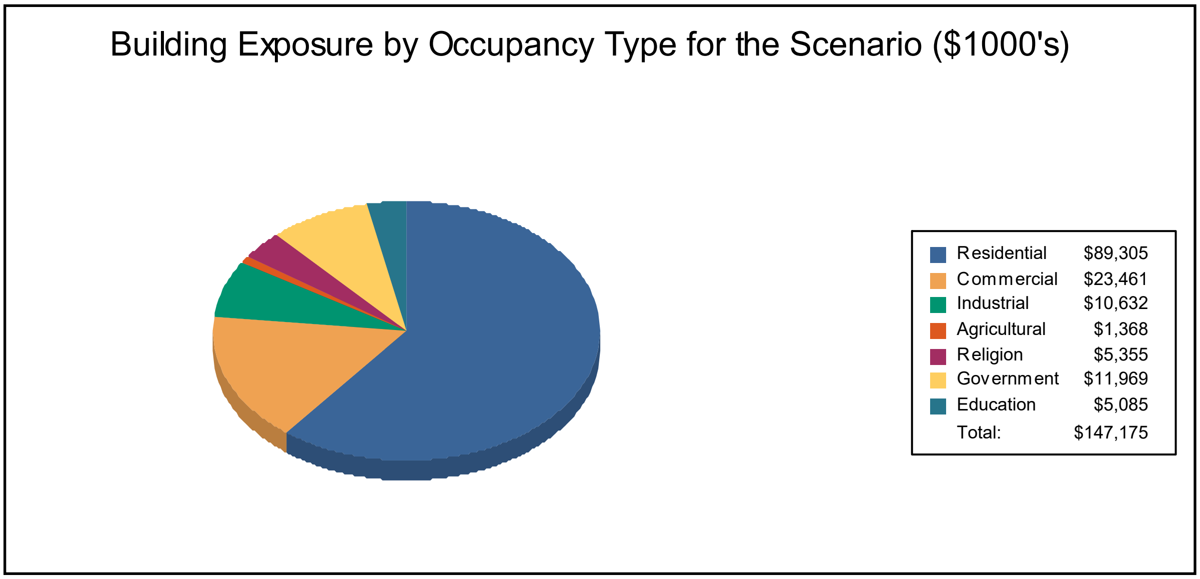


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	89,305	60.7%
Commercial	23,461	15.9%
Industrial	10,632	7.2%
Agricultural	1,368	0.9%
Religion	5,355	3.6%
Government	11,969	8.1%
Education	5,085	3.5%
Total	**147,175**	**100%**



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 1 school, 4 fire stations, 3 police stations and 6 emergency operation centers.

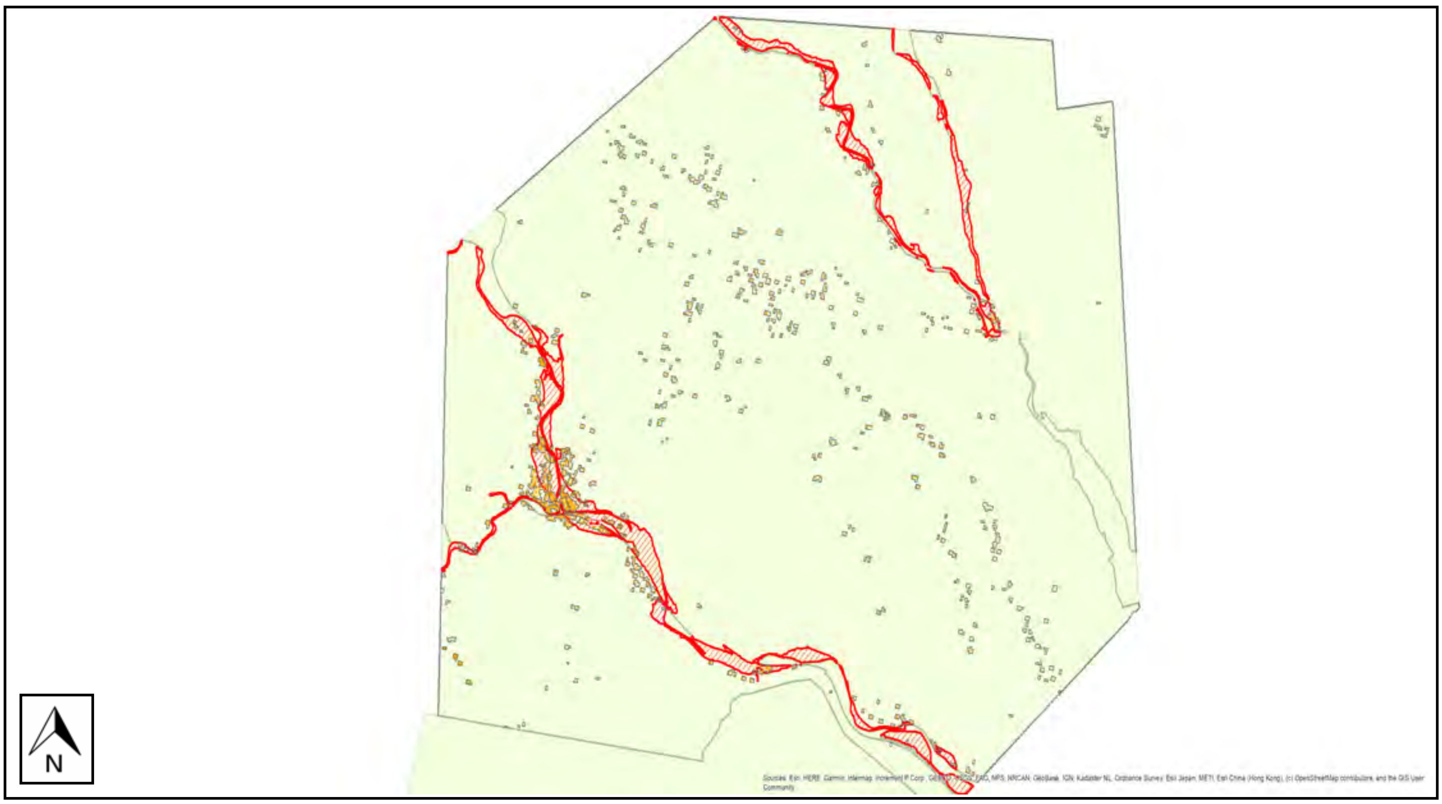
Flood Scenario Parameters

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

Study Region Name:	Chester_Flood
Scenario Name:	100year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure

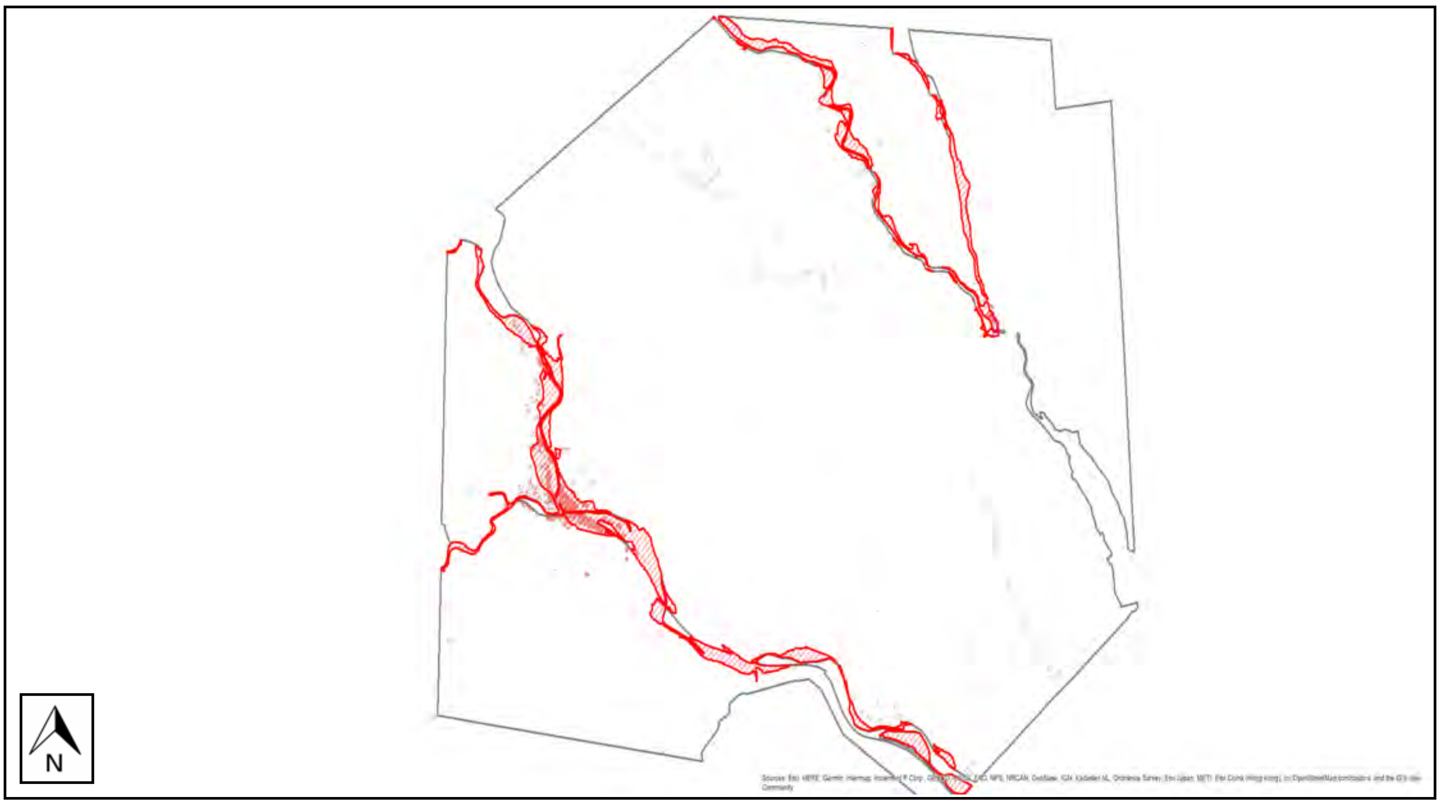


Building Damage

General Building Stock Damage

Hazus estimates that about 23 buildings will be at least moderately damaged. This is over 87% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map



