TOWN OF MILLVILLE

2022 Hazard Mitigation Plan (HMP) & Municipal Vulnerability Preparedness (MVP) Plan

Prepared by the Local Hazard Mitigation Team
Town of Millville, Massachusetts

&

The Central Massachusetts Regional Planning Commission
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<TOWN LETTERHEAD>

CERTIFICATE OF ADOPTION BOARD OF SELECTMEN

TOWN OF MILLVILLE, MASSACHUSETTS

A RESOLUTION ADOPTING THE *TOWN OF MILLVILLE HAZARD MITIGATION PLAN 2022 UPDATE*
WHEREAS, the Town of Millville established a Committee to prepare the *Town of Millville Hazard Mitigation Plan 2022 Update*; and

WHEREAS, the *Town of Millville Hazard Mitigation Plan 2022 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Millville, and

WHEREAS, duly-noticed public meetings were held by the LOCAL HAZARD MITIGATION PLANNING TEAM on April 20, 2022 and April 27, 2022 and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Millville BOARD OF SELECTMEN adopts the *Town of Millville Hazard Mitigation Plan 2022 Update*, in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Millville.

ADOPTED AND SIGNED this Date. _____

Name(s)

Title(s)

Signature(s)

ACKNOWLEDGEMENTS

This Hazard Mitigation Plan (HMP) update, Municipal Vulnerability Preparedness (MVP) planning process, and Community Resiliency Building Workshop was funded by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA). This report and the CRB Workshop were prepared for the community of Millville by the Central Massachusetts Regional Planning Commission (CMRPC).

The Millville Board of Selectmen extends its thanks to participants in the HMP and MVP Core Project Team for their time and hard work in participating in this project. Core Team members include, but are not limited to:

Brian Mullaly, Highway Surveyor

Jennifer Gill, Chair of Selectboard, Capital Program Committee

Roy Liard, Fire Chief and Emergency Management Director

Pam Maloney, Planning Board

Paul Ouellette, Board of Assessors Chairman, Chestnut Hill Community Association

Sarah Hoecker, ARPA Coordinator – Millville Core Team Lead

Sherry Grant, Board of Health

In addition, thanks are extended to the staff of the Central Massachusetts Regional Planning Commission for process facilitation and preparation of this document:

Mary Hannah Smith, Associate Planner

Julia Moore, Assistant Planner

Andrew Loew, Principal Planner

Matthew Franz, GIS Analyst

Thanks are also due to the Executive Office of Energy and Environmental Affairs (EEA) and the Massachusetts Emergency Management Agency (MEMA) for guidance and feedback regarding this plan. Specific thanks to the following individuals for their help throughout this planning process:

Hillary King, MVP Central Regional Coordinator, EEA

Jeff Zukowski, Hazard Mitigation Planner, MEMA

EXECUTIVE SUMMARY

The following plan documents Millville's assessment of its natural hazards, risks to the town posed by climate change, and actions that the Town can take to reduce its vulnerability to natural hazards and adapt to climate change. Through the Municipal Vulnerability Preparedness (MVP) program and the Hazard Mitigation Planning (HMP) process, Millville has completed an assessment of town vulnerabilities and an action plan to address these challenges, which was informed by community outreach and community stakeholders. As a result of completing this plan, Millville is eligible to apply for hazard mitigation funding through the Federal Emergency Management Agency (FEMA) and climate adaptation funding through the MVP Action Grant program.

Planning Process

Millville began working on this plan in November 2021. The planning process consisted of:

1. Assembling a Core Project Team of municipal staff who led the process, developed the public survey, advertised opportunities for community input, provided detailed information on municipal activities, and organized the Community Resilience Building workshop.
2. Developing and publicizing a public survey to solicit community opinions on climate change in Millville.
3. Updating the list of hazards, critical facilities, and vulnerable populations from the 2016 HMP.
4. Hosting the Community Resilience Building workshop to engage community stakeholders in the planning process. At this workshop, stakeholders assessed community vulnerabilities and strengths and developed an action plan to build community resilience to natural hazards and climate change.
5. Finalizing the prioritized action plan and implementation strategy.
6. Inviting public comments on the final plan document.

Vulnerability and Risk

The Millville Core Team identified flooding, severe storms (thunderstorms, wind, and tornados), hurricanes, and severe winter storms (snowstorms, ice storms, nor'easters), as the four hazards that are likely to pose the most risk to the town. This plan also assesses the town's vulnerability to wildfires, earthquakes, dam failure, drought, and landslides.

Millville's Hazard Mitigation Strategy

The hazard mitigation strategy captured in the action plan contains over 30 actions that the Town would like to complete during the next five years to build community resilience. These actions address, and are described by, the following plan objectives:

- Address current stormwater drainage issues and proactively incorporate resilience to extreme precipitation

- Address roadway erosion and maintenance issues and proactively incorporate resilience to extreme precipitation
- Ensure availability of water for fire suppression
- Maintain readiness and response capacities of Millville's emergency services
- Protect the natural environment and ecosystem services
- Protect water quality and public health
- Reduce power outages
- Support community quality of life
- Undertake other actions that build community resilience

The plan includes one or more specific actions for each of the town's objectives. The following actions were designated the highest priority for the town to mitigate natural hazards or foster community climate resilience:

- Create a comprehensive, town-wide stormwater management plan
- Pursue external grant funding for road repairs and reconstruction
- Create a comprehensive, town-wide roadway infrastructure plan to prioritize future maintenance and construction projects
- Address recurring erosion and drainage issues as prioritized by the Highway Surveyor
- Feasibility study of other potential hydrant water sources, including tying into another town's hydrant system or pumping water from the Blackstone River, to determine the long-term use of Mansfield Pond as a water source
- If Mansfield Pond continues to be the hydrant water source in the long-term, upgrade the pond pump system
- Replace the fire suppression water tank at the Elementary School
- Acquire new radios and new antenna to improve communication system for Millville's emergency services
- Invest in a basketball court and other recreational spaces for town youth

Next Steps

The Town of Millville is committed to implementing the actions outlined in this plan. Town leadership will seek funding and incorporate the projects identified in this document into ongoing work plans. The town will also strive to integrate hazard mitigation principles into future municipal plans and policy decisions. Finally, Millville will monitor, evaluate, and update the Hazard Mitigation and Municipal Vulnerability Preparedness Plan, as needed, to reflect work completed, to note changes in local priorities, and to incorporate new best practices.

1.0 INTRODUCTION

1.1 PLAN PURPOSE

This plan identifies the natural hazards facing the Town of Millville, assesses the vulnerabilities of the area's critical facilities, infrastructure, residents, and businesses, and presents recommendations to mitigate the adverse effects of typical natural hazards. This plan also incorporates how the Town of Millville must adapt to prepare for the increasing impacts of climate change.

New England weather is renowned for its mercurial and dramatic nature. Late summer hurricanes, major winter blizzards, and summer droughts are all part of the climatic atmosphere in Central Massachusetts. These occur frequently enough to be familiar scenes to residents of Millville. The intersection of these natural hazards with the built environment can transition these routine events into classified natural disasters. In addition, as climate change continues to progress, the severity and frequency of hazard risk will increase.

This planning effort has drawn on the knowledge of local municipal officials and residents. The recommendations presented in the following report are intended to be realistic and practical steps for mitigating natural hazards and preparing the community as best as possible for the effects of climate change. Implementation of these actions will translate into savings – fewer lives lost, less property destroyed, and less disruption to essential services and ecological systems.

1.2 WHAT IS A HAZARD MITIGATION PLAN?

Congress enacted the Disaster Mitigation Act of 2000 (DMA 2000) on October 10, 2000. Also known as the Stafford Act Amendments, the bill was signed into law by President Clinton on October 30, 2000, creating Public Law 106-390. The law established a national program for pre-disaster mitigation and streamlined the federal administration of disaster relief. Specific rules on the implementation of DMA 2000 were published in the Federal Register in February 2002 and required that all communities must have a Hazard Mitigation Plan (HMP) in place in order to qualify for future federal disaster mitigation grants following a Presidential disaster declaration. The Hazard Mitigation Plan emphasizes local policies or actions that can be implemented over the long-term to reduce or prevent future disaster damages caused by natural hazards.

1.3 WHAT IS A MUNICIPAL VULNERABILITY PREPAREDNESS PLAN?

In September 2016, Massachusetts Governor Baker signed Executive Order 569, directing multiple state agencies to develop and implement a statewide comprehensive climate adaptation plan with the best climate-change data available. Recognizing that many adaptation solutions are local in nature, a key commitment of Executive Order 569 is to assist local governments in completing their own assessments and resiliency plans. The Municipal Vulnerability Preparedness (MVP) Grant and Designation Program represents the first step in fulfilling this commitment.

The MVP program provides planning grants to municipalities to complete vulnerability assessments and develop action-oriented resiliency plans. Funding is used by cities and towns to hire an MVP-

certified consultant who is trained to provide technical assistance and complete a community's vulnerability assessment and resiliency plan using the Community Resilience Building Framework. Towns and cities are free to choose the consultant of their choice from a list of certified MVP providers. The Town of Millville invited the Central Massachusetts Regional Planning Commission (CMRPC) to lead them in this planning effort.

Communities that complete the MVP planning process become certified "MVP Communities" and are eligible for MVP Action Grant funding and other opportunities through the Commonwealth.

1.4 HAZARD MITIGATION AND MUNICIPAL VULNERABILITY PREPAREDNESS PLANNING IN MILLVILLE

This plan is funded through a Fiscal Year 2022 MVP Planning Grant awarded by the Massachusetts Executive Office of Energy and Environmental Affairs. Millville has received this funding to create a Hazard Mitigation and Municipal Vulnerability Preparedness Plan. CMRPC will work with the Town of Millville to create one combined report for both Hazard Mitigation and Municipal Vulnerability Preparedness. Millville's combined HMP and MVP action plan will account for natural hazards based on historic natural hazard data and future climate change projections. This combined plan will account for additional risk imposed by climate change, following the Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) example.

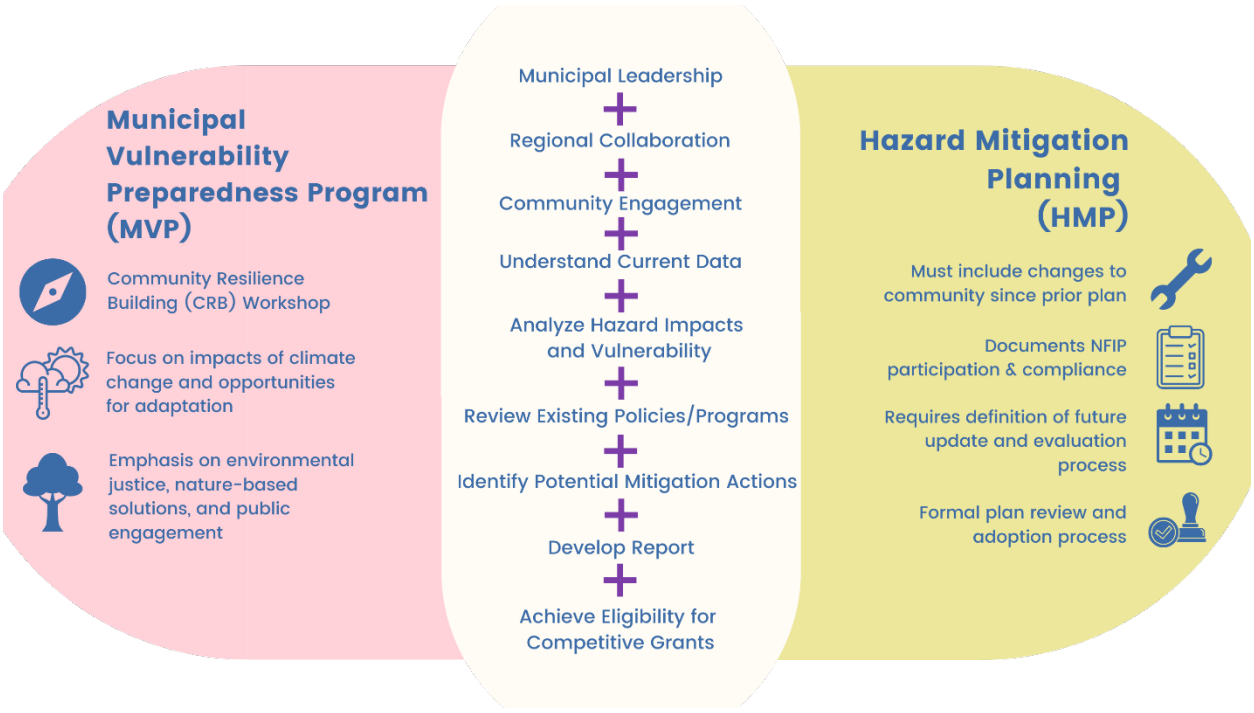

Figure 1: Similarities and differences between MVP and HMP programs.

1.5 PLANNING PROCESS SUMMARY

The planning process for Millville was composed of two distinct but connected phases – data collection and technical review, and public input and planning.

Identification of natural hazards impacting participating communities was accomplished through review of available information from various sources. These included federal and state reports and datasets, as well as existing plans. An assessment of risks and vulnerabilities was performed primarily using geographic information systems (GIS) to identify the infrastructure (critical facilities, public buildings, roads, homes, businesses, etc.) at the highest risk for being damaged by hazards, particularly flooding. Local knowledge as imparted by town officials, staff, emergency management volunteers and other stakeholders was a critical element of this phase.

The second phase of the process was focused on outreach, public participation and input, and planning. This phase was critical to ensuring awareness of the planning process among a wide range of local officials, coordinating plan elements with other sectors of the community, and providing opportunities for public comment and input from a representative base of residents and other stakeholders in each community. CMRPC and the Millville Core Team attempted to solicit initial public opinions on natural hazards and climate change through a public survey, discussed below in Section 1.6.

Next, this phase of the process included the Community Resilience Building (CRB) workshop, which brought together local stakeholders to discuss local vulnerabilities to natural hazards and climate change. The CRB workshop was divided into three virtual sessions on March 2, March 9, and March 16. Millville invited forth-seven stakeholders to the meeting, including representatives from Uxbridge, and regional organizations representing the Blackstone/Millville Regional School District, the Blackstone Watershed Collaborative, the Blackstone Valley Chamber of Commerce. Twelve stakeholders participated in over the course of the three workshop sessions (see Appendix C for a list of invitees and attendees).

The CRB workshop was followed by a public, virtual "listening session" where CMRPC presented on the HMP and MVP process and progress to-date and invited attendees to comment on the project.

Image 1: Screenshot from workshop on March 16, 2022.

Two members of the public attended this listening session and provided comments. The CRB workshop and public listening sessions helped establish community priorities for hazard mitigation and climate change adaptation and develop an understanding of local resources and existing policies and procedures. With this essential information, the planning team developed an informed and community-specific list of hazard mitigation and climate change adaptation strategies for Millville.

After completing a first draft of the plan, the Millville Core Team and CMRPC hosted an additional virtual listening session to finalize the draft and solicit additional public comment. Two members of the public attended this listening session and provided comments. Listening session comments are included in Appendix E, and suggestions were incorporated into the project report where appropriate. Millville has made recordings of the two listening sessions available on the town's public access Youtube channel for anyone who was unable to attend. Millville also solicited public comments on a draft version of the report through its website between April 21 and May 13, though no additional comments were received.

The Millville Planning Board is the primary town agency responsible for regulating development in the town, which is an important tool for hazard mitigation. Feedback to the Planning Board was ensured through the participation of a Planning Board representative, Pam Maloney, on the local hazard planning team and the participation of the Town Administrator, Peter Caruso, in the CRB workshop and listening sessions. In addition, CMRPC, the State-designated regional planning authority for Millville, works with all agencies that regulate development in its region, including the municipal entities listed above and state agencies, such as Department of Conservation and Recreation and MassDOT. This regular involvement ensured that during the development of the Millville Hazard Mitigation Plan, the operational policies and any mitigation strategies or identified hazards from these entities were incorporated.

The Millville Core Team was comprised of:

- Brian Mullaly, Highway Surveyor
- Jennifer Gill, Chair of Selectboard, Capital Program Committee
- Roy Liard, Fire Chief and Emergency Management Director
- Pam Maloney, Planning Board
- Paul Ouellette, Board of Assessors Chairman, Chestnut Hill Community Association
- Sarah Hoecker, ARPA Coordinator – *Millville Core Team Lead*
- Sherry Grant, Board of Health

Other members of the core project team included:

- Mary Hannah Smith, Associate Planner, CMRPC – *CMRPC Lead*
- Julia Moore, Assistant Planner, CMRPC

1.6 SURVEY

In December, the team created an introductory survey for the Millville HMP/MVP. This survey was intended to gauge the understanding of Millville residents' thoughts on climate change impact and natural hazards. The survey was created and distributed using SurveyMonkey.