HAZUS™

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	16	41	17	44	6	15	0	0	0	0	0	0
Total	**16**		**17**		**6**		**0**		**0**		**0**	

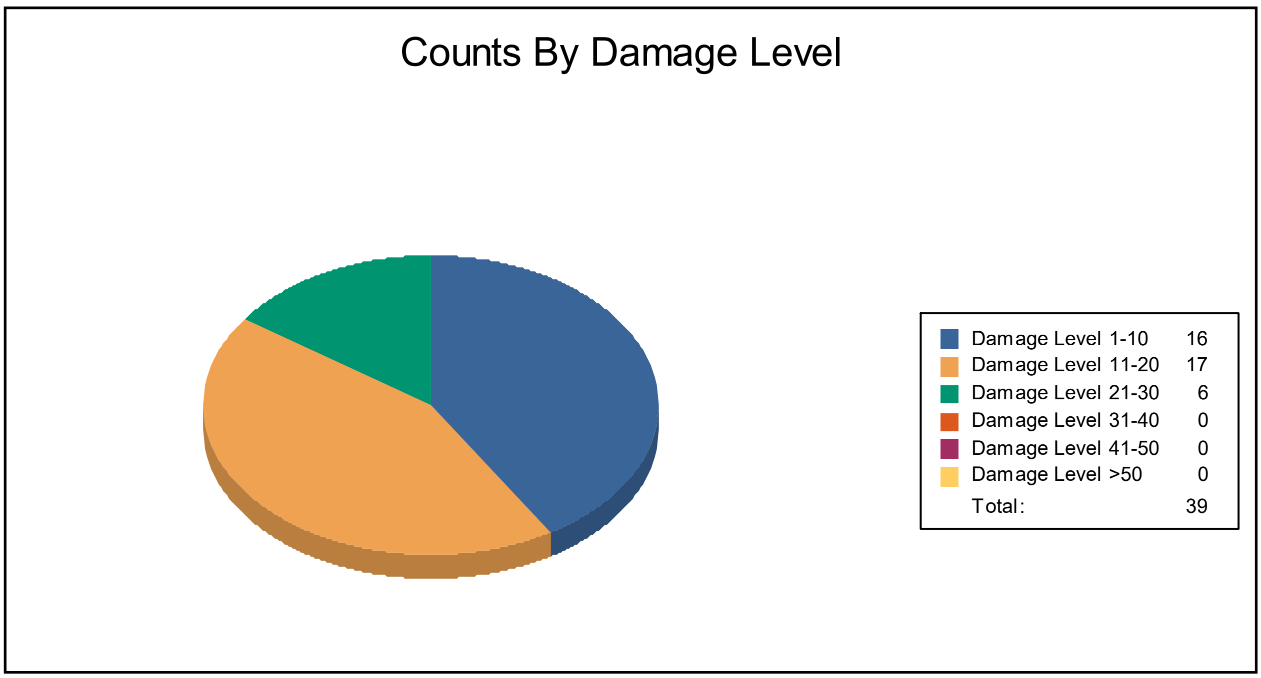


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	16	41	17	44	6	15	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	6	1	0	1
Fire Stations	4	1	0	1
Hospitals	0	0	0	0
Police Stations	3	0	0	0
Schools	1	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

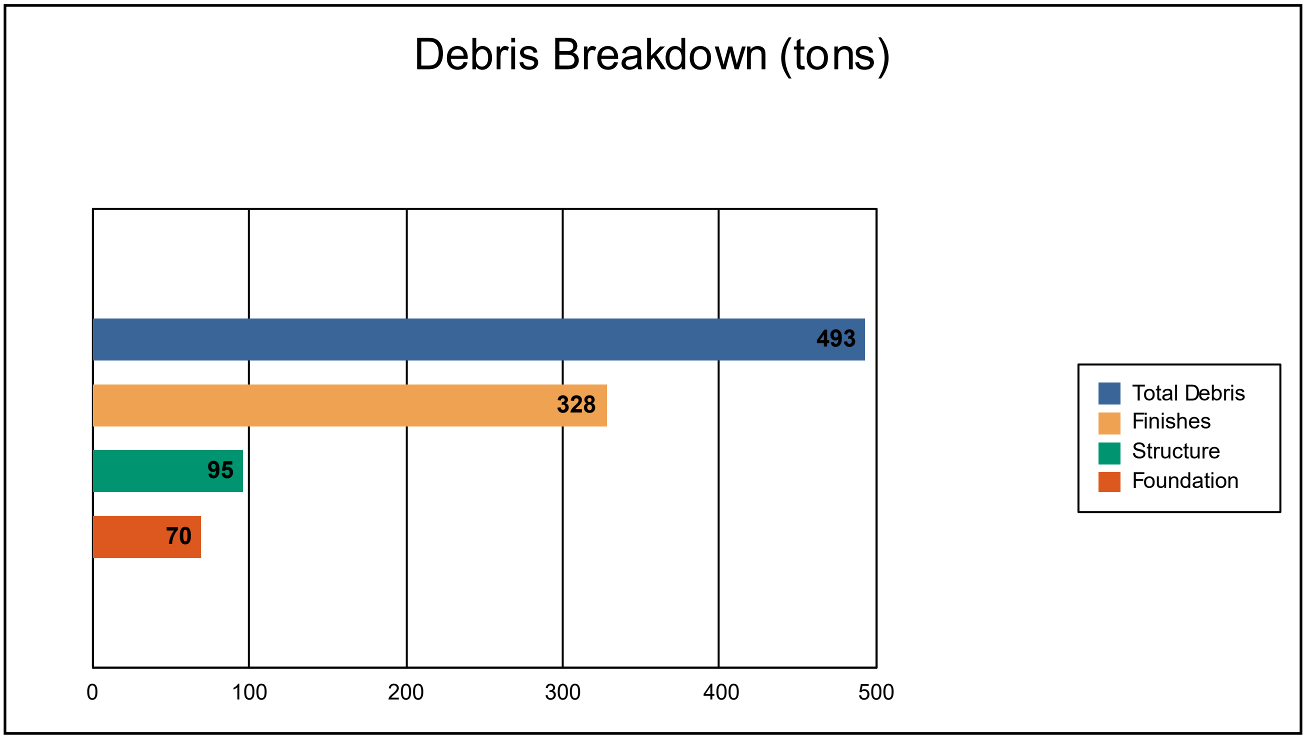
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

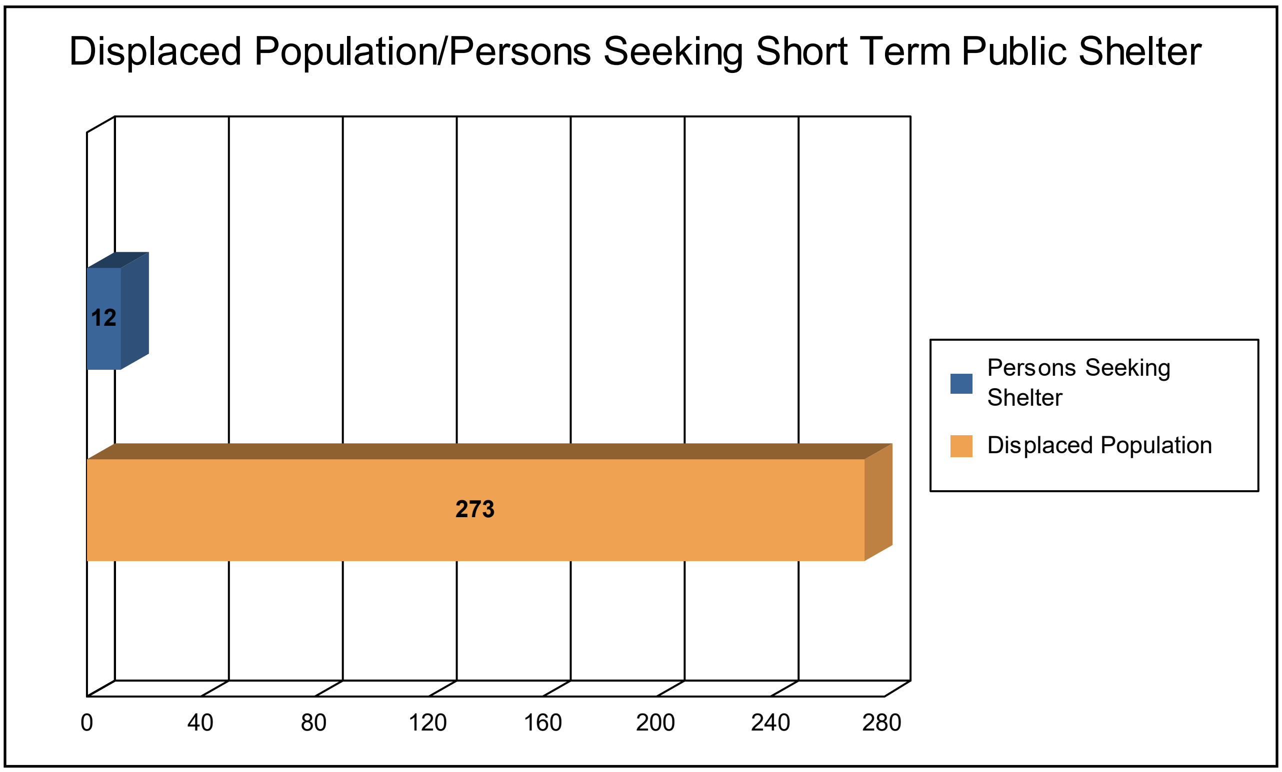


The model estimates that a total of 493 tons of debris will be generated. Of the total amount, Finishes comprises 67% of the total, Structure comprises 19% of the total, and Foundation comprises 14%. If the debris tonnage is converted into an estimated number of truckloads, it will require 20 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 91 households (or 273 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 12 people (out of a total population of 1,223) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 66.43 million dollars, which represents 45.13 % of the total replacement value of the scenario buildings.

Building-Related Losses

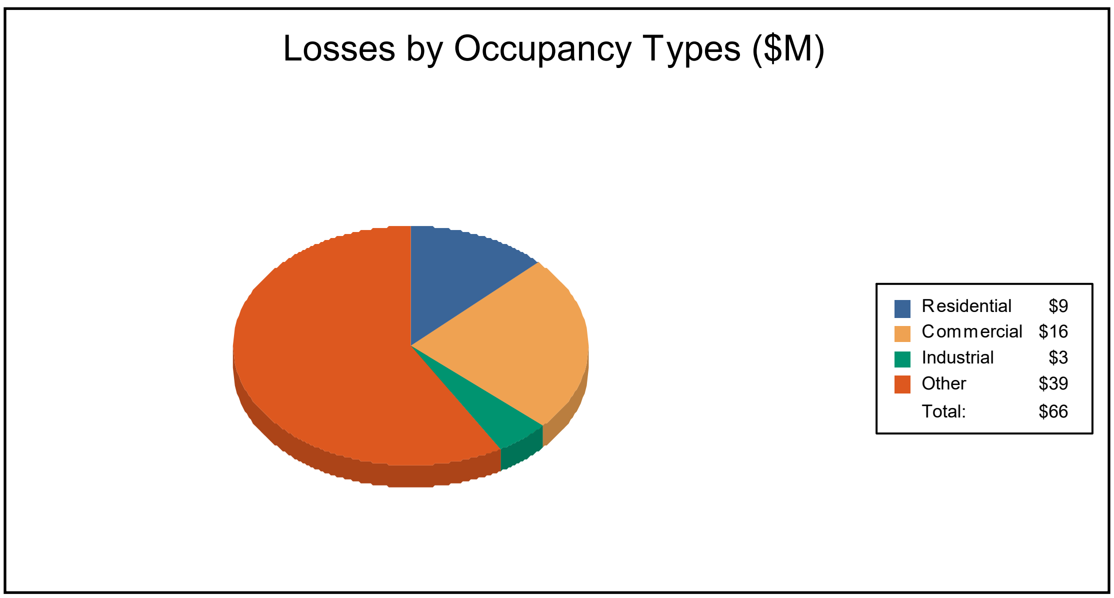
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability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

The total building-related losses were 25.60 million dollars. 61% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 12.84% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	4.49	1.46	0.82	1.27	8.04
	Content	1.97	4.21	2.21	7.88	16.27
	Inventory	0.00	0.51	0.29	0.49	1.30
	Subtotal	**6.46**	**6.19**	**3.32**	**9.64**	**25.60**
Business Interruption						
	Income	0.00	4.42	0.03	1.48	5.93
	Relocation	1.53	0.75	0.05	1.27	3.60
	Rental Income	0.55	0.56	0.01	0.35	1.47
	Wage	0.00	3.82	0.05	25.97	29.83
	Subtotal	**2.07**	**9.55**	**0.14**	**29.06**	**40.83**
ALL	**Total**	**8.53**	**15.74**	**3.46**	**38.70**	**66.43**



Appendix A: County Listing for the Region

Massachusetts

- Hampden

HAZUS™

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Massachusetts				
Hampden	1,223	126,692	75,375	202,067
Total	**1,223**	**126,692**	**75,375**	**202,067**
Total Study Region	**1,223**	**126,692**	**75,375**	**202,067**

FEMA

RiskMAP
Increasing Resilience Together

Hazus: Hurricane Global Risk Report

Region Name: ChesterWind

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, April 25, 2024

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

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

Table of Contents

General Description of the Region

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

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

- Massachusetts

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

The geographical size of the region is 123.55 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 2,914.00 people. The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 575 million dollars. Approximately 90% of the buildings (and 72% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,480.00 buildings in the region which have an aggregate total replacement value o
Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provi
distribution of the building value by State and County.

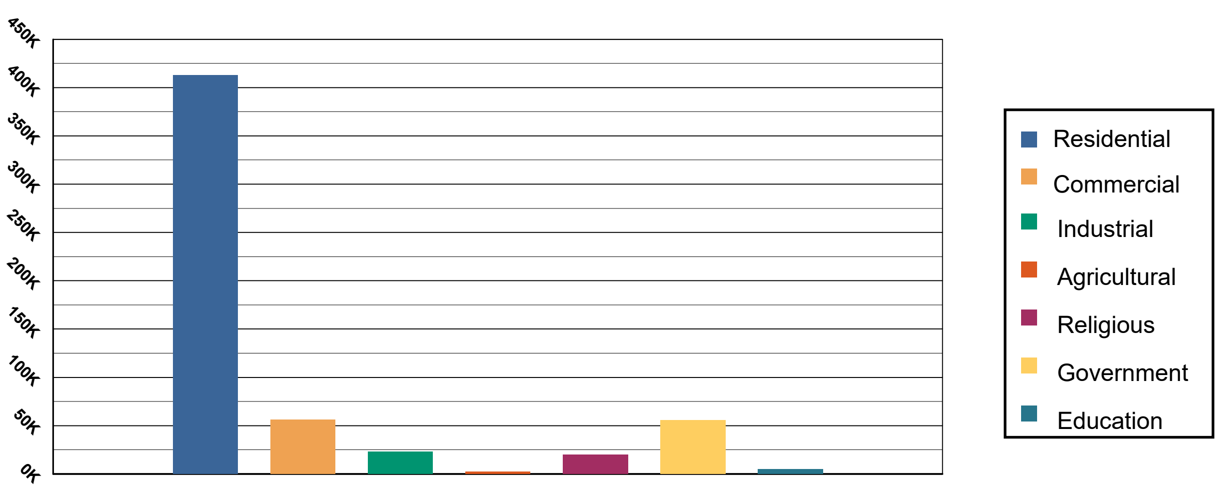


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	412,918	71.82%
Commercial	55,778	9.70%
Industrial	23,185	4.03%
Agricultural	2,457	0.43%
Religious	19,818	3.45%
Government	55,727	9.69%
Education	5,085	0.88%
Total	**574,968**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 1
schools, 4 fire stations, 3 police stations and 6 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 16 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

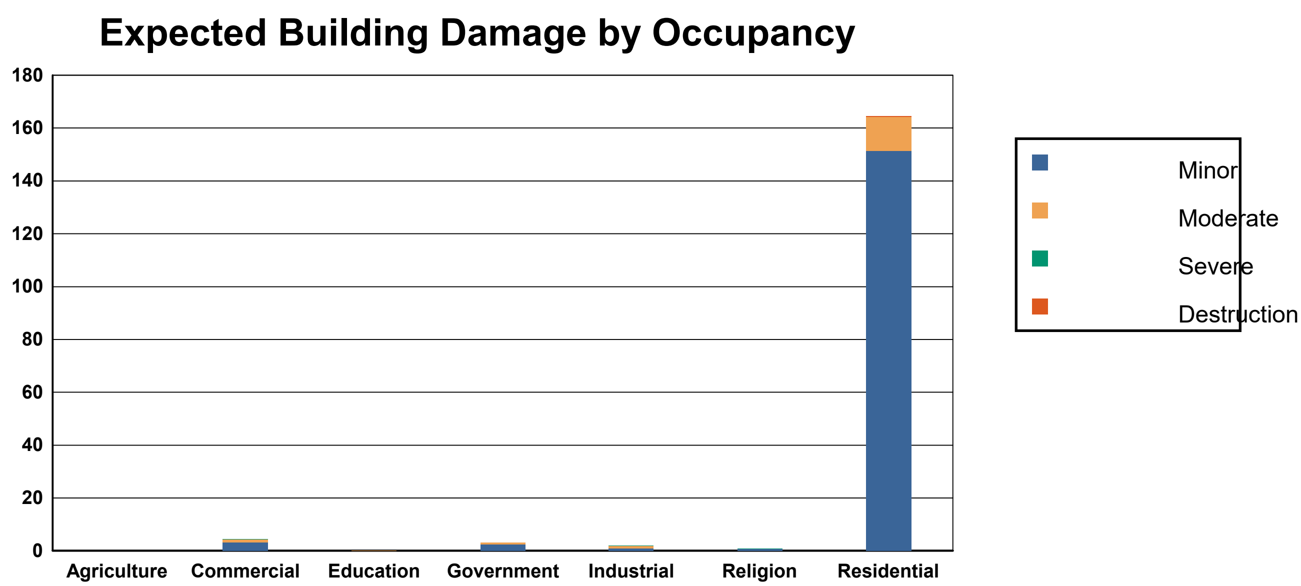


Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	3	96.05	0	3.48	0	0.38	0	0.09	0	0.00
Commercial	56	92.61	3	5.21	1	1.97	0	0.21	0	0.00
Education	1	78.30	0	11.80	0	9.89	0	0.01	0	0.00
Government	40	92.86	2	5.75	1	1.36	0	0.03	0	0.00
Industrial	17	89.59	1	5.61	1	4.11	0	0.69	0	0.00
Religion	14	95.14	1	4.27	0	0.52	0	0.07	0	0.00
Residential	1,173	87.69	151	11.31	13	0.95	0	0.01	0	0.03
Total	**1,305**		**159**		**16**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	93.75	1	5.79	0	0.45	0	0.01	0	0.00
Masonry	84	92.06	6	7.13	1	0.79	0	0.01	0	0.01
MH	34	97.69	1	1.66	0	0.51	0	0.01	0	0.14
Steel	36	86.53	3	7.63	2	5.33	0	0.51	0	0.00
Wood	1,153	88.49	138	10.58	12	0.89	0	0.02	0	0.02