The survey consisted of 8 questions. The survey began by asking residents how natural hazards may have impacted their lives. The questions then began to ask about the larger community and for individuals to identify aspects of life in Millville that natural hazards have affected. The list of survey questions is in Appendix B. Two residents participated in the survey, offering opinions on hazards and vulnerabilities, concerns about climate change, and priorities and suggestions for future climate adaptation actions. Responses focused on improving stormwater management, developing a new fire suppression water source, and trimming dead trees to mitigate outages. These priorities aligned stakeholder recommendations from the Community Resilience Building Workshop.

1.7 PLANNING TIMELINE

2.0 COMMUNITY PROFILE, LAND USE, AND DEVELOPMENT TRENDS

2.1 MILLVILLE COMMUNITY PROFILE

The Central Massachusetts Regional Planning Commission (CMRPC) region occupies roughly 1,000 square miles in the southern two-thirds of Worcester County, Massachusetts. The area surrounds the City of Worcester, which is the second-largest city in Massachusetts and New England, with a population of 206,518 people as of the 2020 Decennial US Census. Nearly 588,141 people live in the CMRPC Region.

The CMRPC area is framed on the west by the Central Massachusetts uplands, on the south by Rhode Island and Connecticut, on the east by the Boston metropolitan area, and on the north by the Montachusett region in northern Worcester County. The forty-community region has been divided for planning purposes into six sub-regions, determined by shared characteristics and roadway corridors. Millville is located in the Southeast sub-region consisting of eleven towns lying within the Blackstone River watershed, including: Blackstone, Douglas, Grafton, Hopedale, Mendon, Millbury, Millville, Northbridge, Sutton, Upton, and Uxbridge. The Town is located on Route 146 (a limited access road) some 20 miles south of Worcester and 20 miles north of Providence, RI.

Massachusetts has a humid continental climate, with maritime influences increasing from northwest to southeast. According to the National Oceanic and Atmospheric Association's National Weather Service, between 2000 and 2021, nearby Worcester saw monthly mean temperatures ranging from 20.7 degrees in January to 78.7 in July. Precipitation is relatively high at 49.38 inches annually, including 73.9 inches of snowfall.[1] Some 30 miles from the Atlantic coast, Millville and its neighboring communities are subject to a variety of severe weather, including hurricanes, nor'easters, thunderstorms, and blizzards.

Today, Millville is largely a bedroom community. Located on Route 146 (a limited access road), the Town is some 20 miles south of Worcester and 20 miles north of Providence, RI. Millville lies entirely within the Blackstone River Basin. Uxbridge borders Millville on the west, Mendon to the North, Blackstone to the East, and North Smithfield (Rhode Island) to the south.

Millville has a total area of 5 square miles. The number of Millville residents grew from 2,724 in the 2000 US Census to 3,190 in the 2010 US Census. The total population has remained stable since 2010, and stands at around 3,174 individuals today, according to the 2020 US Census.[2] Millville is a demographically stable community, with population growth slowing as developable land has been built out following a 1990s and early 2000s surge. According to the Central Massachusetts Regional Planning Commission's (CMRPC) Long Range Transportation Plan, Mobility 2040, the Town of Millville is expected to experience minimal population growth over the next 25 years.

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[1] National Weather Service data collected from 2000 through 2021 in nearby Worcester. https://www.weather.gov/wrh/Climate?wfo=box

[2] US Census Bureau, 2020 Decennial US Census, Table P1.

Millville is a predominantly white community, with 93% of residents identifying within that group (2020 Decennial Census).[3] People who identify as 'two or more races' comprise the largest minority group, at 4.3%. 'Black or African American' and 'Asian' are the two largest single-race minority groups in Millville at approximately .8% of the population in each group. While most Millville residents speak English, approximately 5 households in Millville are considered "limited English-speaking households."[4]

Millville's median age is 41.3 years, slightly higher than the state-wide median age of 39.5.[5] 24.3% of the total population is under 18, which is slightly above the statewide figure. 12.2% of the total population is over age 65, below the statewide figure of 16.2%.

At $79,129, the median household annual income is well below the state ($81,215) and Worcester County ($74,679) median income levels.[6] Households that own their own home have a much higher median household income ($91,667) than households that rent ($49,107).[7]

Housing costs are relatively inexpensive, with a median owner-occupied home valued at $306,600, compared to $386,200 for Massachusetts and $284,900 for the county.[8] 66.4% of occupied homes are detached single-family houses; the remainder is attached units like townhomes, or multi-unit structures. At 4.9%, vacancies are below the percentage of vacancies overall in the state (9.1%) and county (6.7%).[9] Many older homes remain in use in Millville, with 30.8% built before 1940, compared to some 31.6% for Massachusetts and almost 28.5% for Worcester County.[10]

Central Massachusetts Regional Planning Commission (CMRPC) population and housing projections are based on the 2018 Long Range Transportation Plan. According to CMRPC, in 2030, the population is projected to be at 3,532, and in 2040 the population will continue to grow to 3,622.[11] This population projection is based on expected demographic and development trends in the Central Massachusetts region.

2.2 SOCIETAL FEATURES

The Town of Millville is a bedroom community, rich in small town New England character. Millville is known for its historic and beautiful churches, including St. Paul's Church and St. John's Episcopal. The town is also known for the restored Udor Tower, a charismatic stone structure thought to have been used as a private water reservoir to collect rainwater, dating back to the early 1800s.[12]

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[3] US Census Bureau, 2020 Decennial US Census, Table P1.
[4] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, S1602.
[5] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, S0101.
[6] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, S1901.
[7] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, S2503.
[8] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, S2506.
[9] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, DP04.
[10] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, S1901.
[11] http://www.cmrpc.org/demographics
[12] Discover Central Massachusetts Website, Blackstone Valley Region, Millville. 2022. https://www.discovercentralma.org/regions/blackstone-valley/millville/

Today, Millville provides a Library and Senior Center for its residents to enjoy, as well as houses Millville Elementary School as part of the Blackstone-Millville Regional School District. Millville Elementary educates Millville residents from prekindergarten through Grade 5. Millville residents pride the town on its safety, with Police and Fire Departments, roadway maintenance, firefighting water system, and waste disposal. Residents can enjoy outdoor recreation with their children at the many athletic and recreational programs at local playing fields, playgrounds, and the school gymnasium.[13]

According to a town survey done as part of CMRPC's Millville 2018 Open Space and Recreation Plan, the main reasons people choose to live in Millville are its small-town character, neighborhood safety, and low crime and vandalism rates. Close behind those reasons, some residents also stated they chose to live in the town due to its great air and water quality. Schools, community life, and having friends and family in Millville were also important to responded, but slightly less so than the factors mentioned above. Job opportunities, church life, library resources, availability of farm land, and accessibility to highways were less important reasons why residents live in Millville.[14]

2.2.1 CRB WORKSHOP DISCUSSION OF SOCIETAL FEATURES

Table 1: Societal features discussed at the Millville CRB Workshop

Strengths

- The Senior Center and the Town's Senior Coordinator know all the senior residents of Millville and keep an eye on anyone that is especially vulnerable or isolated. The Senior Center was awarded a grant for a generator and has been used as a cooling center in the summer. It should be officially designated as an emergency shelter.
- Millville has strong mutual aid relationships with surrounding communities.
- Most town residents are signed up for Code Red/Reverse 911, which is a service that Millville shares with neighboring towns.
- There are several community groups and places for residents to socialize in town, including: the Chestnut Hill Meeting House Association; the Chestnut Hill Community Association; St Johns and St. Augustine's (Churches); the Polish Club; Galliford's restaurant. These groups and community spaces add to residents' quality of life.
- George's corner store stayed open throughout the Covid pandemic and was a location within town for residents to purchase necessities.
- Millville has a volunteer Fire Department as well as a small MEMA volunteer team.

[13] Central Massachusetts Regional Planning Commission, Town of Millville MA Master Plan. 2018. https://www.millvillema.org/sites/g/files/vyhlif906/f/uploads/millville-master-plan.pdf

[14] Central Massachusetts Regional Planning Commission, The Town of Millville Open Space and Recreational Plan. 2018. https://www.millvillema.org/sites/g/files/vyhlif906/f/uploads/millville-open-space-recreation-plan-.pdf

Vulnerable features

- Millville Heights is an apartment complex for low-income seniors in central Millville.
- Bridge on Central Street, which connects the north and south sides of Millville.
- Millville does not have a hospital in town, so residents need to drive to surrounding communities for medical care. The Fire Department provides an ambulance service, however, the station is not staffed at all times, which can increase the lead time for the ambulance. Also, the fire department ambulance staff have EMT training, so for certain injuries the town must request a more highly trained ambulance team from a neighboring community.
- There are some "dead spots" within town for radio signals.
- Millville police have outdated emergency radio equipment.
- Millville is a very small town, so its municipal resources and staffing. Much of the town's operations are run by volunteers, and certain volunteers wear multiple hats. It has limited capacity for unexpected events like hazards, but does a good job day to day with minimal resources.
- Millville does not have amenities designed for youth or places for kids to congregate outside of school. Youth sports were disrupted by Eastern Equine Encephalitis (EEE) and Covid-19 was very disruptive for all aspects of youth life.
- Millville only one internet provider and unreliable service. This limited access to information for some residents.

2.3 ECONOMIC FEATURES

From its location within the historic Blackstone Valley, to its good schools and quality of life, Millville contains many economic assets. Millville's economy is comprised of a variety of industries, and employment indicators show positive but modest growth for the town's future. The US Census Bureau's 2012 Survey of Business owners showed Millville contains 237 companies. This is lower than that of Millville's bordering towns, with Blackstone containing 719 companies, Mendon containing 440, and Uxbridge with 1,313, however each of those towns have far larger land area and more substantial amounts of commercially zoned land.[15] According to CMRPC's 2018 Master Plan for Millville, the town's largest employers are the Millville Elementary School (50-100 employees), Millville Fire Department (20-49 employees), Century Discount Liquors (10-19 employees), the Millville Police Department (10-19 employees), St. Augustine's Catholic Church (10-19 employees), and St. Augustine's religious Education (10-19 employees).[16]

Today, the educational services, social assistance, and education sectors employ the largest number of residents from Millville, at 23% of all jobs in town. Following that, the manufacturing sector employs 14% of workers, professional sector employs 12%, and the scientific employs 11% of working residents in Millville.[17] From 2000 to 2015, the number of jobs in manufacturing, an important industry for the town's economy, declined 17%. However, in the same timeframe,

[15] US Census, Survey of Business Owners (SBO) – Survey Results (2012) https://www.census.gov/library/publications/2012/econ/2012-sbo.html
[16] CMRPC, Town of Millville MA Master Plan, 2018.
[17] CMRPC, Town of Millville MA Master Plan, 2018.

employment in professional, management, scientific, administrative, and waste management sectors increased by nearly 70%.[18] According to CMRPC's Millville Master Plan, these workforce changes reflect the structural change in town of a decrease in blue-collar workers, specifically machine operators, assemblers, and inspectors. Alongside this decrease in factory workers, there has been an increase in both service-oriented and professional occupations. This pattern reflects the slow decline of manufacturing industries in the Central MA region, and Massachusetts as a whole, as new residents with largely white-collar occupations move in.[19]

2.4 INFRASTRUCTURE FEATURES

From its earliest days of development, Millville was a town of manufacturing. The town housed manufacturing mills such as the U.S. Rubber Company, and many of its neighborhoods were originally designed for factory workers heading home from work.[20] Through the 1800s to its incorporation in 1916, Millville's geographic location on the low-lying land bordering the Blackstone River shaped its industrial development. Hydropower harnessed from the Blackstone River shaped the town's industry. Entrepreneurs used the power of the river to produce manufactured goods, and the rail lines of the Providence and Worcester Railroad for transit of goods.[21]

Today, Millville's primary transportation link is its Main Street via State Route 122. This roadway travels in a northwest-southeast direction through town, running from Uxbridge town line to the Blackstone town line for a total of about 1.7 miles. This road provides access to essential services, such as the Fire Department and Library, as well as shopping centers, residential developments, and town centers. The minor roadways through Millville include Chestnut Hill Road, Central Street, and Lincoln Street. Together, these minor roadways make up a quarter of all road mileage in town.[22]

Of special note in Millville, the 1850s-era Town Hall (including the Emergency Operations Center in the basement) was permanently vacated in July of 2016 due to structural weakness and toxic mold. Administrative operations have relocated to 290 Main Street, and the EOC has relocated from the Town Hall basement to Fire Department headquarters.

2.4.1 CRB WORKSHOP DISCUSSION OF INFRASTRUCTURE FEATURES

Table 2: Infrastructure features discussed at the Millville CRB Workshop

Strengths
• The Blackstone Valley Bikeway runs through south Millville, paralleling Ironstone St and Hope St before crossing the Blackstone River near the Blackstone border. This bikeway is well-used

[18] CMRPC, Town of Millville MA Master Plan, 2018.
[19] CMRPC, Town of Millville MA Master Plan, 2018.
[20] Discover Central Massachusetts Website, Blackstone Valley Region, Millville. 2022.
[21] CMRPC, Town of Millville MA Master Plan, 2018.
[22] CMRPC, Town of Millville MA Master Plan, 2018.

Strengths

and offers an economic development potential if the town can draw people off the trail and into local businesses. The trail is managed by the Massachusetts Department of Conservation and Recreation (DCR).

Vulnerable features

- Roads in Millville suffer from erosion due to stormwater and use. Where the road meets the curb it can erode, and storm drains may sink or rise above the road surface. The road damage can be hazardous to vehicles and repairs are costly for the town. Central St recently had a comprehensive, strategic retrofit and reconstruction, but the town cannot afford that type of project without external funding. The Highway Department budget and current staff levels can only support quick repairs that do not address underlying issues. Roads identified with specific issues include Killiney Woods, Cork Circle, Bantry Road, Alfonso Way, Tower Road (North), and others, though the Highway Department would have the most up-to-date list.
- Aging or failing drainage infrastructure contribute to Millville's stormwater and erosion challenges. Some culverts are beginning to collapse, while other locations experience ponding adjacent to the roadway. Other culverts have been repaired by the Highway Department but may need a complete replacement. Specific locations with current or recent stormwater problems include: Snow Street, Ironstone Street, the storm drain at the end of Hickory Road, Legg St, Kempton Street, Orchard Street and Thayer Street, and Chestnut Hill Road (near the gas and power lines). Millville has not mapped drainage system as a whole to understand interdependencies.
- Millville's fire hydrants draw water from Mansfield Pond in south Millville. The water level of this pond has declined below the pump intake level during prior droughts. Also, the pump station that supplies the hydrants must be switched on manually and fed fuel. This creates an extra task for the volunteer firefighters. The hydrant system does not supply water town wide, only in the densely developed neighborhoods in Southern Millville.
- The water tank at the Millville Elementary School cannot be filled to its capacity and will require a permanent replacement soon.
- The entire town relies on private wells for water. While the Board of Health has processed some redrilling permits, there is not enough data to correlate these permits with drought conditions. However, wells are deeper on the north side or town shallower on the south side, because a rock shelf makes water more difficult to access in the north. The Board of Health is monitoring two sources of water contamination at the 0-65 block of Providence St and the Kempton Road superfund site. Sodium from road salting is a potential future concern.
- The entire town relies on septic systems to process wastewater. Flooding or higher ground water levels could present challenges for these systems in the future.
- Power outages are a common problem during storms. Trees fall across power lines in town, and on transmission coming in from outside of town (Uxbridge area).
- The Providence and Worcester rail line runs through the 1% annual chance flood plain along the Blackstone River. The rail line carries hazardous materials, so derailment is a concern.

2.5 ENVIRONMENTAL FEATURES

Millville's rural character is largely desired by residents to preserve ecological health and nature-based beauty. Driving through the town's backroads, you will find forestland, pastures, and open fields throughout the small town. Through the Open Space and Recreation Plan and Millville Master Plans of 2018, CMRPC has worked with the town to preserve open landscapes of natural resource areas, while stimulating the desired denser economic and residential development along Route 122.[23] However, perhaps the most important environmental features in the Town of Millville are its rivers.

Millville sits within the Lower Blackstone River Watershed and the Blackstone River-West River to Peters River sub-watershed. Within this, the four rivers running through Millville are some of the most important environmental features for the town. The largest, the Blackstone River, although no longer harnessed to drive industry as mentioned above, provides many ecological and social benefits to Millville today. Flowing from west to east, about 1.5 miles of the river passes through town. Millville is home to Lock 21, the best-preserved lock on the Blackstone Canal. Lock 21 is owned by the State of Massachusetts but it is managed locally by the Department of Conservation and Recreation. This historic location nearby the Blackstone riverfront is a cornerstone of Millville's town character. The other three rivers running through Millville are the Branch River, Mill River, and West River.[24]

With the benefits of abundant water resources and nearby rivers comes environmental contamination hazards, such as nonpoint source pollution. Spills of gasoline or other dangerous chemicals can occur during construction of roadways, roadway maintenance, and daily highway use. De-icing salt, debris on roads, and illegal dumping of hazardous chemicals can be picked up by storm water and be washed into catch basins leading to the rivers. Increased development near water sources can catalyze the process of run-off reaching the rivers, as impervious surfaces do not absorb stormwater.[25]

Many points of contamination from Millville to the nearby river have been located and controlled, however the soil's retention of toxic materials from the town's past can pose a contamination threat for the future. New development, hazardous waste sites, erosion, and sedimentation also pose risks for future ground and surface water contamination.[26]

[23] CMRPC, The Town of Millville Open Space and Recreational Plan. 2018.
[24] CMRPC, The Town of Millville Open Space and Recreational Plan. 2018.
[25] CMRPC, The Town of Millville Open Space and Recreational Plan. 2018.
[26] CMRPC, The Town of Millville Open Space and Recreational Plan. 2018.

2.5.1 CRB WORKSHOP DISCUSSION OF ENVIRONMENTAL FEATURES

Table 3: Environmental features discussed at the Millville CRB Workshop

Strengths

- The Blackstone River run through the southern portion of Millville. Most of the current 1% and .5% annual chance floodplains around the Blackstone are not developed, and steep slopes along the river may limit the extent of the floodplain.

Vulnerable features

- The invasive pests known as Spongy Moths (formerly called Gypsy Moths) have caused widespread damage to oak and ash trees in Millville. These insects weaken or kill trees, making them more susceptible to wind, drought and other weather. Falling trees cause outages and create public safety hazards. Tree death in Millville caused by pests, weather, or climate change, may expose the ground to erosive forces or instigate ecosystem shifts. Additionally, the loss of trees may make the town hotter and dryer over time and create additional fuel for wildfires.
- The railroad and part of the library building lie within the 1% annual chance flood plain, along with a couple of other buildings. A severe flood could damage these structures. Additionally, the boundaries of the floodplain do not account for future increases in precipitation volume caused by climate change.
- Beavers have altered the flow of water and created new wetlands in Millville, which have killed trees and led to isolated basement flooding. The wetland areas may slow stormwater and encourage its absorption into the ground, but their potential for property damage is also a concern.

2.6 LAND USE, RECENT AND POTENTIAL DEVELOPMENT

According to digital mapping of the community, Millville contains approximately 3,179 acres of land. Most of the land in Millville is zoned for low-density residential use. Millville has three residential zones, including a Village Center District near the Blackstone River. The town's Commercial zoning district traces Route 122 and Central Street, though only a small portion of the town is used for commercial purposes.[27]

According to assessor's records from 2016 to 2020, most recent development has occurred in south Millville, though homes have been constructed across town. There has been new single-family residential construction on 14 parcels in town, with more construction occurring in 2016 than in the years since. Figure 2 illustrates the location of new development in Millville relative to flood zones and regulated wetlands. Three recently developed parcels intersect with MA DEP regulated wetlands, and one of those also intersects with the .2% annual risk[28] flood zone. The location and

[27] CMRPC, Town of Millville MA Master Plan, 2018.
[28] Also called 500-year flood zone.

limited extent of new development since 2016 in Millville seems unlikely to significantly impact Millville's overall vulnerability to any natural hazards.

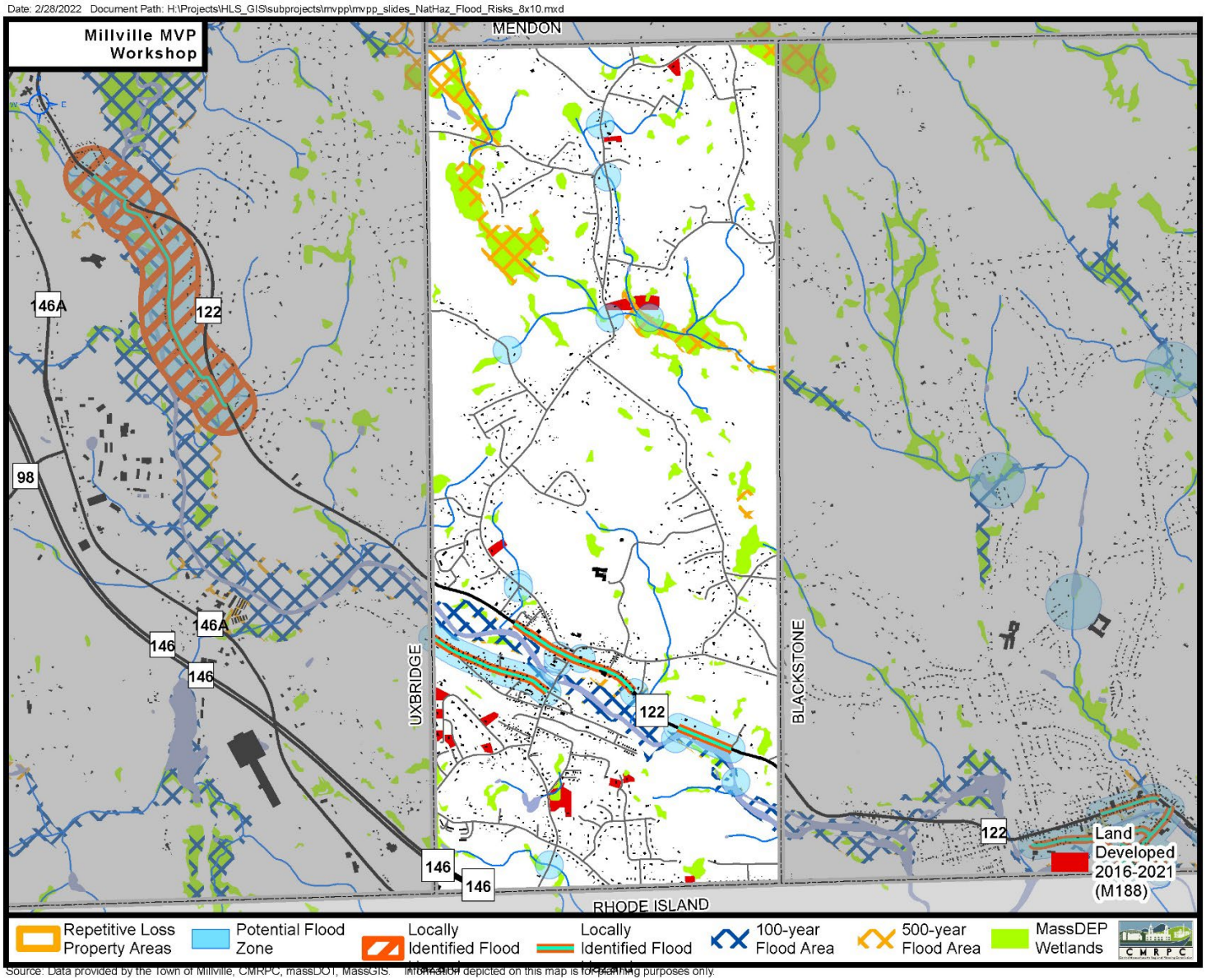

Figure 2: Map highlighting recent land development and flood risk.

3.0 CRITICAL FACILITIES & VULNERABLE POPULATIONS

A Critical Facility is defined as a building, structure, or location which:

- Is vital to the hazard response effort.
- Maintains an existing level of protection from hazards for the community.
- Would create a secondary disaster if a hazard were to impact it.

3.1 CRITICAL FACILITIES WITHIN MILLVILLE

The Critical Facilities List for the Town of Millville has been identified utilizing several sources, and the knowledge and expertise of the team:

- Millville's Comprehensive Emergency Management Plan
- MassGIS data
- Critical infrastructure mapping undertaken by CMRPC under contract with the Central Region Homeland Security Advisory Council, which is charged by the Executive Office of Public Safety and Security to administer and coordinate the State Homeland Security Grant for central Massachusetts.

This list of critical facilities was reviewed and updated by the project Core Team, and some critical facilities were also discussed during the Community Resilience Building workshop.

The Hazard Mitigation Team has broken up this list of facilities into four categories:

- Emergency Response Facilities needed in the event of a disaster
- Non-Emergency Response Facilities that have been identified by the Team as nonessential. These are not required in an emergency response event, but are considered essential for everyday Town operations
- Dams
- Facilities/Populations that the Team wishes to protect in the event of a disaster

Critical infrastructure and facilities are mapped in Appendix A.

3.2 CATEGORY 1 – EMERGENCY RESPONSE FACILITIES

The Town has identified the Emergency Response Facilities and Services as the highest priority in regards to protection from natural and man-made hazards.

Type	Name	Address	Details	Has Emergency Generator?
Police Station	Police Station	10 Central St	It has been damaged by past major storms and is somewhat subject to flooding during long-duration rain events.	Yes

Type	Name	Address	Details	Has Emergency Generator?
Communications Facilities/ Emergency Operation Center/ Fire Stations & Facilities	Fire Station #1 (HQ)	196 Main Street (serving as interim EOC)	Fire HQ is equipped with a backup generator (has to be started manually).	Yes, generator has to be started manually.
Fire Stations & Facilities	Fire Reservoir (Mansfield Pond)	Central Street (west of intersection with Bazeley Ave)	The pond water level has fallen below the pump level during drought conditions.	No, and pump to hydrant system must be started manually.
Communications Facilities	Elementary School		Police/fire/government radio repeater site (a small shed next to the water tower). Town received grant to update radio equipment and build new structure to house it.	
Highway Department	Garage/Office	290 Main Street	Housed within the town hall.	Yes
Highway Department	Salt Shed	30 Main Street		
Primary Evacuation Routes	Route 122 (Main Street)		Partly within 100-year flood zone.	
Primary Evacuation Routes	Lincoln Street			
Primary Evacuation Routes	Central Street		Partly within 100-year flood zone.	
Primary Evacuation Routes	Route 146			

3.3 CATEGORY 2 – NON-EMERGENCY RESPONSE FACILITIES

The Town has identified these facilities as non-emergency facilities; however, they are considered essential for everyday town operations.

Type	Name	Address	Details	Has Emergency Generator?
Water Supply	N/A		Town has private wells.	
Town Facilities	Senior Center	40 Prospect Street		Yes
Town Facilities	Free Public Library	169 Main Street	The library is located just above the high-water line of historic Blackstone River floods during hurricanes in the 1930s and 1950s and is adjacent to the 500-year flood zone.	
Town Facilities	Elementary School	122 Bethelette Way (Primary Shelter)	The school has been damaged (roof) by past severe storms.	Yes
Utilities	Algonquin natural gas pipeline	Runs east/west through center/north part of town	The pipeline briefly passes through the 500-year flood zone.	
Utilities	Providence & Worcester Railroad	Runs east/west along the Blackstone River	The P&W railroad is located predominantly within or next to FEMA flood zones and its historic bridges over the Blackstone may be vulnerable to earthquakes or the most severe river flooding	
Utilities	National Grid power lines	Various locations	A power line right-of-way off Chestnut Hill Road briefly passes through the 500-year flood zone.	

3.4 CATEGORY 3 – DAMS

There are no dams reported in Millville.

For additional information on dams and the dam failure hazard in Millville, also see Chapter 4.

3.5 CATEGORY 4 – FACILITIES/POPULATIONS TO PROTECT

Type	Name	Address	Details
Special Needs Population/Elderly Housing/Assisted Living	Uxbridge/Millville Regional Housing (For seniors)	22 West Street	The facility has a backup generator.

Public Buildings/Areas	Senior Center	40 Prospect Street	The facility has a backup generator. It is used as a heat and cooling shelter.
Public Buildings/Areas	Southern New England Trunkline Trail/Blackstone River Bikeway	Parallel to and south of the Blackstone River	
Schools/Daycares	Millville Elementary	122 Berthelette Way	
Schools/Daycares	Little Dreamers Preschool	11 Cork Circle	
Schools/Daycares	O'Connell (child care)	18 Allard Court	
Historic Buildings/Sites	According to the Massachusetts Cultural Resources Information System (MACRIS) online database accessed in January 2021, there are 10 Areas, 242 Buildings, 4 Burial Grounds, 1 Object, and 17 Structures listed for Millville. Several railroad bridges over the Blackstone River (including the Providence & Worcester Railroad bridges noted by the planning team as critical infrastructure) are included in MACRIS. Most historic buildings, and several of the historic areas in Millville lie within regulated or locally identified flood areas along the Blackstone River.		

EMPLOYMENT CENTERS

Based on data obtained from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD), the following table shows the largest employers in Millville:

Company name	Address	Number of employees
Millville Elementary School	Berthelette Way	50-99
Millville Fire Rescue	Main St	20-49
Millville Police Dept	Central St	10-19
St Augustine's Religious Edu	Lincoln St	10-19

Source: Department of Unemployment Assistance, Economic Research Department website: https://lmi.dua.eol.mass.gov/LMI/LargestEmployersArea#

ENVIRONMENTAL JUSTICE AND VULNERABLE POPULATIONS

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice policy sets the state's office definition for Environmental Justice areas. The policy states that EJ populations are those segments of the population that EEA has determined to be most at risk of being unaware of or unable to participate in environmental decision-making or to gain access to state environmental resources or are especially vulnerable. They are defined as neighborhoods (U.S. Census Bureau census block group data for minority criteria, and American Community Survey (ACS) data for state median income and English isolation criteria) that meet one or more of the following criteria:

- the annual median household income is not more than 65% of the statewide annual median household income;
- minorities comprise 40 % or more of the population;
- 25 % or more of households lack English language proficiency; or
- minorities comprise 25 % or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 % of the statewide annual median household income.

According to the EEA, there is not an Environmental Justice population in Millville.

4.0 HAZARD PROFILES, RISK ASSESSMENT & VULNERABILITIES

The following section includes a summary of natural hazards that have affected or could affect Millville in the future. Natural hazards are weather, climate, or environmental threats to lives, property, or other valuable assets to human society. By examining historical data on natural hazard occurrences, and future projections of how climate change will interact with natural hazards, it is possible to approximate the future risk of natural hazards. Historical research, discussions with local officials and emergency management personnel, available hazard mapping and other weather-related databases were used to develop this list.

The most significant identified hazards are the following:

- Flooding
- Severe Snowstorms / Ice storms/ Nor'easters
- Hurricanes
- Severe Thunderstorms / Wind / Tornadoes
- Wildfires / Brushfires
- Earthquakes
- Dam failure
- Drought
- Extreme Temperatures
- Other hazards

4.1 TOP HAZARDS AS DEFINED IN THE CRB WORKSHOP

The top hazards discussed at the CRB workshop were based on the highest rated hazards from the 2016 Hazard Mitigation Plan and a January 2021 Core Team discussion. These hazards were:

- Flooding
- Severe Snowstorms/ Ice Storms / Nor'easters
- Hurricanes
- Severe Thunderstorms / Wind / Tornado

4.2 STATE-WIDE OVERVIEW OF HAZARDS

4.2.1 MASSACHUSETTS STATE HAZARD MITIGATION AND CLIMATE ADAPTATION

The state of Massachusetts and Governor Baker's administration has instituted the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) through Executive Order 569. This plan outlines how the state of Massachusetts must prepare strategies to prevent, respond, and mitigate natural hazards.[29] The plan is the first of its kind to incorporate climate change adaptations into the

[29] https://resilientma.org/shmcap-portal/index.html

mitigation plan. The plan also makes Massachusetts eligible federal disaster recovery and hazard mitigation. The plan is effective under FEMA from September 19, 2018, to September 18, 2023. The Massachusetts SHMCAP is a useful model for incorporating climate change interactions into the natural hazard mitigation planning process.

4.2.2 CLIMATE CHANGE INTERACTIONS

The State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) outlines four major climate change interactions that influence natural hazards in Massachusetts. These four interactions are described as follows on pg.3-4 of the Massachusetts SHMCAP:

1. Changes in precipitation: Changes in the amount, frequency, and timing of precipitation—including both rainfall and snowfall—are occurring across the globe as temperatures rise and other climate patterns shift in response.
2. Sea level rise: Climate change will drive rising sea levels, and rising seas will have wide-ranging impacts on communities, natural resources, and infrastructure along the Commonwealth's 1,519 tidal shoreline miles.
3. Rising temperatures: Average global temperatures have risen steadily in the last 50 years, and scientists warn that the trend will continue unless greenhouse gas emissions are significantly reduced. The 9 warmest years on record all occurred in the last 20 years (2017, 2016, 2015, 2014, 2013, 2010, 2009, 2005, and 1998), according to the U.S. National Oceanographic and Atmospheric Administration (NOAA).
4. Extreme weather: Climate change is expected to increase extreme weather events across the globe, as well as right here in Massachusetts. There is strong evidence that storms—from heavy downpours and blizzards to tropical cyclones and hurricanes—are becoming more intense and damaging and can lead to devastating impacts for residents across the state.

4.3 NATURAL HAZARD IDENTIFICATION AND ANALYSIS

This section examines the hazards in the Massachusetts SHMCAP which are identified as likely to affect Millville. The analysis is organized into the following sections: Hazard Description, Location, Extent, Previous Occurrences, Probability of Future Events, Impact, and Vulnerability. A description of each of these analysis categories is provided below.

4.3.1 HAZARD DESCRIPTION

The natural hazards identified for Millville are: Flooding, Severe snowstorms / Ice storms / Nor'easters, Hurricanes, Severe thunderstorms / Wind / Tornadoes, Wildfire / Brushfire, Earthquakes, Dam Failure, Drought, and Extreme Temperatures. Many of these hazards result in similar impacts to a community. For example, hurricanes, tornadoes and severe snowstorms may cause wind-related damage.