Essential Facility Damage

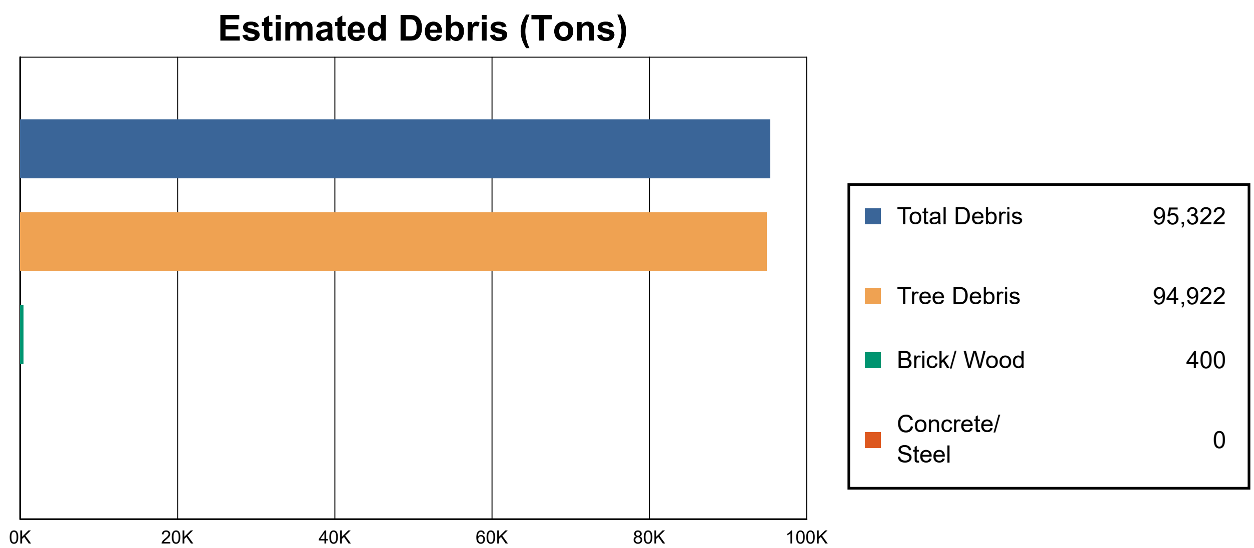
Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30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

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	6	0	0	6
Fire Stations	4	0	0	4
Police Stations	3	0	0	3
Schools	1	0	0	1

Induced Hurricane Damage

Debris Generation

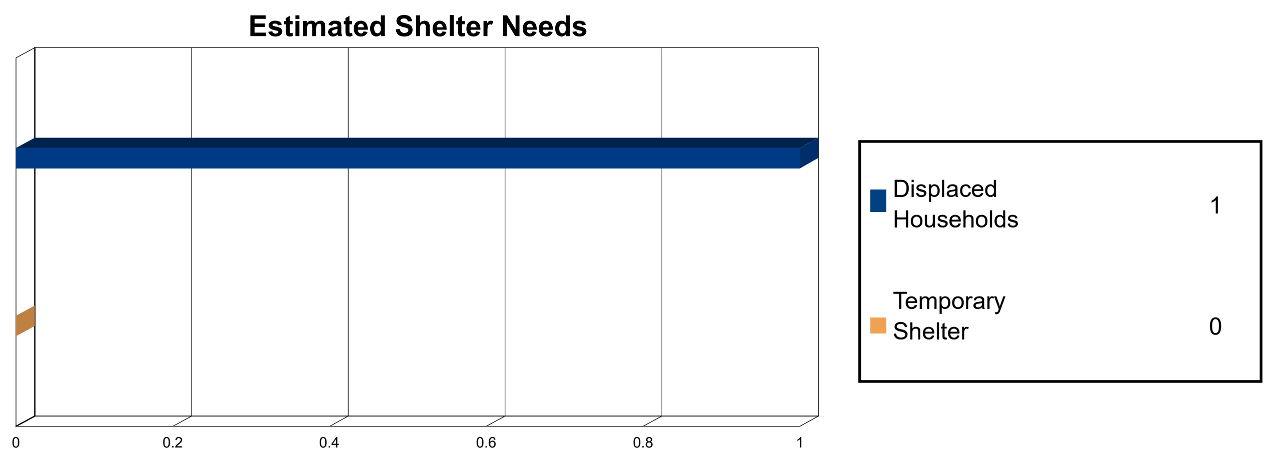


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 95,322 tons of debris will be generated. Of the total amount, 89,227 tons (94%) is Other Tree Debris. Of the remaining 6,095 tons, Brick/Wood comprises 7% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 16 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 5,695 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 2,914) will seek temporary shelter in public shelters.

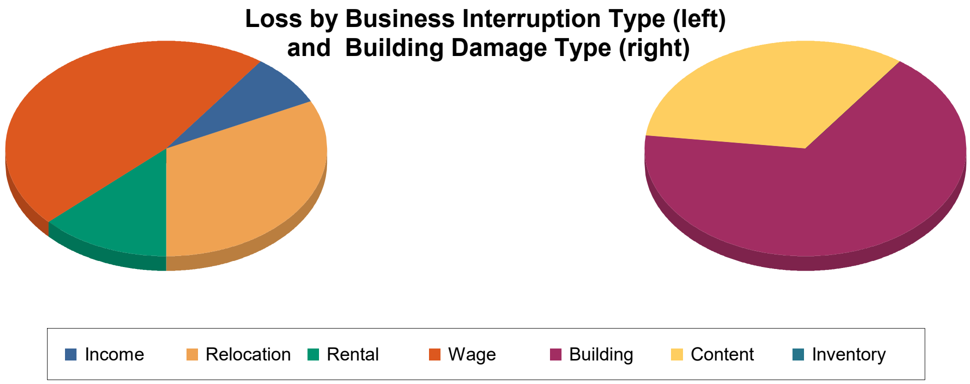
Economic Loss

The total economic loss estimated for the hurricane is 9.1 million dollars, which represents 1.58 % of the total replacement value of the region's buildings.

Building-Related Losses

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

The total property damage losses were 9 million dollars. 7% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 88% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss Type by General Occupancy

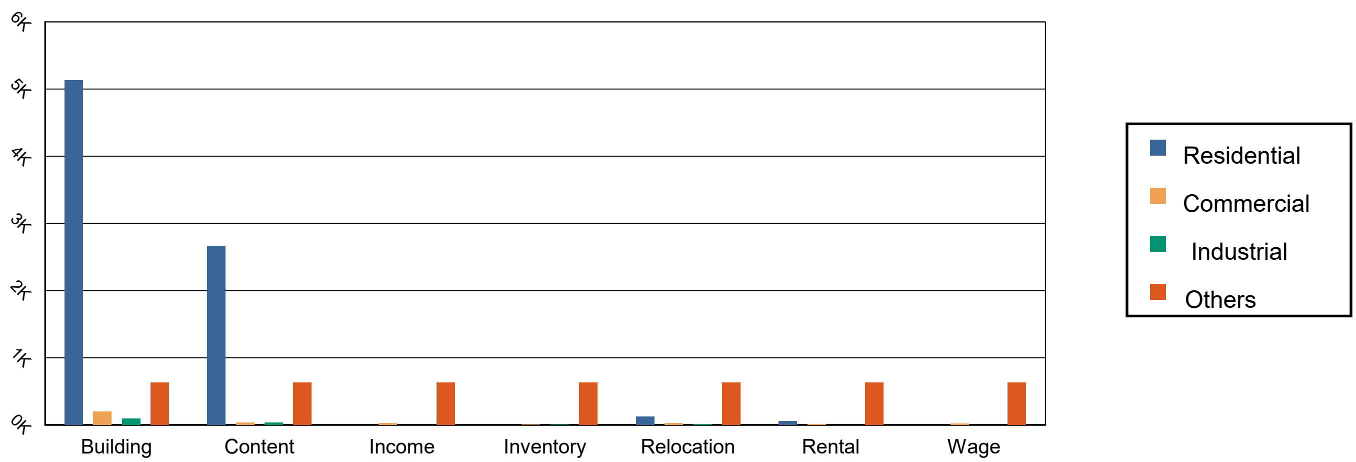


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	5,126.88	198.67	97.64	230.01	5,653.20
	Content	2,669.00	33.93	34.18	36.55	2,773.65
	Inventory	0.00	4.43	3.50	0.75	8.68
	Subtotal	**7,795.88**	**237.03**	**135.32**	**267.31**	**8,435.54**
Business Interruption Loss						
	Income	0.00	31.37	1.39	18.44	51.19
	Relocation	126.06	25.66	14.34	47.89	213.94
	Rental	59.52	14.72	1.25	12.00	87.49
	Wage	0.00	20.91	2.36	287.22	310.50
	Subtotal	**185.58**	**92.66**	**19.33**	**365.55**	**663.12**

Total

Total	**7,981.45**	**329.70**	**154.65**	**632.86**	**9,098.66**

Appendix A: County Listing for the Region

Massachusetts

- Hampden

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Massachusetts				
Hampden	2,914	412,918	162,050	574,968
Total	**2,914**	**412,918**	**162,050**	**574,968**
Study Region Total	**2,914**	**412,918**	**162,050**	**574,968**

Hazus: Hurricane Global Risk Report

Region Name: ChesterWind

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, April 25, 2024

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

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

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General Description of the Region

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

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

- Massachusetts

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

The geographical size of the region is 123.55 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 2,914.00 people. The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 575 million dollars. Approximately 90% of the buildings (and 72% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,480.00 buildings in the region which have an aggregate total replacement value o Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provi distribution of the building value by State and County.