4.3.2 LOCATION

Location refers to the geographic areas within the planning area that are affected by the hazard. Some hazards affect the entire planning area universally, while others apply to a specific portion, such as a floodplain or area that is susceptible to wildfires. Classifications are based on the area that would potentially be affected by the hazard, on the following scale:

Table 4: Percentage of Town Impacted by Natural Hazard

Land Area Affected by Occurrence	Percentage of Town Impacted
Large	More than 50% of the town affected
Medium	10 to 50% of the town affected
Small	Less than 10% of the town affected

4.3.3 EXTENT

Extent describes the strength or magnitude of a hazard. Where appropriate, extent is described using an established scientific scale or measurement system. Other descriptions of extent include water depth, wind speed, and duration.

4.3.4 PREVIOUS OCCURRENCES

Previous hazard events that have occurred are described. Depending on the nature of the hazard, events listed may have occurred on a local, state-wide, or regional level.

4.3.5 PROBABILITY OF FUTURE EVENTS

The likelihood of a future event for each natural hazard was classified according to the following scale:

Table 5: Frequency of Occurrence and Annual Probability of Given Natural Hazard

Frequency of Occurrence	Probability of Future Events
Very High	70-100% probability in the next year
High	40-70% probability in the next year
Moderate	10-40% probability in the next year
Low	1-10% probability in the next year
Very Low	Less than 1% probability in the next year

4.3.6 IMPACT

Impact refers to the effect that a hazard may have on the people and property in the community, based on the assessment of extent described above. Impacts are classified according to the following scale:

Table 6: Impacts, Magnitude of Multiple Impacts of Given Natural Hazard

Impacts	Magnitude of Multiple Impacts
Catastrophic	Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day.
Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

This section also describes aspects of Millville's infrastructure, environment or society that may experience disproportionate impacts of specific hazards relative to the rest of the town.

4.3.7 POTENTIAL CLIMATE CHANGE EFFECTS

Each natural hazard is influenced by one or more of the climate change interactions listed in *Section 4.2.2 Climate Change Interactions*. Climate change interactions can modify the location, extent, and probability of future events depending on the hazard. The section of the hazard risk assessment lists climate change interactions as described by the 2018 State Hazard Mitigation and Climate Adaptation Plan (SHMCAP).

4.3.8 VULNERABILITY

Based on the above metrics, a hazard index rating was determined for each hazard. The hazard index ratings are based on a scale of 1 through 5 as follows:

1 – Highest risk
2 – High risk
3 – Medium risk
4 – Low risk
5 – Lowest risk

The ranking is qualitative and is based, in part, on local knowledge of past experiences with each type of hazard. The size and impacts of a natural hazard can be unpredictable. However, many

of the mitigation strategies currently in place and many of those proposed for implementation can be applied to the expected natural hazards, regardless of their unpredictability.

Table 7: Hazard Identification and Analysis Worksheet for Millville

Type of Hazard	**Location of Occurrence**	**Probability of Future Events**	**Impact**	**Potential Climate Change Effects**	**Hazard Risk Index Rating**
Flooding	Small	Moderate	Minor	Increase extent; increase probability	3
Severe Snowstorms / Ice Storms/ Nor'easter	Large	Very High	Limited	Increase extent	2
Hurricanes	Large	Low	Limited	Increase extent; increase probability	3
Severe Thunderstorms/	Small	Moderate	Minor	Unclear	2
Tornadoes	Small	Very Low	Limited	Unclear	4
Wildfire / Brushfire	Small	Moderate	Minor	Increase extent; increase probability	4
Earthquakes	Large	Very Low	Minor	None	5
Dam Failure	Small	Very Low	Minor	Indirect effects related to flooding	5
Drought	Large	Very Low	Minor	Increase extent; increase probability	4
Extreme Temperatures	Large	Moderate	Limited	Increase in average temperature; increase in probability of extreme heat	4

Source: based on Massachusetts State Hazard Mitigation Plan, 2013; modified to reflect conditions in Millville.

4.4 FLOODING

Flooding was the most prevalent natural hazard identified by local officials in Millville. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Global climate change has the potential to exacerbate these issues over time with the potential for more severe and frequent storm and rainfall events. There are several different types of flood hazards – from stormwater inundation and poor drainage infrastructure to riverine flooding and storm surges to dam failures. Riverine and stormwater flooding both occur in Millville, though stormwater flooding is more common. Riverine flooding occurs when the surge of water comes from the top of streams, ponds, and rivers. Stormwater flooding occurs when the amount of precipitation in a storm is greater than the volume that the stormwater management system can handle.

LOCATION

Flooding and flood-prone areas in Millville are closely associated to the course of the Blackstone River and associated tributaries and wetlands, including Still Corner Brook. According to a GIS analysis performed by CMRPC, there are 141 parcels in Millville in areas that FEMA has assigned a 1% or .2% annual risk of flooding. Buildings on these parcels may be secure depending on their elevation within the parcel, building characteristics, and other factors. However, 13 buildings intersect with the 1% annual risk flood zone, and an additional 6 intersect with the .2% annual risk flood zone. Building footprints that overlap with these flood zones may be impacted by flooding of that magnitude, especially if homeowners have not taken action to mitigate their personal flood risk.

FEMA FLOOD ZONES

FEMA creates and manages Flood Insurance Rate Maps (FIRMs) that identify local flood hazard areas. These Special Flood Hazard Areas (SFHA) are locations that will be inundated by a flood event with a 1% or greater chance of occurring in any year. These areas are also referred to as the base flood, or 100-year flood zone. These areas are considered at high risk of flooding, and have around a 1 in 4 chance of flooding during a 30-year mortgage.

FEMA FIRMs also identify areas with a "moderate" flood risk, defined as locations between the 1% annual chance flood and a .2% annual chance flood. These areas are also known as the 500-year flood zone.

While Millville is in the heart of the Blackstone River lowland, the town's low hills and plateaus mean that the actual Blackstone floodplain is quite narrow (150 to 200 yards) – as a result, the location of this hazard is relatively "small". Map 2 in Appendix A illustrates the FEMA FIRM 1% and .2% annual chance flood zones in town, as well as locally-identified flooding areas. See below for discussion of previous flood occurrences and their locations.

As of May 2022, the Town of Millville has no repetitive loss structures as defined by FEMA's NFIP. As defined by the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see https://www.fema.gov/repetitive-flood-claims-grant-program-fact-sheet.

EXTENT

The average annual precipitation for the closest weather station to Millville[30] has been 50.19 inches for the period from 2010 to 2021. Annual rainfall levels recently peaked in 2018 at 62.46 inches.[31]

Water levels in Millville's rivers, streams, and wetlands rise and fall seasonally and during high rainfall events. High water levels are typical in spring, due to snowmelt and ground thaw. This is the period when flood hazards are normally expected. Low water levels occur in summer due to high evaporation and plant uptake (transpiration). Monthly precipitation levels are highly variable but for the period between 2010 and 2021 Millville[1] received the most precipitation in the months of April, October, and December. At any time, heavy rainfall may create conditions that raise water levels in rivers and streams above bank full stage, which then overflow adjacent lands. Heavy rainfall may also cause excessive runoff that causes the sides of roads to give way, creating a public safety concern and maintenance problem for the town's Highway Department.

PREVIOUS OCCURRENCES

In addition to the floodplains mapped by FEMA for the 1% and .2% annual chance floods, Millville periodically experiences minor flooding at isolated locations due to drainage problems, or problem culverts. Town staff have reported that flooding events are becoming more frequent in recent years. The following specific flooding locations (mapped in Appendix A) were identified by the Millville Hazard Mitigation Team:

- Chestnut Hill Road (at creek south of Vineyard St, at creek south of Hickory Road, at creek near the power line crossing, and near Oak Street)
- Chestnut Hill Road (severe road erosion at culvert near Desjardins Way)
- Kempton Road (near the National Grid power lines just north of Forest View Drive)
- 140s-160s Main Street (Hood's Brook/Blackstone River)
- Blackstone River at Providence & Worcester Railroad bridges
- Police Station/Town Hall (basement flooding when Blackstone River is high or during long-duration rainstorms; runoff intrudes into the dirt-floor basement; adjacent historic cemetery also floods)
- Central Street (at wetlands and cemetery on Rhode Island state line)
- Small Cemetery Flooding
- Ironstone Street (along Blackstone River)
- Main Street (Hood Brook Flooding)

[30] The Northbridge 2 weather station.

[31] National Weather Service. (n.d.). Observed Weather Annual Climate Report. National Weather Service. https://www.weather.gov/wrh/Climate?wfo=box

- Oak Street (near Chestnut Hill Road)
- The railroad bridges
- Hickory Road (storm drain damage)
- Debra Road (severe road erosion and drainage issues)
- Killiney Woods (severe road erosion and stormwater issues)
- Fisher Street

Most of the flood hazard areas listed here were identified due to known past occurrence in the respective area. There are other areas with no record of previous flood incidents that could be affected in the future by heavy rain and runoff. Additionally, some areas have experienced erosion and stormwater drainage failures.

Additionally, as noted in *2.4: Infrastructure Features,* the former Town Hall (including the Emergency Operations Center in the basement) was permanently vacated in July of 2016 due to structural weakness and toxic mold. The mold issue was caused by excess moisture in and around the building, rather than a catastrophic flood. The Core Project team reported that a stream underneath the old Emergency Operations Room, which may have been a source of the excess moisture, might also flow beneath the existing Police Station.

PROBABILITY OF FUTURE EVENTS

Based upon previous data, there is a "moderate" probability of localized flooding occurring in Millville in the next year.

IMPACT

The Town faces a minor impact, with less than 10% of total town area likely to be affected by a 1% annual chance flooding event. Based on the HAZUS analysis described below, a flood in Millville is unlikely to completely destroy any buildings, but a .2% annual chance flood event could displace residents and come with a significant economic cost.

Utilizing the GIS analysis noted in Location, above, the total building value of the 13 parcels with structures that are susceptible to a 1% annual chance flood is approximately $528,000. The total building value of the 6 parcels with structures that are susceptible to a .2% annual chance flood is approximately $595,600. This approximates the property value at risk of flooding, rather than the estimated financial impact of a major flood event.

HAZUS- MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The HAZUS software was used to model potential damages to the community from a .2% annual chance flood event, assuming a 1 square mile data resolution.

Table 8: Estimated Damages from Flooding

	.2% annual chance flood event
Building Characteristics	

Estimated total number of buildings in Millville	1,064
Estimated total building replacement value (2014 $)	$ 402,000,000
Building Damages	
# of buildings sustaining minor damage (1-10%)	0
# of buildings sustaining moderate damage (11-40%)	0
# of buildings sustaining severe damage (41-50%)	0
# of buildings destroyed	0
Population Needs	
# of households displaced	35
# of people seeking public shelter	5
Value of Damages	
Total property damage (buildings and content)	$ 6,360,000
Total losses due to business interruption	$ 5,260,000
Total Economic loss	**$11,630,000**

Though there are no recorded instances of a flood event of this size in Millville, this model was included in order to present a reasonable "worst case scenario" that would help planners and emergency personnel evaluate the impacts of flooding that might be more likely in the future, as we enter into a period of more intense and frequent storms. For more information on the HAZUS-MH software, go to http://www.fema.gov/hazus-software.

Millville is also concerned about impacts from excessive water other than flood inundation. The Core team observed that beaver dams (see Map 1 &3) have the potential to damage septic systems, which all Millville residences and businesses rely on. Also, the police station is currently challenged by rot in its foundation, which could be related to excessive moisture underneath the building. The building has experienced a prior toxic mold issue, and its suspended floor may allow moisture to seep into the building from below.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to flooding, or be disproportionately impacted by it, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in Section 3.0. These features include:

- Low-lying areas, including but not limited to the FEMA 1% and .2% annual chance flood zones.

- Specific locations with undersized or outdated storm water infrastructure that cannot handle sudden surges in precipitation.
- Residents who may have trouble evacuating from their residence due to age, health concerns, or lack of a vehicle.
- Flood-prone municipal buildings and critical infrastructure.
- Private wells that are subject to flooding and potential contamination from flood waters.
- Septic systems, especially in flood prone areas or locations with high water tables.
- Aquatic ecosystems, which may suffer from erosion, eutrophication, or sedimentation due to stormwater.
- The municipal financial burden of infrastructure maintenance and upgrades meant to address flooding.
- Highway department staff, who sometimes must unclog storm drains during extreme weather events. Due to limited staffing, highway department employees often have to go out alone, making safety a concern.
- Sides of roadways, which may be erode due to excessive rainfall. Lack of funding to make road repairs may compound this issue.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are three major ways that inland flooding can be influenced by climate change:

- Changes in precipitation may lead to more intense and more frequent downpours. Intense downpours that generate a high volume of precipitation in a short period of time may overwhelm stormwater infrastructure, saturate soils, and make them unable to absorb additional moisture, and cause river or stream flows to rise.
- Climate change may result in more frequent severe storms, which would increase the frequency of flooding, and make it more likely for multiple storms in a short duration to cause cumulative damage.
- "Vegetated ground cover" can slow down runoff water, making it more likely to absorb into the ground rather than flow into streams and rivers. Climate change could create more frequent drought conditions, and drought can stress or kill plants, limiting their ability to mitigate runoff from heavy rainfall.

In summary, climate change is likely to increase the extent and probability of future flood events in Millville.

VULNERABILITY

Based on this analysis and the assessment of the Millville Core Team, Millville faces a hazard index rating of "3 - medium risk" from flooding.

4.5 SEVERE SNOWSTORMS / ICE STORMS / NOR'EASTERS

Severe winter storms can pose a significant risk to property and human life. Severe snowstorms and ice storms can involve rain, freezing rain, ice, snow, cold temperatures, and wind. Heavy snowfall and extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia. A northeast coastal storm, known as a nor'easter, is typically a large counterclockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain.

LOCATION

The entire town of Millville is susceptible to severe snowstorms, which means the location of occurrence is "large." Because these storms occur regionally, they would impact the entire town is equally vulnerable.

EXTENT

The Northeast Snowfall Impact Scale (NESIS) characterizes and ranks high-impact Northeast snowstorms. These storms have large areas of 10-inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, NESIS gives an indication of a storm's societal impacts.

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score which varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers.

Table 9: Northeast Snowfall Impact Scale Categories[32]

Category	NESIS Value	Description
1	1—2.499	Notable
2	2.5—3.99	Significant
3	4—5.99	Major
4	6—9.99	Crippling
5	10.0+	Extreme

[32] National Centers for Environmental Information. (n.d.). Regional Snowfall Index (RSI). National Oceanic and Atmospheric Association. Retrieved January 27, 2022, from https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis

PREVIOUS OCCURRENCES

Based on data available from the National Oceanic and Atmospheric Administration, there are 66 high-impact snowstorms since 1958 that have affected the Northeast Corridor. Of these, approximately 34 storms resulted in snow falls in Millville of at least 10 inches. These storms are listed in the table below:

Table 10: Winter Storms Producing over 10 Inches of Snow in Millville, 1958-2023[33]1

Start Date	NESIS Value	NESIS Category	NESIS Classification
12/14/2020	3.21	2	Significant
3/11/2018	3.16	2	Significant
1/3/2018	2.27	1	Notable
3/12/2017	5.03	3	Major
2/8/2015	1.32	1	Notable
1/29/2015	5.42	3	Major
1/25/2015	2.62	2	Significant
3/4/2013	3.05	2	Significant
2/7/2013	4.35	3	Major
1/26/2011	2.17	1	Notable
1/9/2011	5.31	3	Major
12/24/2010	4.92	3	Major
2/23/2010	5.46	3	Major
12/18/2009	3.99	2	Significant
3/15/2007	2.54	2	Significant
2/12/2006	4.10	3	Major
1/21/2005	6.80	4	Crippling
2/15/2003	7.50	4	Crippling
3/31/1997	2.29	1	Notable
2/8/1994	5.39	3	Major
3/12/1993	13.2	5	Extreme
2/10/1983	6.25	4	Crippling
4/6/1982	3.35	2	Significant
2/5/1978	5.78	3	Major
1/19/1978	6.53	4	Crippling
2/18/1972	4.77	3	Major
2/22/1969	4.29	3	Major
2/8/1969	3.51	2	Significant
2/5/1967	3.50	2	Significant

[33] National Centers for Environmental Information. (n.d.). Regional Snowfall Index (RSI).

Start Date	NESIS Value	NESIS Category	NESIS Classification
2/2/1961	7.06	4	Crippling
1/18/1961	4.04	3	Major
12/11/1960	4.53	3	Major
3/2/1960	8.77	4	Crippling
2/14/1958	6.25	4	Crippling

PROBABILITY OF FUTURE EVENTS

Based upon the availability of records for Worcester County, the likelihood that a severe snowstorm will affect Millville is "very high" (greater than 70 percent in any given year).

Research on climate change indicates that there is great potential for stronger, more frequent storms as the global temperature increases (see *Potential Climate Change Effects*, below).

IMPACT

Millville faces a "limited" impact or less than 10 percent of total property damaged, from snowstorms.

The weight from multiple snowfall events can test the load ratings of building roofs and potentially cause significant damage. Multiple freeze-thaw cycles can also create large amounts of ice and make for even heavier roof loads. Of note, Millville's former town hall experienced structural damage from prior heavy snowstorms, which contributed to the building being condemned. This building has been condemned and is no longer heated. The lack of heating could cause additional snow and ice buildup on the compromised roof.

Utilizing the total value of all property, $362,628,726,[34] and an estimated 5 percent of damage to 10 percent of all structures, approximately $1,813,143 worth of damage could occur from a severe snowstorm. This is a rough estimate and likely reflects a worst-case scenario. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Other impacts from snowstorms and ice storms include:

- Tree damage and fallen branches that cause utility line damage and roadway blockages
- Disrupted power and phone service
- Unsafe roadways and increased traffic accidents
- Infrastructure and other property are also at risk from severe winter storms and the associated flooding that can occur following heavy snow melt.

[34] MA Department of Revenue Division of Local Services. (2022). Assessed Values by Class. Data Analytics and Resources Bureau. https://dlsgateway.dor.state.ma.us/reports/rdPage.aspx?rdReport=PropertyTaxInformation.AssessedValuesbyClass.assessedvaluesbyclass

- Damage to telecommunications structures
- Reduced ability of emergency officials to respond promptly to medical emergencies or fires

The Millville project team also noted that the town uses relatively heavy road salting, which helps prevent winter traffic accidents but may negatively impact salinity levels in private wells in the future.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to winter storms, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3.0*. These features include:

- Elderly residents, who may have more difficulty clearly snow and walking on icy or snow-covered sidewalks. Elderly residents may also be more vulnerable to extremely low temperatures.
- Households with low or fixed incomes who may be less able to afford sufficient heating or home improvements to improve energy efficiency and insulation.
- Renters, who may have less control over their living situation and indoor environment than homeowners.
- Public safety, utility, and highway department workers, who are tasked with responding to emergency calls, keeping the heat and power on, and keeping the streets clear during winter storms.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are three major ways that severe winter storms (including ice storms and nor'easters) can be influenced by climate change:

- Warming surface waters in the ocean will cause air moving over the water to retain more moisture, and as a result certain winter storms will be capable of dropping more snow than is typical for Massachusetts.
- Rising ocean temperatures may lead to changing atmospheric circulation patterns that make the formation of winter storms along the US East Coast more likely.
- Nor'easters may increase in frequency and intensity and may become more concentrated in the coldest winter months.

In summary, climate change is likely to increase the extent of winter storms in Millville.

VULNERABILITY

Based on the above assessment, Millville has a hazard index rating of "2 — high risk" from snowstorms and ice storms.

4.6 HURRICANES

Hurricanes begin as tropical storms that form over warm ocean waters in the Atlantic Ocean, Pacific Ocean, or off the west coast of Africa. The heated, moist air is drawn up into the atmosphere and begins circulating clockwise or counterclockwise depending on which hemisphere they are in. Tropical storms become hurricanes when their sustained winds exceed 74 miles per hour, or greater. The primary damaging forces associated with these storms are high-level sustained winds and heavy precipitation. Hurricanes winds can reach speeds of up to 200 miles per hour and can grow to 500 miles in diameter. In New England, hurricanes generally occur between August, September, and the first half of October, and can result in flooding and wind damage to structures and above-ground utilities.[35]

LOCATION

Because of the hazard's regional nature, all of Millville is at risk from hurricanes, meaning the location of occurrence is "large." Ridgetops are more susceptible to wind damage. Areas susceptible to flooding are also likely to be affected by heavy rainfall.

EXTENT

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Hurricane Wind Scale, which rates hurricane wind intensity on a scale of 1 to 5, with 5 being the most intense.

Table 11: Saffir-Simpson Scale[36]

Category	Maximum Sustained Wind Speed
1	74–95 mph: very dangerous winds will produce some damage
2	96–110 mph: extremely dangerous winds will cause extensive damage
3	111–129 mph: devastating damage will occur
4	130–156 mph: catastrophic damage will occur
5	157 + mph: catastrophic damage will occur

[35] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[36] National Hurricane Center and Central Pacific Hurricane Center. (n.d.). Saffir-Simpson Hurricane Wind Scale. National Oceanic and Atmospheric Association. Retrieved January 31, 2022, from https://www.nhc.noaa.gov/aboutsshws.php

PREVIOUS OCCURRENCES

Hurricanes that have affected the region in which Millville is located are shown in the following table:

Table 12: Major Hurricanes and Tropical Storms Affecting Millville (1970-Present)[37]

Storm Name	Year	Saffir/Simpson Category (when reached MA)
Belle	1976	Tropical Storm
Gloria	1985	1
Henri	1985	Tropical Storm
Chris	1988	Minor Storm
Bob	1991	2
Beryl	1994	Tropical Storm
Bertha	1996	Tropical Storm
Floyd	1999	Tropical Storm
Gordon	2000	Minor Storm
Hermine	2004	Tropical Storm
Barry	2007	Minor Storm
Hanna	2008	Minor Storm
Irene	2011	Tropical Storm
Sandy	2012	"Super Storm"
Andrea	2013	Minor Storm
Elsa	2021	Tropical Storm
Fred	2021	Extratropical Storm
Henri	2021	Tropical Storm/Depression

PROBABILITY OF FUTURE EVENTS

Millville's location in central Massachusetts approximately 35 miles inland reduces the risk of extremely high winds that are associated with hurricanes, although it can still experience some high wind events. Based upon past occurrences, it is reasonable to say that there is a "low" probability (1 percent to 10 percent in any given year) of hurricanes in Millville. Climate change is projected to result in more severe weather, including increased occurrence of hurricanes and tropical storms. Because of this, the occurrence of hurricanes will increase in the future.

[37] Office for Coastal Management. (2021). Historical Hurricane Tracks [Digital]. National Oceanic and Atmospheric Administration.

IMPACT

A description of the damages that could occur due to a hurricane is described by the Saffir-Simpson scale, as shown below:

Table 13: Hurricane Damage Classifications[38]

Storm Category	Damage Level	Description of Damages	Wind Speed (MPH)
1	MINIMAL Very dangerous winds will produce some damage	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. An example of a Category 1 hurricane is Hurricane Dolly (2008).	74-95
2	MODERATE Extremely dangerous winds will cause extensive damage	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. An example of a Category 2 hurricane is Hurricane Francis in 2004.	96-110
3	EXTENSIVE Devastating damage will occur	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland. An example of a Category 3 hurricane is Hurricane Ivan (2004).	111-129
4	EXTREME Catastrophic damage will occur	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. An example of a Category 4 hurricane is Hurricane Charley (2004).	130-156
5	CATASTROPHIC Catastrophic damage will occur	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. An example of a Category 5 hurricane is Hurricane Andrew (1992).	157+

HAZUS- MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The HAZUS software was used to model potential damages to the community from a 100-year and 500-year hurricane event; storms that are 1% and .0.2% likely to happen in a given year, and roughly equivalent to a Category 1 and Category 2 hurricane.

[38] National Hurricane Center and Central Pacific Hurricane Center. (n.d.). Saffir-Simpson Hurricane Wind Scale. National Oceanic and Atmospheric Association. https://www.nhc.noaa.gov/aboutsshws.php

The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the Town, bringing the strongest winds and greatest damage potential.

Table 14: Estimated Damages from Hurricanes

	100-Year storm (89 mph winds)	500-Year storm (102-105 mph winds)
Building Characteristics		
Estimated total number of buildings	1,064	
Estimated total building replacement value (2014 $)	$402,000,000	
Building Damages		
# of buildings sustaining minor damage	36	180
# of buildings sustaining moderate damage	2	25
# of buildings sustaining severe damage	0	1
# of buildings destroyed	0	0
Population Needs		
# of households displaced	0	6
# of people seeking public shelter	0	3
Debris		
Building debris generated (tons)	145	610
Tree debris generated (tons)	1,429	3,176
# of truckloads to clear building debris	6	24
Value of Damages (thousands of dollars)		
Total property damage (buildings and content)	$ 1,545,840	$6,294,190
Total losses due to business interruption	$ 92,240	$563,500

Though there are no recorded instances of a hurricane equivalent to a 500-year storm passing through Massachusetts, this model was included in order to present a reasonable "worst case scenario" that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms. For more information on the HAZUS-MH software, go to http://www.fema.gov/hazus-software.

The Town faces a "limited" impact from hurricanes, with 10 percent or less of Millville affected.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to hurricanes, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3.0*. Vulnerable community features include:

- The electrical grid is vulnerable to outages from trees falling across power lines. National Grid proactively trims trees in their right of way, but outages are still common. The Core Team reported that extensive, recent trimming along Chestnut Hill Road has reduced the number of outages experienced in this part of Millville. Certain residents, such as people dependent on life support machines or ventilators, may be more vulnerable to power outages. This challenge has been exacerbated by a recent gypsy moth resurgence, which damaged many trees. Climate change is expected to place further stress on local trees, and therefore increase the management burden for the town.

- Municipal buildings have been impacted by high winds in the past. Damage to these buildings could impact critical town functions and be a distraction from other essential emergency response and recovery activities. Buildings with prior storm damage include the former Town Hall, the Library, the Police Headquarters, the Elementary School, and the Highway Department's salt shed.

- Public safety, utility, and highway department workers, who are tasked with responding to emergency calls and keeping the streets clear during hurricanes.

In addition to high winds, hurricanes can also bring heavy precipitation and cause flooding. The vulnerable features identified in the Flooding section on page 36 also apply to hurricanes.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are two major ways that hurricanes and tropical storms can be influenced by climate change:

- Warming oceans will provide more energy for hurricanes and tropical storms, which could lead to more intense or potentially damaging storms in the future, and larger storms could result in more storms that are likely to impact Massachusetts.
- Warmer air can hold more water vapor and will enable greater precipitation rates during future storms.

In summary, climate change is likely to increase the frequency and extent of hurricanes in Millville.

VULNERABILITY

Based on the above analysis, Millville has a hazard index rating of "3 – medium risk" from hurricanes.

4.7 SEVERE THUNDERSTORMS / WIND / TORNADO

A thunderstorm is a storm with lightning and thunder produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain, and sometimes generating hail. Effective January 5, 2010, the NWS modified the hail size criterion to classify a thunderstorm 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.

Every thunderstorm has an updraft (rising air) and a downdraft (sinking air). Sometimes strong downdrafts known as downbursts can cause tremendous wind damage that is similar to that of a tornado. A small (less than 2.5 mile path) downburst is known as a "microburst" and a larger downburst is called a "macro-burst." An organized, fast-moving line of microbursts traveling across large areas is known as a "derecho." These occasionally occur in Massachusetts. The strongest downburst recorded was a downburst in North Carolina of 175 mph. Winds exceeding 100 mph have been measured from downbursts in Massachusetts.[39]

Wind is air in motion relative to surface of the earth. For non-tropical events over land, the NWS issues a Wind Advisory (sustained winds of 31 to 39 mph for at least 1 hour or any gusts 46 to 57 mph) or a High Wind Warning (sustained winds 40+ mph or any gusts 58+ mph). For non-tropical events over water, the NWS issues a small craft advisory (sustained winds 25-33 knots), a gale warning (sustained winds 34-47 knots), a storm warning (sustained winds 48 to 63 knots), or a hurricane force wind warning (sustained winds 64+ knots). For tropical systems, the NWS issues a tropical storm warning for any areas (inland or coastal) that are expecting sustained winds from 39 to 73 mph. A hurricane warning is issued for any areas (inland or coastal) that are expecting sustained winds of 74 mph. Effects from high winds can include downed trees and/or power lines and damage to roofs, windows, etc. High winds can cause scattered power outages. High winds are also a hazard for the boating, shipping, and aviation industry sectors.

Tornadoes are swirling columns of air that typically form in the spring and summer during severe thunderstorm events. In a relatively short period of time and with little or no advance warning, a tornado can attain rotational wind speeds in excess of 250 miles per hour and can cause severe devastation along a path that ranges from a few dozen yards to over a mile in width. The path of a tornado may be hard to predict because they can stall or change direction abruptly. Within Massachusetts, tornadoes have occurred most frequently in the Connecticut River Valley and in western Worcester County, with Millville some 35 miles east of the zone of most frequent past occurrence. High wind speeds, hail, and debris generated by tornadoes can result in loss of life, downed trees and power lines, and damage to structures and other personal property.

LOCATION

As per the Massachusetts Hazard Mitigation Plan, the entire Town is at risk of high winds, severe thunderstorms, and tornadoes. The plan identifies Millville and its surrounding communities as having

[39] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

a moderate frequency of tornado occurrence within the Massachusetts context. However, the actual area affected by thunderstorms, wind, or tornadoes is "small," with less than 10 percent of the Town generally affected.

EXTENT

An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms. Thunderstorms can cause hail, wind, lightning damage, and flooding.

High wind can be linked to a number of different hazards, including hurricanes and winter storms, in addition to thunderstorms and tornadoes. High winds can cause damage to structures, trees, as well as increase the risk of wildfire.

Tornadoes are measured using the enhanced F-Scale, shown with the following categories and corresponding descriptions of damage:

Table 15: Enhanced Fujita Scale Levels and Descriptions of Damage[40]

EF-Scale Number	Intensity Phrase	3-Second Gust (MPH)	Type of Damage Done
EF0	Gale	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	Moderate	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	Significant	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	Devastating	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

[40] National Oceanic and Atmospheric Administration. (n.d.). The Enhanced Fujita Scale (EF Scale). National Weather Service; NOAA's National Weather Service. Retrieved January 31, 2022, from https://www.weather.gov/oun/efscale

Table 16: Extent Scale for Hail[41]

HAIL SIZE (in.)	OBJECT ANALOG REPORTED
.50	Marble, moth ball
.75	Penny
.88	Nickel
1.00	Quarter
1.25	Half Dollar
1.50	Walnut, ping pong
1.75	Golf ball
2.0	Hen egg
2.5	Tennis ball
2.75	Baseball
3.00	Tea cup
4.00	Grapefruit
4.50	Softball

PREVIOUS OCCURRENCES

Because thunderstorms and wind affect the town regularly on an annual basis, there are not significant records available for these events. As per the Massachusetts Hazard Mitigation Plan, there are approximately 10 to 30 days of thunderstorm activity in the state each year.

In Worcester County, there have been several F1 tornadoes over the years. However, a data search for tornadoes rating 3 or above, or resulting in death/injury, or significant property damage, identifies the following events:

- In 1953, an F4 tornado struck Worcester. The event resulted in at least 90 fatalities, and more than 1,200 injured. There was extensive property damage. On the same date, an F3 tornado began in the Town of Sutton.
- In 1981 an F3 tornado struck Westminster, resulting in just 3 injuries and very little reported property damage.
- In June 2011, an F3 tornado struck Massachusetts. Few deaths were reported, all in Hampden County. No deaths were reported in Worcester County.

[41] National Oceanic and Atmospheric Administration. (n.d.). Hail Size as Related to Objects. Storm Prediction Center. Retrieved January 31, 2022, from https://www.spc.noaa.gov/misc/tables/hailsize.htm

In 1986, an F1 tornado touched down in southern Millville. It caused significant tree and power line damage, but only minor property damage. However, within the last 5 years, there has only been one small tornado that has affected communities near Millville:

- 2018 Tornado (East Douglas, Uxbridge, Upton

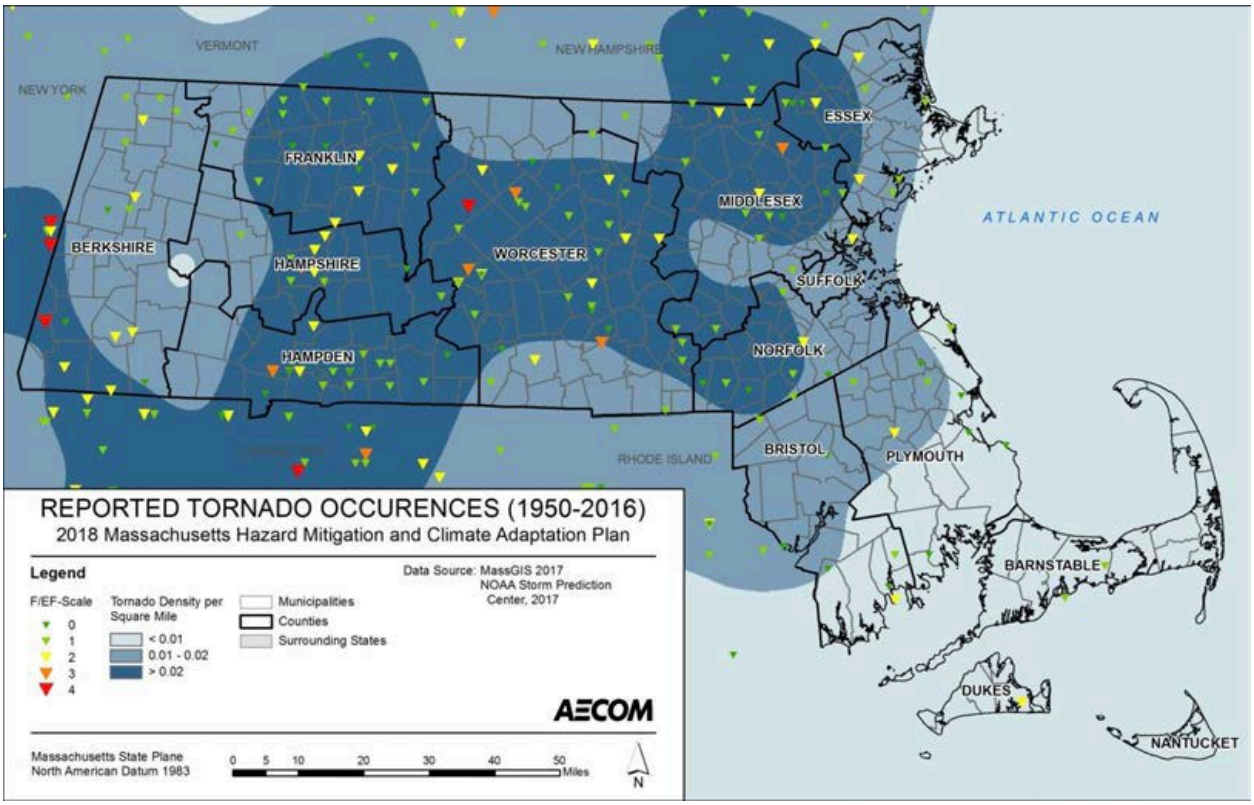

Image 2: Density of Reported Tornados per Square Mile (1950-2016). Source: Massachusetts State Hazard Mitigation and Climate Adaptation Plan, 2018.