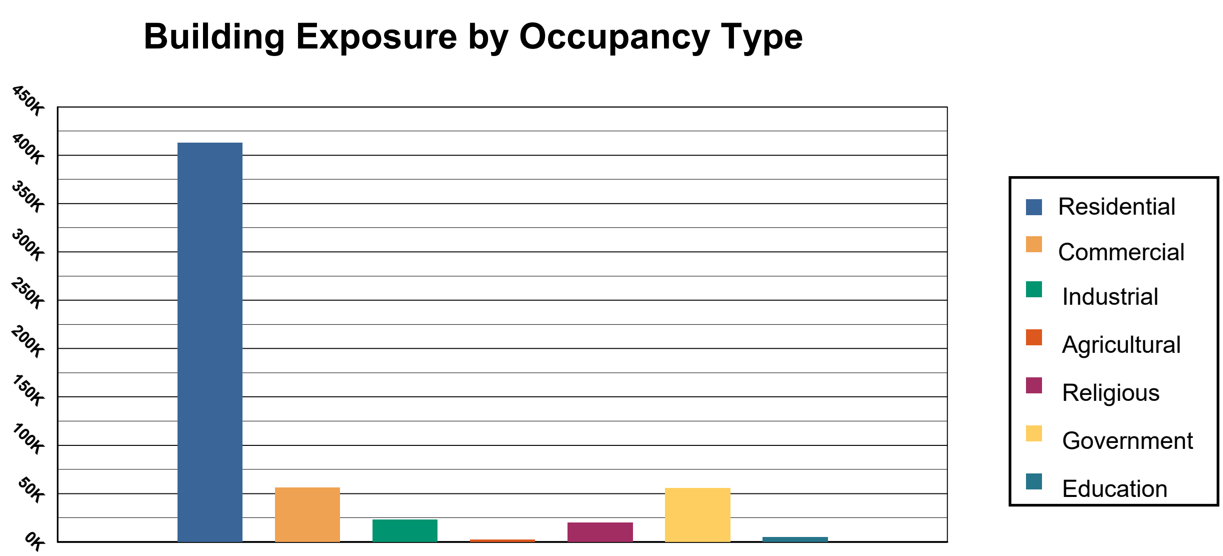


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	412,918	71.82%
Commercial	55,778	9.70%
Industrial	23,185	4.03%
Agricultural	2,457	0.43%
Religious	19,818	3.45%
Government	55,727	9.69%
Education	5,085	0.88%
Total	**574,968**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 1 schools, 4 fire stations, 3 police stations and 6 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 35 buildings will be at least moderately damaged. This is over 2% of the total number of buildings in the region. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

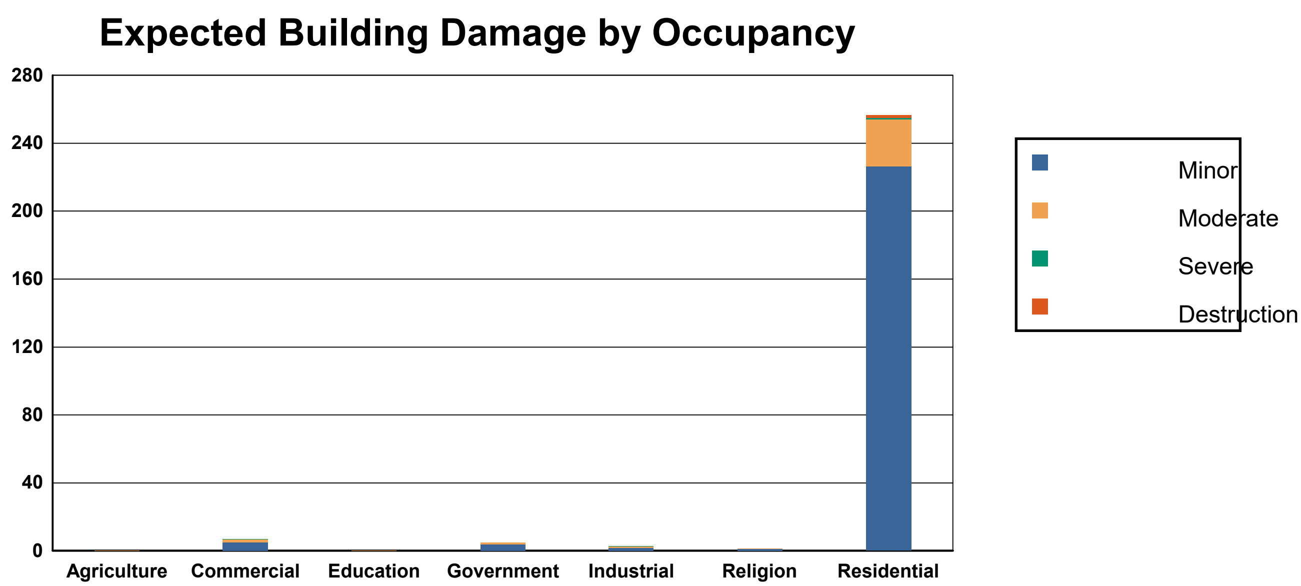


Table 2: Expected Building Damage by Occupancy : 1000 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	3	93.06	0	6.07	0	0.73	0	0.14	0	0.00
Commercial	54	88.31	5	8.05	2	3.20	0	0.43	0	0.00
Education	1	70.47	0	14.54	0	14.96	0	0.03	0	0.00
Government	38	88.41	4	8.99	1	2.53	0	0.07	0	0.00
Industrial	16	84.26	2	8.14	1	6.10	0	1.51	0	0.00
Religion	14	91.59	1	7.18	0	1.11	0	0.12	0	0.00
Residential	1,081	80.83	226	16.92	28	2.07	1	0.07	2	0.12
Total	**1,207**		**238**		**32**		**2**		**2**	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	89.18	1	9.37	0	1.41	0	0.04	0	0.00
Masonry	79	86.79	10	11.28	2	1.84	0	0.05	0	0.04
MH	33	94.82	1	3.33	0	1.41	0	0.03	0	0.41
Steel	34	80.24	4	10.50	3	8.14	0	1.12	0	0.00
Wood	1,069	82.04	207	15.88	25	1.90	1	0.08	1	0.10

Essential Facility Damage

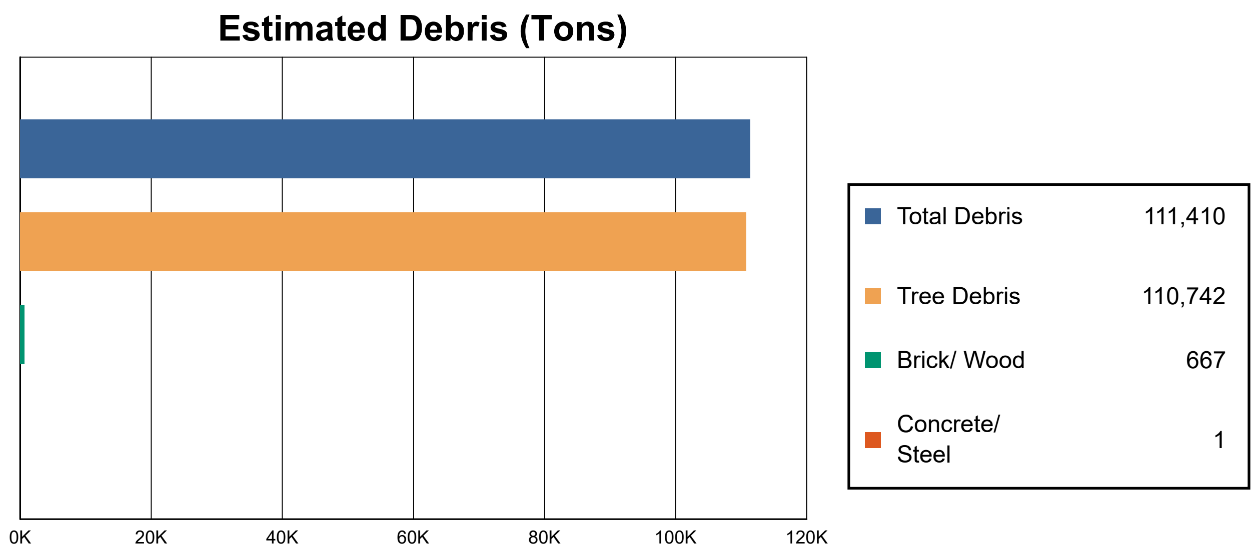
Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30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

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	6	0	0	6
Fire Stations	4	0	0	4
Police Stations	3	0	0	3
Schools	1	0	0	1

Induced Hurricane Damage

Debris Generation

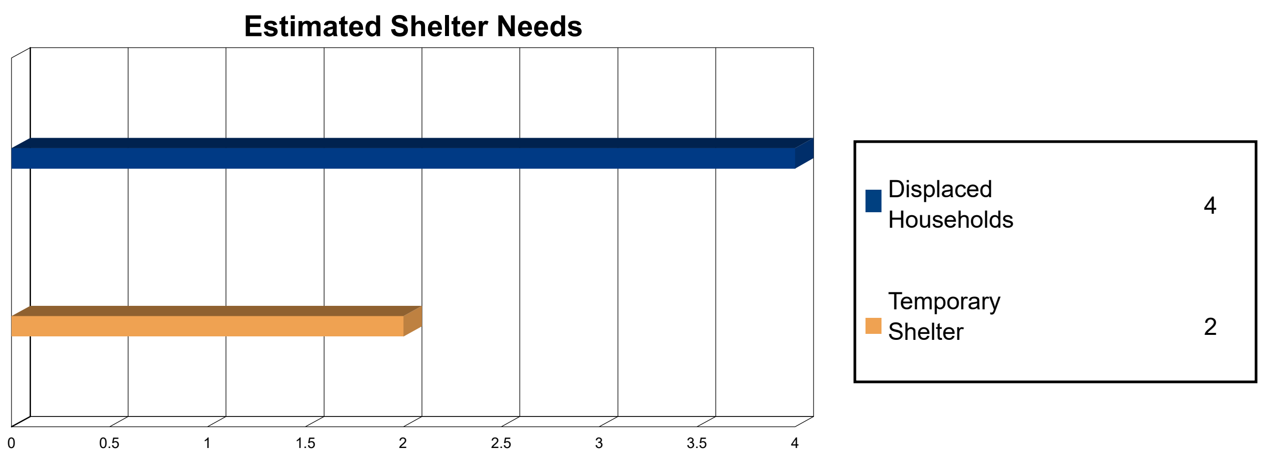


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 111,410 tons of debris will be generated. Of the total amount, 104,097 tons (93%) is Other Tree Debris. Of the remaining 7,313 tons, Brick/Wood comprises 9% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 27 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 6,645 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 4 households to be displaced due to the hurricane. Of these, 2 people (out of a total population of 2,914) will seek temporary shelter in public shelters.

Economic Loss

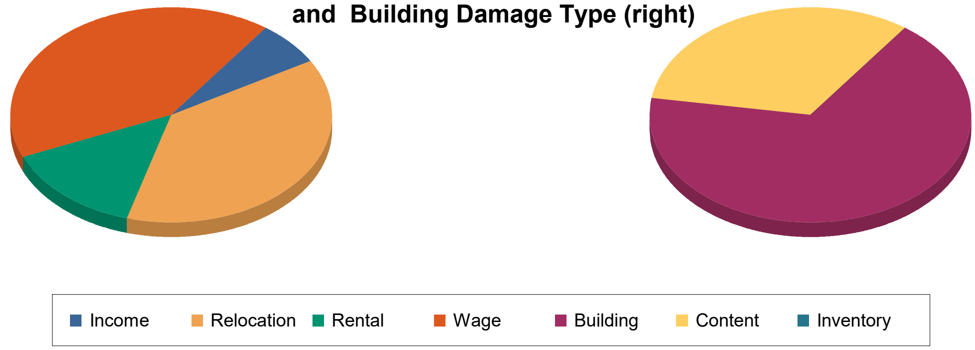
The total economic loss estimated for the hurricane is 13.5 million dollars, which represents 2.36 % of the total replacement value of the region's buildings.

Building-Related Losses

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

The total property damage losses were 14 million dollars. 8% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 87% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

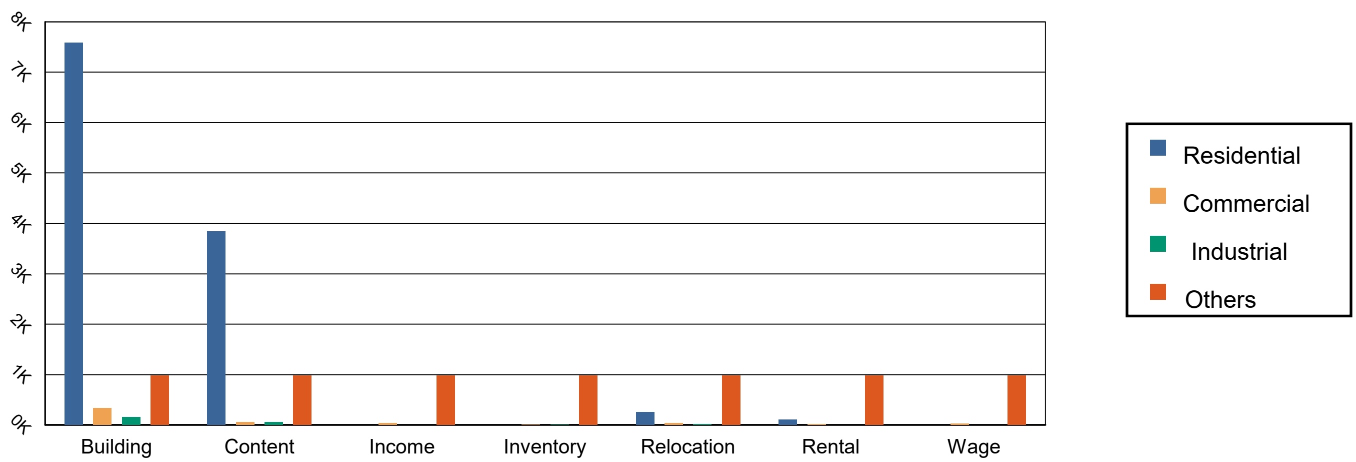


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	7,577.46	329.22	159.27	387.40	8,453.35
	Content	3,839.69	58.88	59.13	72.09	4,029.80
	Inventory	0.00	7.39	6.05	1.32	14.75
	Subtotal	**11,417.15**	**395.49**	**224.45**	**460.80**	**12,497.90**
Business Interruption Loss						
	Income	0.00	42.01	1.77	26.37	70.15
	Relocation	257.09	39.08	22.28	75.24	393.68
	Rental	107.23	21.60	1.86	18.15	148.84
	Wage	0.00	27.80	3.02	399.52	430.34
	Subtotal	**364.32**	**130.49**	**28.93**	**519.28**	**1,043.02**

Total

Total	**11,781.47**	**525.98**	**253.38**	**980.08**	**13,540.92**

Appendix A: County Listing for the Region

Massachusetts

- Hampden

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Massachusetts				
Hampden	2,914	412,918	162,050	574,968
Total	**2,914**	**412,918**	**162,050**	**574,968**
Study Region Total	**2,914**	**412,918**	**162,050**	**574,968**

Hazus: Earthquake Global Risk Report

Region Name: ChesterWind

Earthquake Scenario: 1500-Year

Print Date: April 25, 2024

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

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

HAZUS™ FEMA

Table of Contents

General Description of the Region

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

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

Massachusetts

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

The geographical size of the region is 123.62 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 2,914 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 574 (millions of dollars). Approximately 90.00 % of the buildings (and 72.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 572 and 122 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 574 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 88% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 1 schools, 4 fire stations, 3 police stations and 6 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 694.00 (millions of dollars). This inventory includes over 62.76 miles of highways, 38 bridges, 385.87 miles of pipes.

Table 1: Transportation System Lifeline Inventory

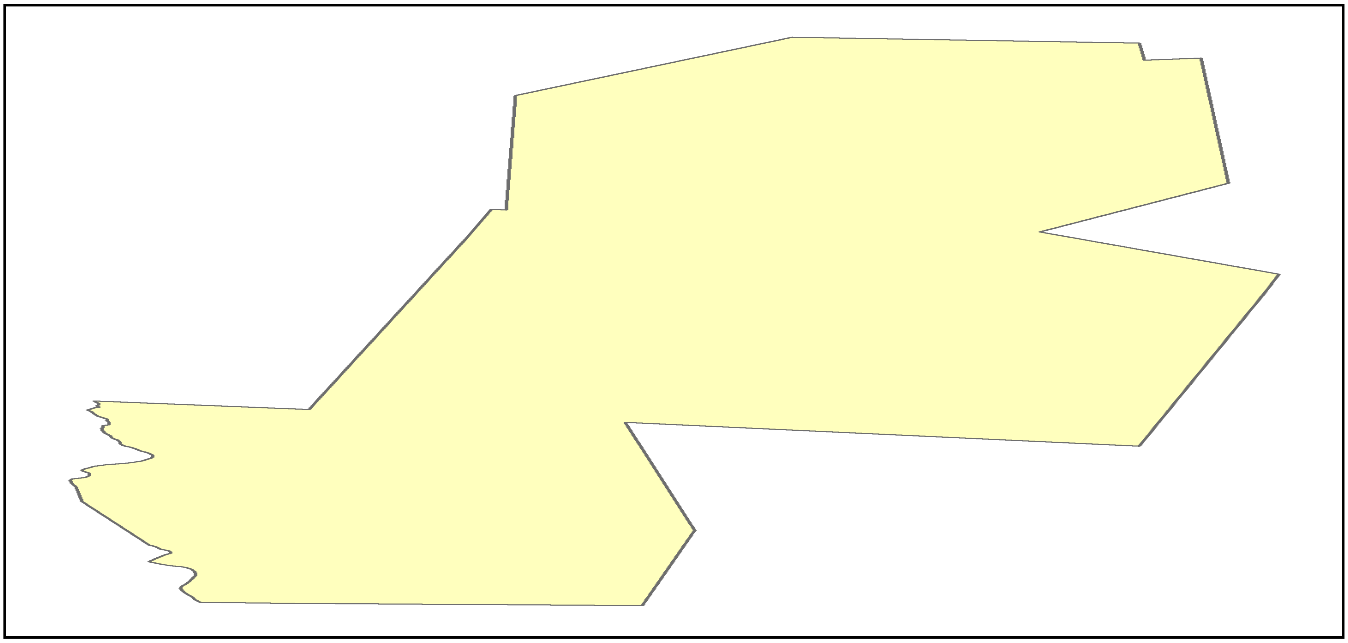
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	38	41.2479
	Segments	15	418.0558
	Tunnels	0	0.0000
		Subtotal	**459.3037**
Railways	Bridges	11	57.0900
	Facilities	0	0.0000
	Segments	4	56.5023
	Tunnels	0	0.0000
		Subtotal	**113.5923**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	0	0.0000
	Runways	0	0.0000
		Subtotal	**0.0000**
		Total	**572.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	7.5919
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**7.5919**
Waste Water	Distribution Lines	NA	4.5551
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.5551**
Natural Gas	Distribution Lines	NA	3.0367
	Facilities	0	0.0000
	Pipelines	2	86.6549
		Subtotal	**89.6916**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	2	20.2174
		Subtotal	**20.2174**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**122.10**

Earthquake Scenario

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



Scenario Name	1500-Year
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	1,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	5.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 6 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