Image 3: Above: NASA released this image of part of the 39-mile-long tornado track through south-central Mass. The image was captured on June 5, 2011 by Landsat 5 satellite.

PROBABILITY OF FUTURE EVENTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, Massachusetts experienced 171 tornados between 1950 and 2017, or an average of 2.6 tornado events per year. The report goes on to state that "Massachusetts ranks 35th among the states for the frequency of tornadoes, 14th for the frequency of tornadoes per square mile, 21st for injuries, and 12th for cost of damage." Tornado activity may become more variable due to climate change, so it is difficult to predict the likelihood of future events in Millville (see below, Potential Climate Change Effects).

Based upon the available historical record, as well as Millville's location in a moderate-density cluster of tornado activity for Massachusetts, there is a "very low" probability (less than 1 percent chance in any given year) of a tornado affecting the town, and a moderate (10 percent to 40 percent chance in any given year) probability of a severe thunderstorm and/or high winds.

IMPACT

Overall, Millville faces a "minor" impact from severe thunderstorms, and a "limited" impact from severe winds, or tornados, with 10 percent or less of the Town likely to be affected.

The Enhanced Fujita Scale Levels (see above, Extent) for tornados describes the likely impacts of tornados on the physical environment.

The potential for locally catastrophic damage is a factor in any tornado, severe thunderstorm, or wind event. In Millville, approximately half of the residential buildings in the town have been built to Zone 1, Design Wind Speed Codes. The first edition of the Massachusetts State Building Code

went into effect on January 1, 1975, and 50% percent of the town's 1,315 housing units was constructed in 1979 or earlier.[42] Older homes may be vulnerable to high winds, as well as utility lines throughout town, particularly where trees have not been trimmed recently.

Utilizing the total value of all property, $362,628,726,[43] and an estimated 10 percent of damage to 5 percent of all structures, the estimated amount of damage from a tornado would be $1,813,143. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to severe thunderstorms/wind/tornadoes, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3.0*. Vulnerable features to severe thunderstorms/wind/tornadoes overlap with features vulnerable to hurricanes (pg. 46) and flooding (pg. 36).

POTENTIAL CLIMATE CHANGE EFFECTS

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) notes that it is not currently possible to predict how tornados will be impacted by climate change. Tornados are too small to be simulated with accuracy by climate models. Also, they are measured based on their impact rather than inherent physical characteristics, so it's difficult to state whether tornados will increase in frequency and intensity because that depends in part on how many people live in the areas where tornados occur. These challenges make specific predications about the changes to tornadoes from impossible. However, the SHMCAP report goes on to note that "the conditions that are conducive to tornadoes (which are also conducive to other weather phenomena, such as hurricanes and tropical storms) are expected to become more severe under global warming" (pg. 4-246).

The SHMCAP report also does not draw clear conclusions about the impact of climate change on thunderstorms. It notes that while a warming climate will increase the capacity of the atmosphere to hold water vapor, precipitation rates are dependent on other factors that complicate predictions at local scales. It is likely that annual precipitation will increase, and some studies seem to indicate that precipitation rates will increase the temperatures when peak participation rates are likely to occur (pg. 4-465).

[42] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, DP04.
[43] MA Department of Revenue Division of Local Services. (2022). Assessed Values by Class. Data Analytics and Resources Bureau.

VULNERABILITY

Based on the above assessment, Millville has a hazard index rating of "2- high risk" from severe thunderstorms and winds, and a "4 – low risk" from tornadoes.

4.8 WILDFIRES / BUSH FIRES

Wildfires are typically larger fires, involving full-sized trees as well as meadows and scrublands. Brushfires are uncontrolled fires that occur in meadows and scrublands, but do not involve full-sized trees. Typical causes of brushfires and wildfires are lightning strikes, human carelessness, and arson. Relative humidity and wind and two weather-related factors that influence fire danger. Relative humidity refers to "the ratio of the amount of moisture in the air to the amount of moisture necessary to saturate the air at the same temperature and pressure."[44] When relative moisture drops, light fuels like grasses become drier and burn more easily.[45]

FEMA has classifications for 3 different classes of wildfires:

- Surface fires are the most common type of wildfire, with the surface burning slowly along the floor of a forest, killing or damaging trees.
- Ground fires burn on or below the forest floor and are usually started by lightening
- Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions.

Potential vulnerabilities to wildfires include damage to structures and other improvements and impacts on natural resources. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases.

LOCATION

62% of total land area in Southern Worcester County is forested land.[46] Much of this region of Massachusetts, including the Millville area, have a high risk of wildfire. In Millville, an estimated 66% of the land is forested.[47] While Millville is developed in a mostly low-density rural/suburban pattern and few uninterrupted tracts of forest are present, the substantial tree coverage does present some risk for wildfires and brush fires. The total amount of town that could be affected by a wildfire is categorized as "small," or less than 10 percent of the total area.

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[44] U.S. National Park Service. (2021, January 21). Understanding Fire Danger. National Park Service. https://www.nps.gov/articles/understanding-fire-danger.htm
[45] U.S. National Park Service (2021).
[46] Mass GIS. (2016). Land Cover/Land Use [Map]. https://www.mass.gov/info-details/massgis-data-2016-land-coverland-use
[47] Mass GIS (2016).

Millville residents and business utilize individual private well water. The Millville Fire Department maintains a dry hydrant system drawing from a Mansfield Pond off of Central Street to provide fire protection to the south-central portion of town. The draw system is powered by a manually-operated generator lacking autostart capability, and the reservoir frequently runs low during dry times of year (and drought years), rendering hydrants ineffective or inoperable. Mitigation measures include using a pump truck to access Blackstone River water. Tanker trucks can also go directly to fire sites.

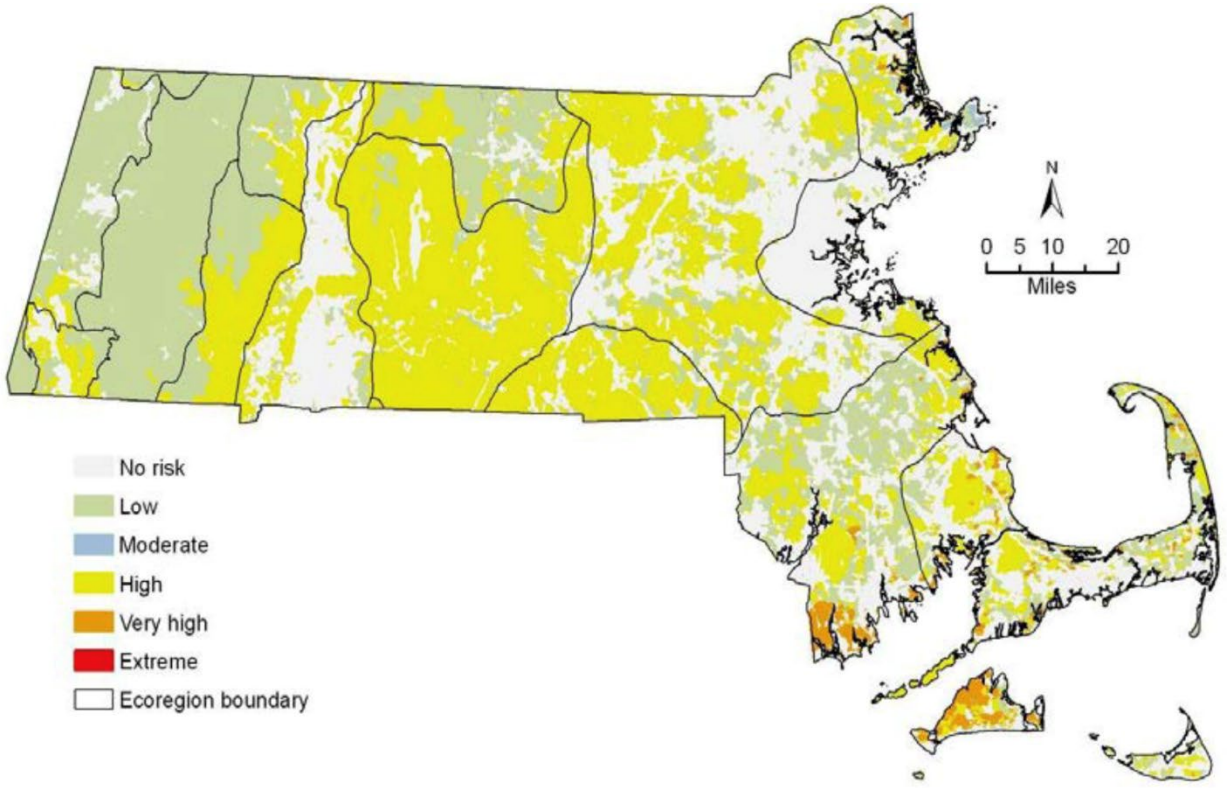

Figure 3: Wildfire Risk Areas for the Commonwealth of Massachusetts. Source: 2018 SHMCAP.

EXTENT

Wildfires can cause widespread damage. They can spread very rapidly, depending on local wind speeds and can be very difficult to get under control. Fires can last for several hours up to several days.

In Millville, approximately 66% percent of the town's total land area is deciduous forest, and an additional 3% of the town consists of grassland or shrub. These areas are at risk of fire and are spread evenly throughout the community, with developed areas, rivers and major transportation corridors (Route 146 and the Providence & Worcester Railroad) breaking up the forest. In drought conditions, a brushfire or wildfire would be a matter of concern.

There have not been any major wildfires in Millville in recent decades. Based on historic data for 2011-2020, the 17 natural vegetation fires in Millville during that period burned 8 acres of land.[48] Therefore, the average fire size over that period was only .47 acres per incident.

The National Fire Danger Rating system illustrates the potential extent of wildfires should they occur under the described fire danger conditions:

Table 17: National Fire Danger Rating System[49]

Rating	Basic Description	Detailed Description
CLASS 1: Low Danger (L) Color Code: Green	Fires not easily started	Fire starts are unlikely. Weather and fuel conditions will lead to slow fire spread, low intensity, and relatively easy control with light mop up. Controlled burns can usually be executed with reasonable safety.
CLASS 2: Moderate Danger (M) Color Code: Blue	Fires start easily and spread at a moderate rate	Some wildfires may be expected. Expect moderate flame length and rate of spread. Control is usually not difficult and light to moderate mop up can be expected. Although controlled burning can be done without creating a hazard, routine caution should be taken.
CLASS 3: High Danger (H) Color Code: Yellow	Fires start easily and spread at a rapid rate	Wildfires are likely. Fires in heavy, continuous fuel, such as mature grassland, weed fields, and forest litter, will be difficult to control under windy conditions. Control through direct attack may be difficult but possible, and mop up will be required. Outdoor burning should be restricted to early morning and late evening hours.
CLASS 4: Very High Danger (VH) Color Code: Orange	Fires start very easily and spread at a very fast rate	Fires start easily from all causes and may spread faster than suppression resources can travel. Flame lengths will be long with high intensity, making control very difficult. Both suppression and mop up will require an extended and very thorough effort. Outdoor burning is not recommended.
CLASS 5: Extreme (E) Color Code: Red	Fire situation is explosive and can result in extensive property damage	Fires will start and spread rapidly. Every fire start has the potential to become large. Expect extreme, erratic fire behavior. NO OUTDOOR BURNING SHOULD TAKE PLACE IN AREAS WITH EXTREME FIRE DANGER.

[48] Massachusetts Department of Fire Services. (2021). Natural Vegetation Fires (2011-2020).
[49] U.S. National Park Service (2021). U.S. National Park Service (2021).

PREVIOUS OCCURRENCES

Millville has a volunteer/on-call fire department. There have not been any major forest fires in Millville in recent decades. During the period 2011-2020, there were between 0 and 4 brush fires per year in town, resulting in a financial loss of $3,200 over the 10-year period.

PROBABILITY OF FUTURE EVENTS

In accordance with the 2018 State Hazard Mitigation and Climate Adaptation Plan, the Millville Hazard Mitigation Team found it difficult to predict the likelihood of wildfires in a probabilistic manner because of the number of variables involved - fuel availability, weather and climate conditions, and human activity all factor into wildfire occurrences. However, based on regular previous occurrences of minor brush fires, the planning team determined the probability of future damaging wildfire events to be "moderate" (10 percent to 40 percent probability in the next year).

Climate scenarios project that by mid-century, the mean summer temperatures in the Blackstone River basin will increase by 1.08° F to 4.53° F.[50] Combined with increasingly variable precipitation, rising temperatures could exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases.

Climate change is also predicted to bring increased wind damage from major storms, as well as new types of pests to the region. Both increased wind and the introduction of new pests could potentially create more debris in wooded areas and result in a larger risk of fires.

IMPACT

While a large wildfire could in theory damage much of the landmass of Millville, most forested areas are sparsely developed, meaning that wildfire affected areas are not likely to cause damage to property. For this reason, the town faces a "minor" impact from wildfires, with little damage likely to occur.

Both wildfires and brush fires can consume homes, other buildings and/or agricultural resources. The impact of wildfires and brush fires are as follows:

- Impact to benefits that people receive from the environment, such as food/water and the regulation of floods and drought
- Impact on local heritage, through the destruction of natural features
- Impact to the economy, due to damage to property and income from land following a wildfire

[50] Northeast Climate Adaptation Science Center. (n.d.). Datagrapher. ResilientMA. https://resilientma.org/datagrapher

- Impact through the destruction of people and property

Utilizing the total value of all property, $362,628,726,[51] and an estimated 5 percent of damage to 1 percent of all structures, the estimated amount of damage from a wildfire is $181,314. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to wildfires/brushfires, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3.0*. Vulnerable community features include:

- People who are sensitive to smoke, including children, the elderly, and individuals with other health conditions. Wildfires outside of Millville may also impact the town residents. Air pollution from wildfires can be a severe public health concern. Smoke can exacerbate respiratory conditions like asthma and carry toxic chemicals and particulate matter. In 2021, wildfire smoke from western states and Canada extended across the continental US forced the Massachusetts Department of Environmental Protection to issue an air quality alert.[52]
- The Millville Elementary School. The water suppression pumping tower at elementary school was recently relined but it is likely at the end of its useful life. The water tower is operating at 65% of capacity because a full tower could compromise the structural integrity of the tank. This pump feeds the school's hydrant system and sprinkler system. School district staff noted that the tank pump had jammed in April 2022, creating a major maintenance problem for the school, and highlighting the need for a more resilient system.
- First responders, especially the town's volunteer firefighters.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are two major ways that wildfires/brushfires can be influenced by climate change:

- Seasonal drought risk is projected to increase and summer temperatures are expected to rise. Rising temperatures and changes in precipitation could cause vegetation to dry out and become more flammable.
- Rising temperatures may cause the frequency of lightning strikes to increase, which could spark more wildfires.

[51] MA Department of Revenue Division of Local Services. (2022). Assessed Values by Class. Data Analytics and Resources Bureau.
[52] McAlpine, K. J. (2021, July 27). Wildfire Smoke in New England Is "Pretty Severe from Public Health Perspective." The Brink. https://www.bu.edu/articles/2021/wildfire-smoke-in-new-england/

Seasonal drought may also make it more difficult to ensure a reliable water source for firefighting. The more densely developed South Millville neighborhoods benefit from the town's hydrant system, though the hydrant water source is already affected by seasonal dry spells. Elsewhere in town, Millville relies on tanker trucks to supply water. The Blackstone River may be a more reliable water source for firefighting in the future.