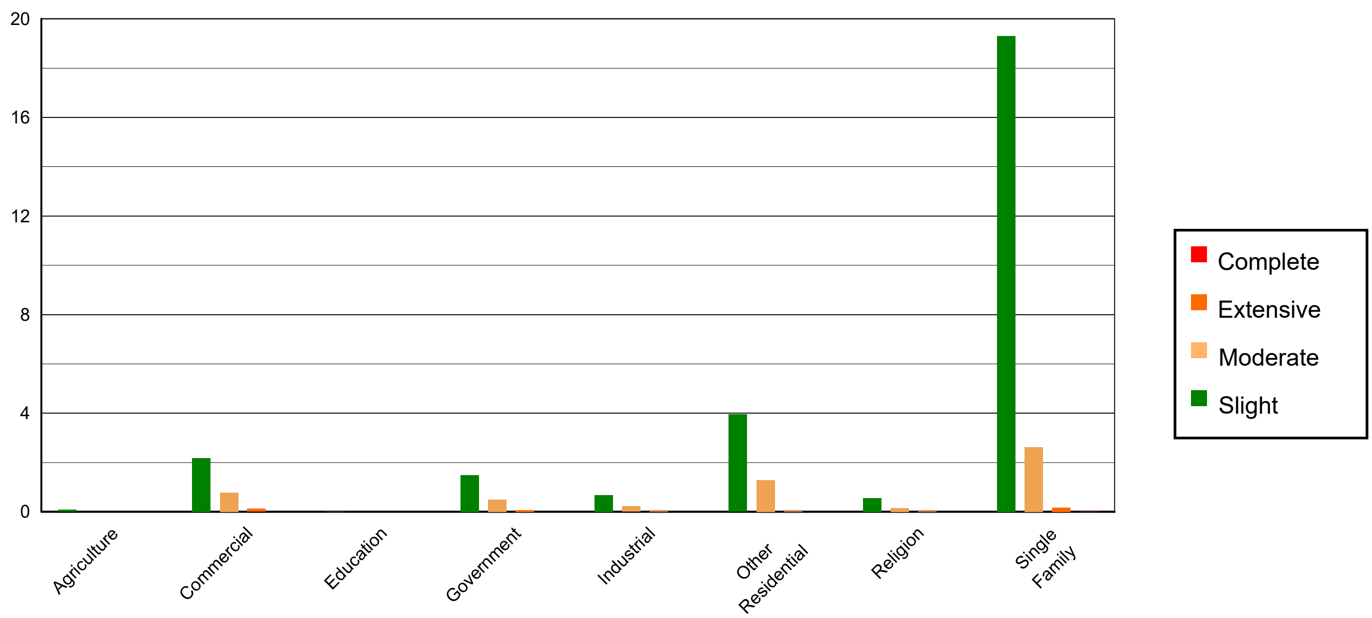


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	2.91	0.20	0.08	0.29	0.00	0.09	0.00	0.00	0.00	0.00
Commercial	57.93	4.01	2.17	7.69	0.78	13.97	0.12	26.44	0.01	27.82
Education	0.99	0.07	0.01	0.04	0.00	0.05	0.00	0.00	0.00	0.00
Government	40.94	2.83	1.49	5.28	0.50	9.00	0.06	14.57	0.00	15.15
Industrial	18.07	1.25	0.68	2.40	0.23	4.05	0.03	6.58	0.00	2.03
Other Residential	88.73	6.14	3.95	14.00	1.29	23.12	0.03	6.72	0.00	4.24
Religion	14.27	0.99	0.56	1.97	0.15	2.72	0.02	5.27	0.00	8.58
Single Family	1221.90	84.52	19.30	68.33	2.61	47.01	0.18	40.41	0.01	42.17
Total	**1,446**		**28**		**6**		**0**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1282.82	88.73	18.21	64.46	1.57	28.24	0.00	0.00	0.00	0.00
Steel	39.92	2.76	1.46	5.15	0.55	9.96	0.06	14.50	0.00	0.00
Concrete	5.70	0.39	0.20	0.70	0.06	0.99	0.00	0.55	0.00	0.00
Precast	3.66	0.25	0.19	0.66	0.12	2.08	0.02	4.59	0.00	0.00
RM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
URM	82.79	5.73	5.21	18.44	2.12	38.17	0.33	76.29	0.02	100.00
MH	30.85	2.13	2.99	10.59	1.14	20.55	0.02	4.07	0.00	0.00
Total	**1,446**		**28**		**6**		**0**		**0**	

*Note:

RM	Reinforced Masonry
URM	Unreinforced Masonry
MH	Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	1	0	0	1
EOCs	6	0	0	6
PoliceStations	3	0	0	3
FireStations	4	0	0	4

Transportation Lifeline Damage

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	15	0	0	14	14
	Bridges	38	0	0	38	38
	Tunnels	0	0	0	0	0
Railways	Segments	4	0	0	1	1
	Bridges	11	0	0	11	11
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	2	0	0	2	2
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	236	1	0
Waste Water	142	0	0
Natural Gas	9	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	1,267	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, Brick/Wood comprises 73.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)

Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	0 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 2,914) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter

Displaced households as a result of the earthquake	Persons seeking temporary public shelter
0	0

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- · Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- · Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- · Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- · Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.02	0.00	0.00	0.00
	Single Family	0.06	0.01	0.00	0.00
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0.15	0.02	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.02	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**
5 PM	Commercial	0.11	0.01	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.01	0.00	0.00	0.00
	Single Family	0.02	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**

Economic Loss

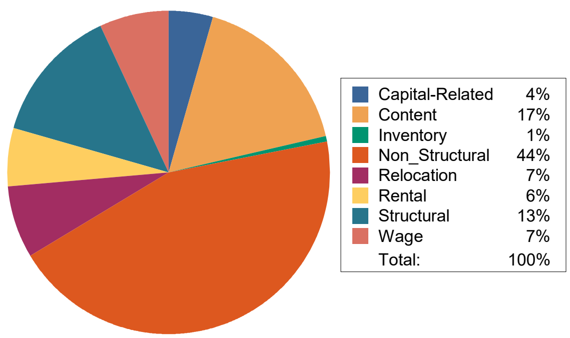
The total economic loss estimated for the earthquake is 1.72 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

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

The total building-related losses were 1.13 (millions of dollars); 25 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 51 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

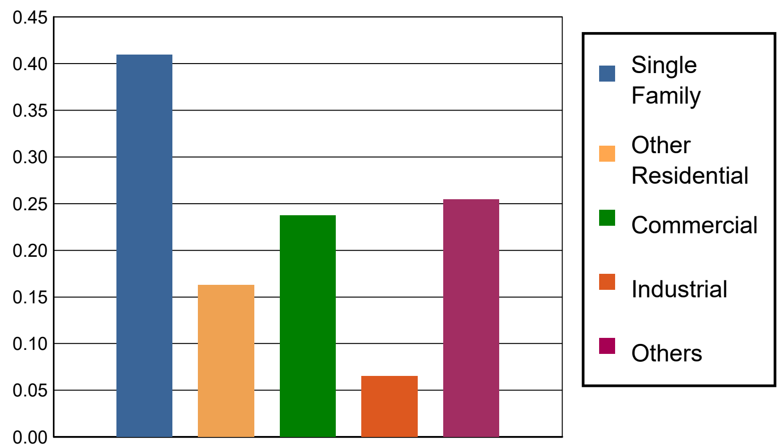


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0249	0.0295	0.0010	0.0235	0.0789
	Capital-Related	0.0000	0.0105	0.0364	0.0005	0.0014	0.0488
	Rental	0.0060	0.0319	0.0157	0.0005	0.0115	0.0656
	Relocation	0.0197	0.0051	0.0189	0.0042	0.0356	0.0835
	Subtotal	**0.0257**	**0.0724**	**0.1005**	**0.0062**	**0.0720**	**0.2768**
Capital Stock Losses							
	Structural	0.0526	0.0179	0.0350	0.0102	0.0363	0.1520
	Non_Structural	0.2473	0.0601	0.0669	0.0285	0.0976	0.5004
	Content	0.0836	0.0125	0.0309	0.0176	0.0475	0.1921
	Inventory	0.0000	0.0000	0.0043	0.0026	0.0011	0.0080
	Subtotal	**0.3835**	**0.0905**	**0.1371**	**0.0589**	**0.1825**	**0.8525**
	Total	**0.41**	**0.16**	**0.24**	**0.07**	**0.25**	**1.13**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	418.0558	0.0000	0.00
	Bridges	41.2479	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**459.3037**	**0.0000**	
Railways	Segments	56.5023	0.0000	0.00
	Bridges	57.0900	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**113.5923**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**572.90**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	7.5919	0.0036	0.05
	Subtotal	**7.5919**	**0.0036**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.5551	0.0018	0.04
	Subtotal	**4.5551**	**0.0018**	
Natural Gas	Pipelines	86.6549	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	3.0367	0.0006	0.02
	Subtotal	**89.6916**	**0.0006**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	20.2174	0.5861	2.90
	Subtotal	**20.2174**	**0.5861**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**122.06**	**0.59**	

Appendix A: County Listing for the Region

Hampden,MA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Massachusetts					
	Hampden	2,914	412	162	574
Total Region		**2,914**	**412**	**162**	**574**

Hazus: Earthquake Global Risk Report

Region Name: ChesterWind

Earthquake Scenario: 2500yr

Print Date: April 25, 2024

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

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

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HAZUS™ FEMA

General Description of the Region

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

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

Massachusetts

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

The geographical size of the region is 123.62 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 2,914 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 574 (millions of dollars). Approximately 90.00 % of the buildings (and 72.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 572 and 122 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 574 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 88% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 1 schools, 4 fire stations, 3 police stations and 6 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 694.00 (millions of dollars). This inventory includes over 62.76 miles of highways, 38 bridges, 385.87 miles of pipes.

Table 1: Transportation System Lifeline Inventory

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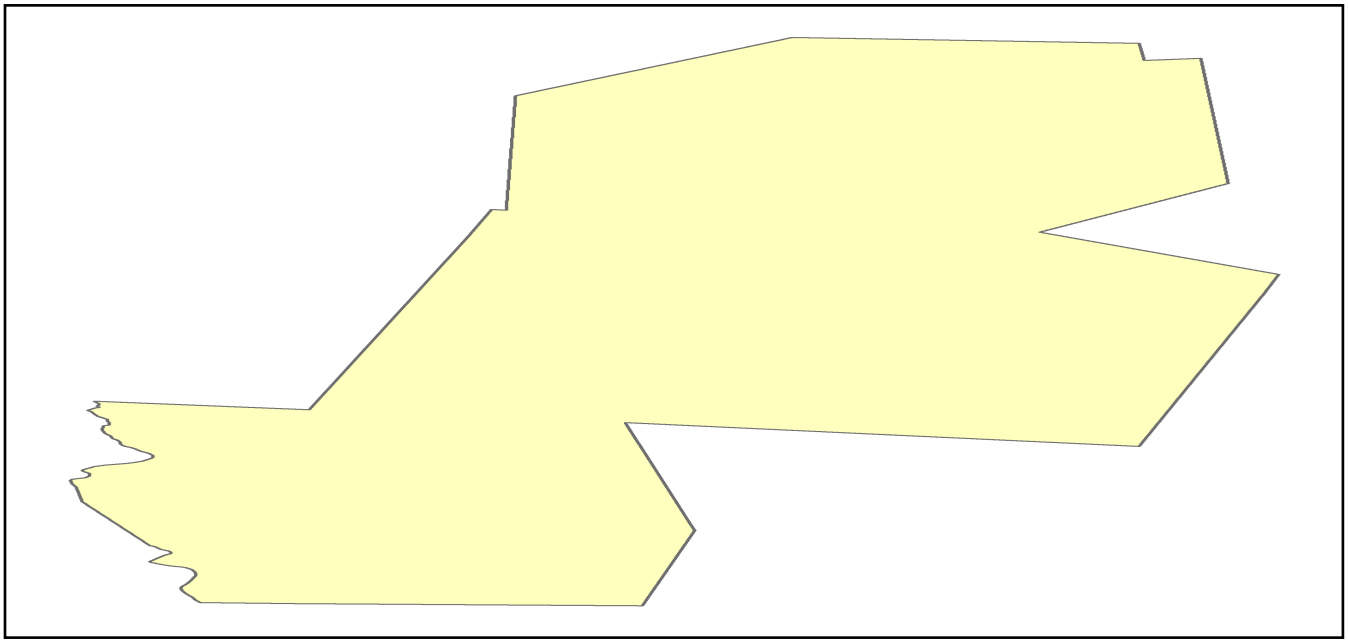
Railways	Bridges	11	57.0900
	Facilities	0	0.0000
	Segments	4	56.5023
	Tunnels	0	0.0000
		Subtotal	**113.5923**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	0	0.0000
	Runways	0	0.0000
		Subtotal	**0.0000**
		Total	**572.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	7.5919
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**7.5919**
Waste Water	Distribution Lines	NA	4.5551
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.5551**
Natural Gas	Distribution Lines	NA	3.0367
	Facilities	0	0.0000
	Pipelines	2	86.6549
		Subtotal	**89.6916**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	2	20.2174
		Subtotal	**20.2174**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**122.10**

Earthquake Scenario

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



Scenario Name	2500yr
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	2,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	6.50
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 11 buildings will be at least moderately damaged. This is over 1.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

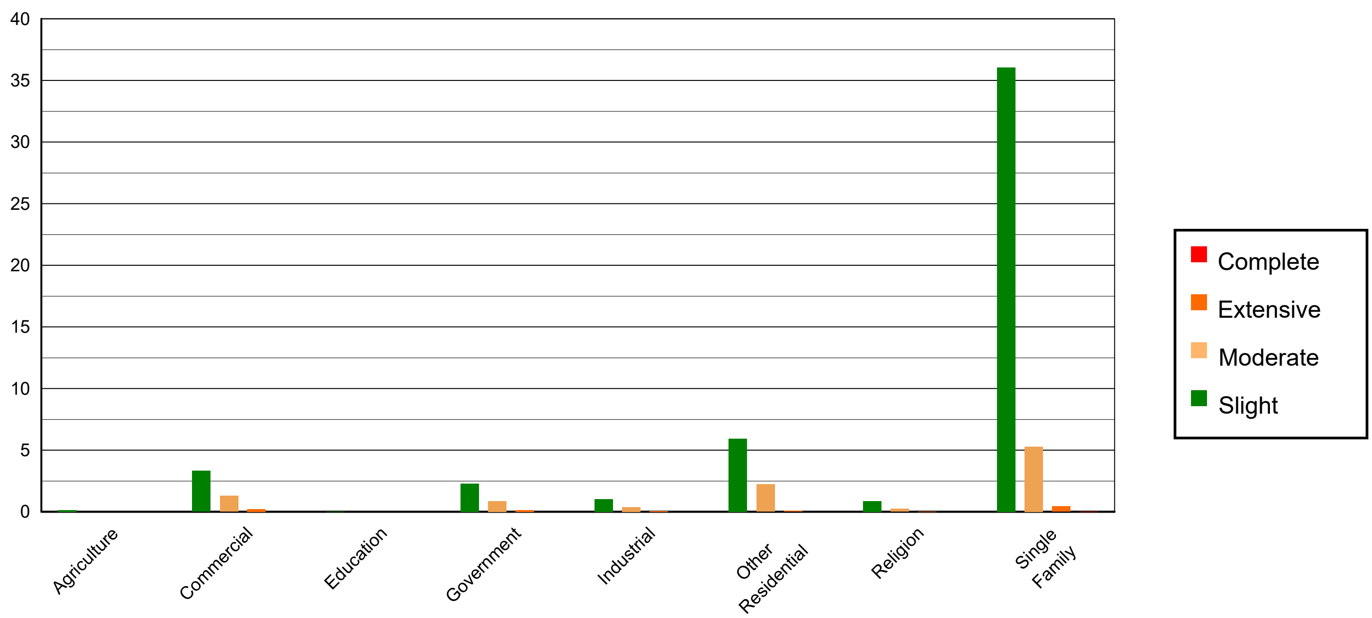


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	2.85	0.20	0.14	0.28	0.01	0.11	0.00	0.01	0.00	0.00
Commercial	56.16	3.96	3.32	6.68	1.29	12.48	0.22	22.64	0.01	24.21
Education	0.97	0.07	0.03	0.05	0.01	0.07	0.00	0.02	0.00	0.00
Government	39.71	2.80	2.29	4.62	0.86	8.34	0.12	12.81	0.01	13.09
Industrial	17.50	1.23	1.05	2.11	0.39	3.80	0.06	5.99	0.00	1.89
Other Residential	85.76	6.04	5.94	11.95	2.22	21.52	0.08	8.13	0.00	3.61
Religion	13.85	0.98	0.86	1.72	0.25	2.38	0.04	4.30	0.00	7.32
Single Family	1202.16	84.72	36.07	72.59	5.29	51.30	0.45	46.10	0.03	49.87
Total	**1,419**		**50**		**10**		**1**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1263.62	89.05	35.18	70.80	3.67	35.55	0.13	13.17	0.00	0.00
Steel	38.60	2.72	2.25	4.53	1.00	9.72	0.14	14.07	0.00	0.00
Concrete	5.52	0.39	0.32	0.64	0.11	1.07	0.01	0.61	0.00	0.00
Precast	3.50	0.25	0.26	0.52	0.18	1.79	0.04	3.86	0.00	0.49
RM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
URM	78.88	5.56	7.52	15.13	3.41	33.06	0.61	62.89	0.06	99.51
MH	28.84	2.03	4.16	8.38	1.94	18.81	0.05	5.40	0.00	0.00
Total	**1,419**		**50**		**10**		**1**		**0**	

*Note:

RM	Reinforced Masonry
URM	Unreinforced Masonry
MH	Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	1	0	0	1
EOCs	6	0	0	6
PoliceStations	3	0	0	3
FireStations	4	0	0	4

Transportation Lifeline Damage

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	15	0	0	14	14
	Bridges	38	0	0	38	38
	Tunnels	0	0	0	0	0
Railways	Segments	4	0	0	1	1
	Bridges	11	0	0	11	11
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	2	0	0	2	2
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	236	2	0
Waste Water	142	1	0
Natural Gas	9	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	1,267	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, Brick/Wood comprises 71.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)

Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	0 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 2,914) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter

Displaced households as a result of the earthquake	Persons seeking temporary public shelter
0	0

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

· Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
· Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
· Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
· Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.03	0.00	0.00	0.00
	Single Family	0.11	0.01	0.00	0.00
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0.26	0.03	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.01	0.00	0.00	0.00
	Single Family	0.03	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**
5 PM	Commercial	0.20	0.03	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.01	0.00	0.00	0.00
	Single Family	0.04	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**

Economic Loss

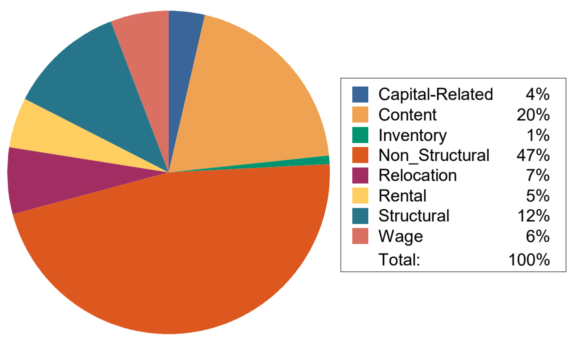
The total economic loss estimated for the earthquake is 3.74 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

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

The total building-related losses were 2.36 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 52 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

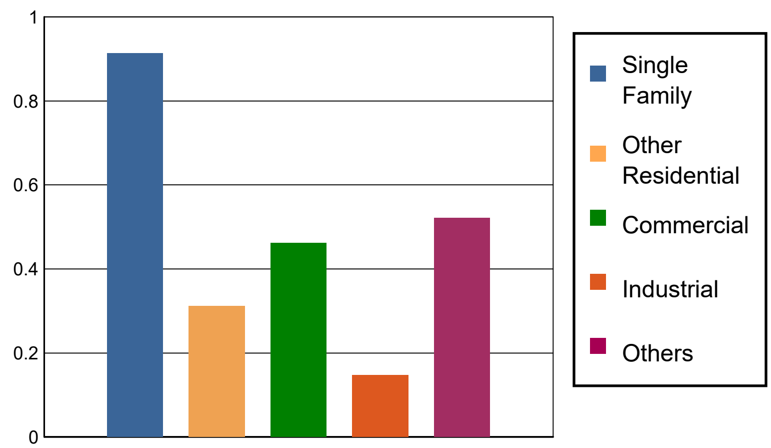


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0440	0.0505	0.0018	0.0394	0.1357
	Capital-Related	0.0000	0.0187	0.0622	0.0010	0.0024	0.0843
	Rental	0.0126	0.0542	0.0265	0.0010	0.0204	0.1147
	Relocation	0.0417	0.0090	0.0328	0.0076	0.0638	0.1549
	Subtotal	**0.0543**	**0.1259**	**0.1720**	**0.0114**	**0.1260**	**0.4896**
Capital Stock Losses							
	Structural	0.1060	0.0308	0.0606	0.0181	0.0640	0.2795
	Non_Structural	0.5504	0.1251	0.1442	0.0681	0.2133	1.1011
	Content	0.2034	0.0298	0.0749	0.0441	0.1157	0.4679
	Inventory	0.0000	0.0000	0.0105	0.0065	0.0030	0.0200
	Subtotal	**0.8598**	**0.1857**	**0.2902**	**0.1368**	**0.3960**	**1.8685**
	Total	**0.91**	**0.31**	**0.46**	**0.15**	**0.52**	**2.36**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	418.0558	0.0000	0.00
	Bridges	41.2479	0.0002	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**459.3037**	**0.0002**	
Railways	Segments	56.5023	0.0000	0.00
	Bridges	57.0900	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**113.5923**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**572.90**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	7.5919	0.0073	0.10
	Subtotal	**7.5919**	**0.0073**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.5551	0.0037	0.08
	Subtotal	**4.5551**	**0.0037**	
Natural Gas	Pipelines	86.6549	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	3.0367	0.0013	0.04
	Subtotal	**89.6916**	**0.0013**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	20.2174	1.3686	6.77
	Subtotal	**20.2174**	**1.3686**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**122.06**	**1.38**	

Appendix A: County Listing for the Region

Hampden,MA

HAZUS™ FEMA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Massachusetts					
	Hampden	2,914	412	162	574
Total Region		**2,914**	**412**	**162**	**574**