In summary, climate change is likely to increase the frequency and extent of wildfires in Millville.

VULNERABILITY

Based on the above assessment, Millville has a hazard risk index of "4 – low risk" from wildfires. However, this risk assessment is highly dependent on short term weather patterns like wind, lightning, and rainfall, which are impossible for the town to predict with certainty.

4.9 EARTHQUAKES

An earthquake is a sudden, rapid shaking of the ground that is caused by the breaking and shifting of rock beneath the Earth's surface. Earthquakes can occur suddenly, without warning, at any time of the year. Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings, buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.

LOCATION

Because of the regional nature of the hazard, the entire Town of Millville is susceptible to earthquakes. This makes the location of occurrence "large," or over 50 percent of the total area.

EXTENT

The magnitude of an earthquake is sometimes measured using the Richter Scale, which measures the energy of an earthquake by determining the size of the greatest vibrations recorded on the seismogram. On this scale, one step up in magnitude (from 5.0 to 6.0, for example) increases the energy more than 30 times. Earthquakes are also commonly measured using the moment magnitude scale, which provides similar measurements to the Richter scale but more accurately measures earthquakes with magnitudes greater than 8.[53]

Table 18: Richter Scale Magnitudes and Effects

Magnitude	Effects
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

[53] Michigan Tech. (n.d.). How Do We Measure Earthquake Magnitude? Michigan Technological University. Retrieved February 3, 2022, from https://www.mtu.edu/geo/community/seismology/learn/earthquake-measure/

The intensity of an earthquake is measured using the Modified Mercalli Scale. This scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and man-made structures on a scale of I through XII, with I denoting a weak earthquake and XII denoting an earthquake that causes almost complete destruction.

Table 19: Modified Mercalli Intensity Scale for and Effects[54]

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs.	
II	Feeble	Some people feel it.	< 4.2
III	Slight	Felt by people resting; like a truck rumbling by.	
IV	Moderate	Felt by people walking.	
V	Slightly Strong	Sleepers awake; church bells ring.	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

[54] U.S. Geological Survey. (n.d.). The Modified Mercalli Intensity Scale. UGGS. Retrieved February 3, 2022, from https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale?qt-science_center_objects=0#qt-science_center_objects

PREVIOUS OCCURRENCES

The last earthquake to cause major damage in New England occurred in 1755,[55] though seismologists state that another serious earthquake occurrence is possible. There are five seismological faults in Massachusetts, but there is no discernible pattern of previous earthquakes along these fault lines. Additionally, earthquakes that are based in more seismologically active regions like parts of Canada may also impact Massachusetts.[56] Earthquakes occur without warning and may be followed by aftershocks. Image 3 shows the locations of earthquakes that have occurred across the New England region and beyond over the last 45 years.

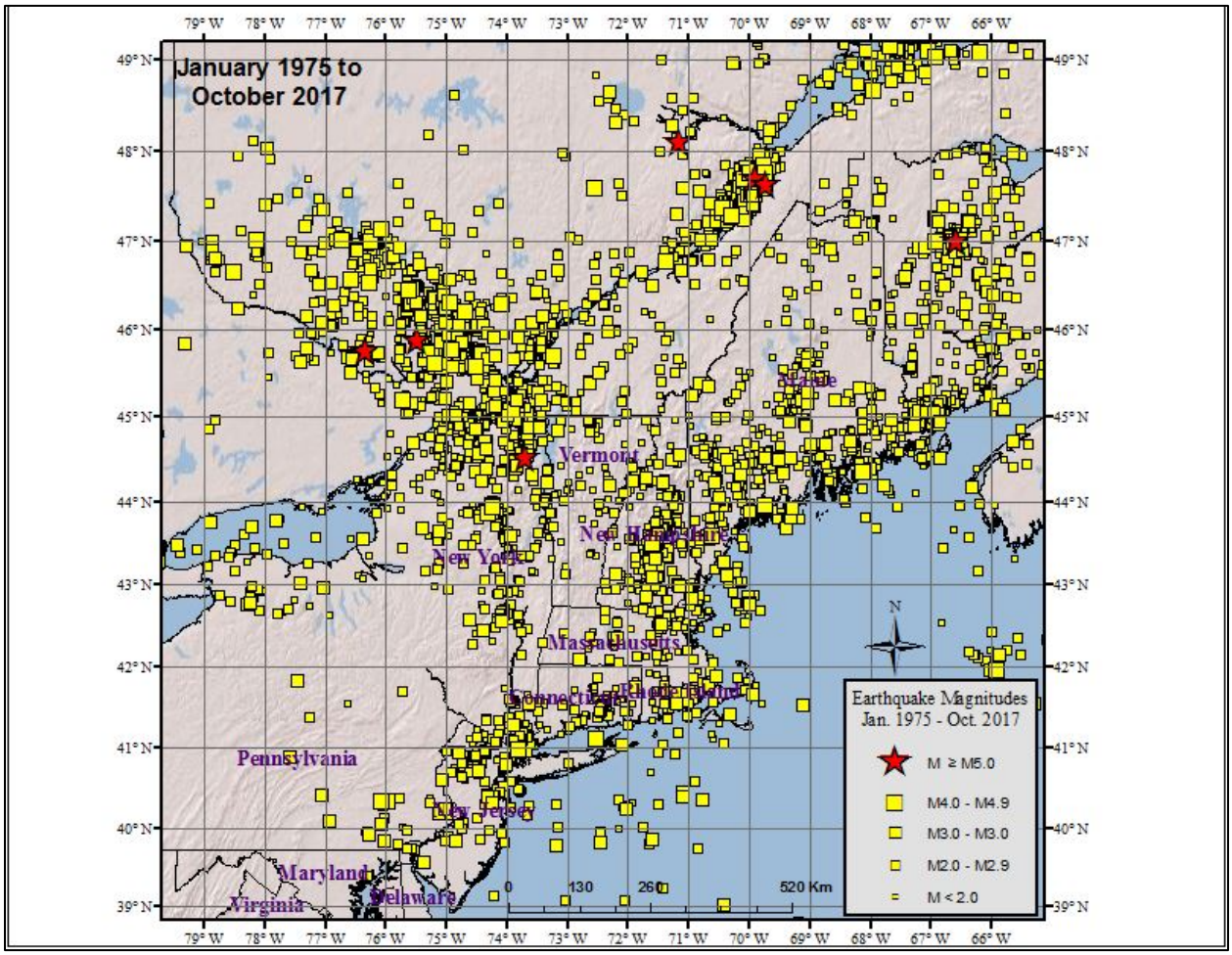

Image 4: Map of Earthquakes of the Northeastern US and Southeastern Canada 1975 to 2017. Source: The Northeast States Emergency Consortium website.

[55] Northeast States Emergency Consortium. (n.d.). Massachusetts Earthquakes. Retrieved February 3, 2022, from http://nesec.org/massachusetts-earthquakes/

[56] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

PROBABILITY OF FUTURE EVENTS

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) notes that "Earthquakes cannot be predicted and may occur at any time." Additionally, the report notes that a strong earthquake could occur anywhere within the New England Region, rather than in specific hotspots. Therefore, it is difficult to estimate the probability of a future damaging earthquake in Millville.

The local Hazard Mitigation Team reports that no earthquakes have been felt in Millville. Based upon existing records, there is a "very low" frequency (less than 1 percent probability in any given year) of a damaging earthquake in Millville.

IMPACT

Massachusetts introduced earthquake design requirements into their building code in 1975 and improved building code for seismic reasons in the 1980s. However, these specifications apply only to new buildings or to extensively modified existing buildings. Buildings, bridges, water supply lines, electrical power lines and facilities built before the 1980s may not have been designed to withstand the forces of an earthquake. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975, and 50% percent of the town's 1,315 housing units was constructed in 1979 or earlier.[57] The seismic standards were upgraded with the 1997 revision of the State Building Code. Despite its fairly old average housing stock, Millville faces a "minor" impact from earthquakes, with little damage likely to occur due to the extreme rarity of damaging events.

HAZUS-MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The HAZUS earthquake module allows users to define an earthquake magnitude and model the potential damages caused by that earthquake as if its epicenter had been at the geographic center of the study area. For the purposes of this plan, a magnitude 5.0 earthquake was selected for analysis. Historically, major earthquakes are rare in New England, although a magnitude 5 event occurred in 1963.

Table 20 - Estimated Damages from an Earthquake

	Magnitude 5.0
Building Characteristics	
Estimated total number of buildings	1,064
Estimated total building replacement value (2010 $)	$ 401,000,000
Building Damages	
# of buildings sustaining slight damage	313
# of buildings sustaining moderate damage	172

[57] US Census Bureau, 2015-2019 American Community Survey 5-year estimates, DP04.

# of buildings sustaining extensive damage	49
# of buildings completely damaged	13
Population Needs	
# of households displaced	40
# of people seeking public shelter	21
Debris	
Building debris generated (tons)	9000
# of truckloads to clear debris (@ 25 tons/truck)	360
Value of Damages (dollars)	
Total property damage	$47,222,600
Total losses due to business interruption	$7,687,400

For more information on the HAZUS-MH software, go to www.fema.gov/hazus-software.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to earthquakes, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3.0*. Vulnerable community features include:

- Older buildings constructed prior to the first edition of the Massachusetts State Building Code.
- The Providence and Worcester elevated rail bridges over the Blackstone River.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), earthquakes in Massachusetts are not influenced by climate change.

VULNERABILITY

Based on the above analysis, Millville has a hazard index rating of "5- lowest risk" from earthquakes.

4.10 DAM FAILURE

Dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control. However, 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 released rapidly. Some dam failures occur when floodwaters above overtop and erode the material components of the dam. Others failures are caused by foundation defects, inadequate maintenance, internal erosion caused by seepage, and many other specific causes.[58] Dam failure may be influenced by storm floodwaters but most are caused by structural, mechanical, or hydraulic failures.[59] Dam breeches can lead to catastrophic consequences as the water rushes in a torrent downstream flooding an area engineers refer to 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.

Many dams in Massachusetts were built during the 19th century without the benefit of modern engineering design and construction oversight. Dams of this age can fail because of structural problems due to age and/or lack of proper maintenance, as well as from structural damage caused by an earthquake or flooding. The Massachusetts Department of Conservation and Recreation Office of Dam Safety is the agency responsible for regulating dams in the state (M.G.L. Chapter 253, Section 44 and the implementing regulations 302 CMR 10.00). To be regulated, these dams are in excess of 6 feet in height (regardless of storage capacity) and have more than 15 acre-feet of storage capacity (regardless of height). Dam safety regulations enacted in 2005 transferred significant responsibilities for dams from the Commonwealth of Massachusetts to dam owners, including the responsibility to conduct dam inspections.

LOCATION

According to the Massachusetts Office of Dam Safety, there are no dams in Millville. The planning team noted no special concerns about any unreported dams or those in upstream communities. The closest upstream dam on the Blackstone River is the State-owned Rice City Pond Dam (High Hazard, MA00935), some 6-7 miles upriver in Uxbridge, with substantial intervening channels and wetland areas that would slow the velocity of an inundation wave.

Inundation areas cover essentially none of Millville, or a "small" portion of its area.

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[58] Association of State Dam Safety Officials. (n.d.). Dam Failures and Incidents. Association of State Dam Safety Officials. Retrieved December 29, 2021, from https://damsafety.org/dam-failures

[59] FEMA. (2013). Living with Dams: Know Your Risks (FEMA P-956; p. 9). Federal Emergency Management Agency. https://www.fema.gov/sites/default/files/2020-08/fema_living-with-dams_p-956.pdf

EXTENT

Often dam or levee breaches lead to catastrophic consequences as the water ultimately rushes in a torrent downstream flooding an area engineers refer to 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.

Dams in Massachusetts are assessed according to their risk to life and property. The state has three hazard classifications for dams:

- High Hazard: Dams located where failure or improper operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.
- Significant Hazard: Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.
- Low Hazard: Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Some dams do not have a hazard rating.

PREVIOUS OCCURRENCES

To date, there have been no catastrophic dam failures in Millville.

PROBABILITY OF FUTURE EVENTS

Millville has no dams. Probability for future failure events is therefore "very low" with less than 1 percent chance of a dam bursting in any given year.

IMPACT

The Town faces a "minor" impact from failure of dams with, with essentially none of the town likely to see damage.

It is not possible to estimate the property loss impacts of dam failure quantitatively given the large number of variables involved in failure events. Qualitatively, losses from failure of an individual dam could be significant but would be geographically limited to portions of the dam's inundation zone.

POTENTIAL CLIMATE CHANGE EFFECTS

Dam failure through overtopping can be caused by floodwaters flowing into a dammed body of water, exceeding the spillway capacity of the dam, and causing water to flow over dam the top of the dam (overtopping). If the water flowing over the dam erodes the dam itself, then a dam

failure can occur. Therefore, the risk of dam failure may be indirectly impacted by climate change through its impacts on flooding. See *Section 4.4: Flooding, Potential Climate Change Effects* for more details.

VULNERABILITY

Based on a mostly qualitative assessment, Millville has a hazard index rating of "5-lowest risk" from dam failure.

4.11 DROUGHT

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. Reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of the direct impacts of drought. Of course, these impacts can have far-reaching effects throughout the region and even the country.

LOCATION

Because of this hazard's regional nature, a drought would likely impact the entire community, meaning the location of occurrence is "large" or over 50 percent of the town. The Millville Core Team reported that wells along the northern side of town tend to be deeper, whereas wells along the southern side are more shallow, so residents on the southern side of town may be more vulnerable to long-term drought.

EXTENT

The severity of a drought would determine the scale of the event. The National Drought Mitigation Center also records information on historical drought occurrence. Unfortunately, data are only available at the state level. The National Drought Mitigation Center categorizes drought on a D0-D4 scale as shown below.

Table 21: U.S. Drought Monitor[60]

Classification	Category	Description
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

[60] National Drought Mitigation Center. (n.d.). Drought Classification. U.S. Drought Monitor. Retrieved February 3, 2022, from https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx

PREVIOUS OCCURRENCES

In Massachusetts, six major droughts have occurred statewide since 1930, though the Millville area has been spared the most severe impacts in each case according to USGS Water Supply Paper for Massachusetts #2375. These historic major droughts range in severity and in length, lasting from three to eight years. In many of these droughts, water-supply systems around the state were found to be inadequate. Water was piped into urban areas, and water-supply systems were modified to permit withdrawals at lower water levels. The following table displays peak drought severity since 2000, from the National Drought Mitigation Center:

Table 22: Annual Drought Status[61]

Year	Maximum Severity
2000	No drought
2001	D2 conditions in 21% of the state
2002	D2 conditions in 100% of the state
2003	No drought
2004	D0 conditions in 48% of the state
2005	D1 conditions in 7% of the state
2006	D0 conditions in 98% of the state
2007	D1 conditions in 71% of the state
2008	D0 conditions in 69% of the state
2009	D0 conditions in 45% of the state
2010	D1 conditions in 27% of the state
2011	D0 conditions in 0.01% of the state
2012	D2 conditions in 51% of the state
2013	D1 conditions in 60% of the state
2014	D1 conditions in 54% of the state
2015	D1 conditions in 58% of the state
2016	D3 conditions in 52% of the state
2017	D3 conditions in 9% of the state
2018	D1 conditions in 36% of the state
2019	D0 conditions in 85% of the state
2020	D3 conditions in 36% of the state
2021	D2 conditions in 1% of the state

[61] National Drought Mitigation Center. (2016, 2022). Statistics by Threshold. U.S. Drought Monitor. https://droughtmonitor.unl.edu/DmData/DataDownload/StatisticsbyThreshold.aspx

2022 (to Feb. 3)	No drought

In Millville, the last known drought event with substantial impacts occurred in 2016. Some private wells have run dry during previous droughts in Millville.

PROBABILITY OF FUTURE EVENTS

In Millville, as in the rest of the state, extreme and exceptional droughts occur at a "very low" probability (1 to 10 percent in the next year). Based on past events and current criteria outlined in the Massachusetts Drought Management Plan, it appears that Central Massachusetts may be slightly more vulnerable than parts of eastern Massachusetts to severe drought conditions. However, many factors, such as water supply sources, population, economic factors (i.e., agriculture based economy), and infrastructure, may affect the severity and length of a drought event.

In the long-term, the risk of drought may increase in Millville due to climate change influences, which will result in annual increases in consecutive dry days.

IMPACT

The specific impacts of drought in Massachusetts are categorized by the National Drought Mitigation Center in Table 23, below.

Table 23: Historic Impacts of Drought in Massachusetts[62]

Category	Historically observed impacts
D0	Crop growth is stunted; planting is delayed
	Fire danger is elevated; spring fire season starts early
	Lawns brown early; gardens begin to wilt
	Surface water levels decline
D1	Irrigation use increases; hay and grain yields are lower than normal
	Honey production declines
	Wildfires and ground fires increase
	Trees and landscaping are stressed; fish are stressed
	Voluntary water conservation is requested; reservoir and lake levels are below normal capacity
D2	Specialty crops are impacted in both yield and fruit size
	Producers begin feeding cattle; hay prices are high
	Warnings are issued on outdoor burns; air quality is poor
	Golf courses conserve water

[62] National Drought Mitigation Center. (n.d.). State Impacts. U.S. Drought Monitor. Retrieved February 3, 2022, from https://droughtmonitor.unl.edu/DmData/StateImpacts.aspx

	Trees are brittle and susceptible to insects
	Fish kills occur; wildlife move to farms for food
	Water quality is poor; groundwater is declining; irrigation ponds are dry; outdoor water restrictions are implemented
D3	Crop loss is widespread; Christmas tree farms are stressed; dairy farmers are struggling financially
	Well drillers and bulk water haulers see increased business
	Water recreation and hunting are modified; wildlife disease outbreak is observed
	Extremely reduced flow to ceased flow of water is observed; river temperatures are warm; wells are running dry; people are digging more and deeper wells

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation plan notes that while drought is a naturally occurring climate phenomenon, its impacts can be exacerbated by human behavior. The volume and rate of groundwater withdrawn from underground aquifers can impact the amount of water that flows through surface water bodies, negatively impacting aquatic ecosystems. Additionally, more impervious surface coverage, and some forms of stormwater infrastructure, can prevent natural infiltration of precipitation into groundwater.[63]

Specific impacts in Millville may vary among customers of the water system and private well users. As noted in *Location*, above, the southern area of Millville may be more vulnerable to drought due to the more shallow depth of its wells. So, while the impact of a drought can be assessed as "minor" overall, with very little damage to people or property likely to occur, impacts may be higher in the Southern portion of Millville.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to drought, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3.0*. Vulnerable community features include:

- Residences or businesses with shallow wells.
- Wild plants and animals, including trees.
- Vegetation, which may become more vulnerable to wildfire due to prolonged drought.

Higher water bills or the cost of re-drilling private wells due to drought impacts, could also negatively affect local residents. Other factors like PFAS contamination of water sources could compound drought-related water supply challenges, though PFAS has not been detected in significant quantities in Millville to-date.

[63] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are two major ways that drought can be influenced by climate change:

- The frequency and extent of droughts are projected to increase in summer and fall as higher temperatures result in more evaporation, snow melts earlier in the year, and precipitation becomes less constant and more extreme.
- Rising temperatures and changes in precipitation will reduce the snowpack and hasten snowmelt. This could result in less snowmelt recharge of groundwater, less snowmelt feeding stream flows, and less snowmelt as a water source for agriculture.

In summary, climate change is likely to increase the frequency and extent of drought in Massachusetts.

VULNERABILITY

Based on the above assessment, Millville has a hazard index rating of "4 – low risk" from drought. Minimal or no loss of property, or damage to people or property is expected due to this hazard. See also Section 4.8 for a discussion on the impacts of drought on wildfires.

4.12 EXTREME TEMPERATURES

As per the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan, there is no universal definition for extreme temperatures, with the term relative to local weather conditions. Extreme heat in Massachusetts is typically defined as a period of 3 or more consecutive days with temperatures above 90 °F.[64] Extreme heat may also refer to any prolonged period of especially hot weather (a heat wave), which may also be accompanied by high humidity. Extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat.

For Massachusetts, extreme temperatures can be defined as those that are far outside the normal ranges. Normal temperatures for the Millville area are:

Table 24: Monthly Climate Normals (1991-2020) – Woonsocket, RI[65]

	July (Hottest Month)	January (Coldest Month)
Average High (°F)	84.0°	37.8°
Average Low (°F)	63.3°	18.8°

[64] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[65] National Weather Service. (n.d.). NOAA Online Weather Data (NOWData). National Oceanic and Atmospheric Administration. https://www.weather.gov/wrh/Climate?wfo=box

Specific criteria used by the National Weather Service for issuing extreme heat and extreme cold watches, warnings, and advisories, are described in Extent, below.

LOCATION

Extreme temperatures can be expected to be uniform across Millville during a given weather event, due to the town's lack of extreme elevations, urban areas, and coastal areas. Therefore, this hazard has a "large" geographic coverage.

EXTENT

2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan notes that the extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature Index. Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. In Massachusetts, a wind chill warning is issued by the National Weather Service (NWS) Norton Forecast Office when the Wind Chill Temperature Index, based on sustained wind, is –25°F or lower for at least three hours. NWS Windchill Chart (shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops.

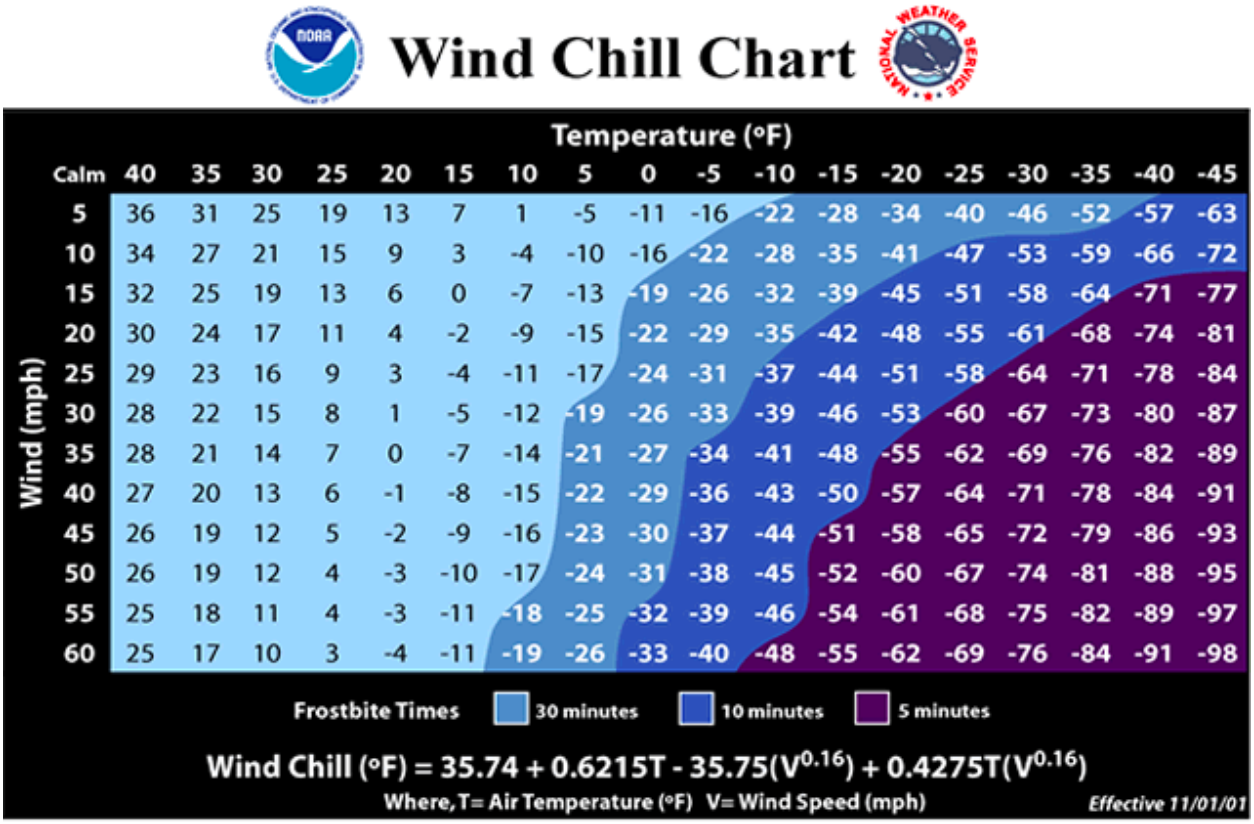

Figure 4: NWS Wind Chill Temperature (WCT) index. Source: https://www.weather.gov/safety/cold-wind-chill-chart

For extremely hot temperatures, the heat index scale is used, which combines relative humidity with actual air temperature to determine the risk to humans. The NWS issues an Excessive Heat Warning when the daytime heat index is forecasted to reach 105 degrees F for 2 or more hours. The NWS issues an Excessive Heat Advisory if the heat index is forecast to reach 95°F-99°F for 2 or more hours over 2 consecutive days, or 100°F-104°F for 2 or more hours over 1 day. The NWS defines a heat wave as 3 or more days of ≥ 90°F temperatures. The following chart indicates the relationship between heat index and relative humidity:

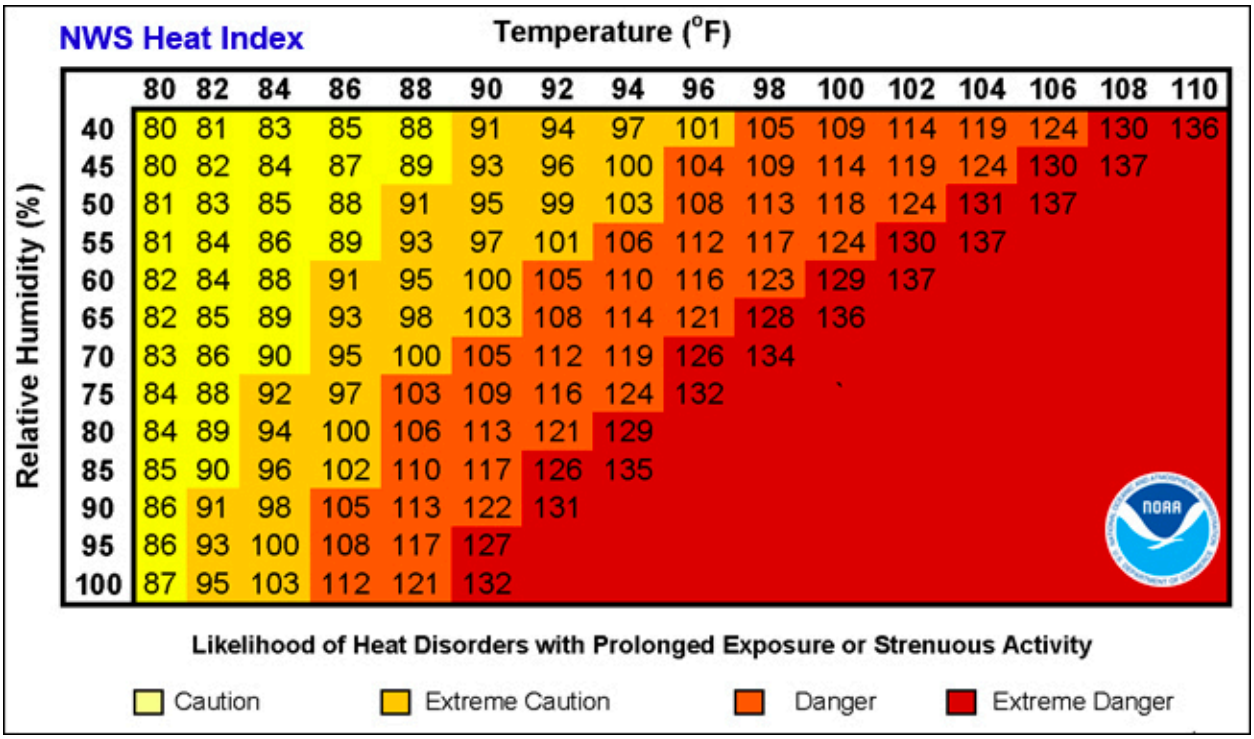

Figure 5: Heat Index. Source: https://www.weather.gov/safety/cold-wind-chill-chart

Extreme heat causes more fatalities in the United States that all other weather-related natural hazards combined.[66] Extreme heat can be the underlying cause of death or can worsen other medical conditions like heart disease, hypertension, alcohol poisoning and drug overdoses.[67] The heat-related mortality rate is higher among males and people aged 65 years and older.[68]

Table 25: Heat Effects on Body lists the effects of the body at different levels of the heat index. It is important to note that while temperatures exceeding 100°F are unusual for Central Massachusetts, high humidity is very common during the summer and can drive the heat index to dangerous levels.

[66] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[67] Vaidyanathan, A. (2020). Heat-Related Deaths—United States, 2004–2018. MMWR. Morbidity and Mortality Weekly Report, 69. https://doi.org/10.15585/mmwr.mm6924a1
[68] Vaidyanathan, A. (2020).

Table 25: Heat Effects on Body[69]

Classification	Heat Index	Effect on Body
Caution	80°-90°F	Fatigue possible with prolonged exposure and/or physical activity.
Extreme Caution	90°-103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°-124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F+	Heat strokes highly likely.

Other impacts of high temperatures include drought, wildfire, and the formation of ground-level ozone.[70] Prolonged heat can cause power use to spike and overload the electrical grid, causing outages.[71] Cold temperatures are often combined with winter storms. Individuals may have to deal with the loss of heat and power due to storm damage, which could further subject them to the cold.[72] Carbon monoxide poisoning is another risk during cold weather, especially when households lack adequate power or heat.[73] Extreme heat and cold can both negatively impact transportation infrastructure. Railroad tracks are a particular concern because the metal rails can kink in high temperatures.[74]

PREVIOUS OCCURRENCES

There is not a comprehensive data source listing instances when the National Weather Service has issued extreme heat or cold warnings or advisories in Worcester County. Across Massachusetts as a whole, there were 33 cold weather events between 1994 and 2018, and 43 warm weather events between 1995 and 2018.[75] Inland portions of Massachusetts are more subject to extreme temperatures because they lack the moderating effect of the Atlantic Ocean, and densely developed cities are more likely to be impacted by heat waves than smaller towns like Millville.

PROBABILITY OF FUTURE EVENTS

The probability of future extreme heat or extreme cold is considered to be "moderate," or between 10 and 40 percent in the next year.

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[69] National Weather Service. (n.d.). What is the heat index? National Weather Service; NOAA's National Weather Service. Retrieved February 4, 2022, from https://www.weather.gov/ama/heatindex
[70] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[71] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[72] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[73] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[74] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[75] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

IMPACT

The impact of extreme heat or cold in Millville is considered to be "limited," with no property damage and a limited effect on humans.

EXPOSURE

Certain features within Millville's community infrastructure, society, and environment may face more exposure to extreme temperatures, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3.0*. Vulnerable community features include:

- Children and elderly residents, who may find it difficult to regulate their body temperatures in extremely hot or cold conditions. Consequently, Millville's ambulance service may be busier during periods of extreme temperature. As a mitigation measure, Millville users its Senior Center as a cooling center during extreme heat.
- Low-income residents who are unable to afford adequate cooling or heating.
- Renters who may have few options for mitigating extreme heat and cold through home improvements.
- People who work outdoors such as construction or farm workers.
- The utility grid, which could be vulnerable to outages due to surges in power during extreme temperatures. Power outages during extremely hot or cold days could cause further problems to those who rely on air conditioners or electric heaters.
- Certain forms of agriculture may be negatively affected by extreme temperatures, especially extreme heat.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are two major ways that temperature in Massachusetts be influenced by climate change:

- High temperatures overall will result in higher extreme temperatures in the summer months. By 2100, extreme heat could occur between 13 and 65 days during the summer.
- By 2100, annual average temperatures are expected in increase by 3.8 to 10.8 degrees compared to the 1971-2000 baseline.

In summary, climate change is likely to increase the frequency of extreme heat in Massachusetts. Changes to average annual temperatures will also impact Millville. Seasonal temperatures may shift, with spring and summer temperatures extending through more of the year.[76] Winters may also be more mild than historical norms.[77] Changes to average temperatures could impact the agricultural industry and the natural environment. Farmers may need to shift their practices to

[76] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
[77] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

account for new climate conditions, and certain specific of plants and animals may need to migrate to new ranges to find suitable habitat.[78]

VULNERABILITY

Millville's vulnerability from extreme heat and cold is considered to be, "4 - Low Risk."

4.13 OTHER HAZARDS

In addition to the hazards identified in previous sections, the Hazard Mitigation Team reviewed the other hazards listed in the Massachusetts Hazard Mitigation Plan: coastal hazards, atmospheric hazards, ice jams, coastal erosion, sea level rise, and tsunamis. It was determined that these hazards are irrelevant to Millville due to the town's location.

4.13.1 LANDSLIDES

One other hazard that can affect Millville is landslides. Landslides occur in all U.S. states and territories. In a landslide, masses of rock, earth, or debris move down a slope. Landslides may be small or large, slow or rapid. They are generally activated by:

- storms
- earthquakes
- volcanic eruptions
- fires
- alternate freezing or thawing
- steepening of slopes by natural erosion or by human modification

Debris and mud flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." They can flow rapidly, striking with little or no warning at avalanche speeds. They also can travel several miles from their source, growing in size as they pick up trees, boulders, cars, and other materials.

There are no documented previous occurrences of significant landslides in Millville. The town is relatively flat and most of its rivers are slow moving and frequently dammed, which can minimize landslide risk. Roadways are not generally built close to river channels, reducing undercutting risk from stormwater-induced bank erosion. High slope terrain (defined as 15 to 25% grade) covers 128 acres, or only 4% of the town; very high slopes (higher than 25% grade) cover 11 acres, or less than 1% of the town's area. Little development is present in these areas. Should a landslide occur in the future in Millville, the type and degree of impacts would be highly localized. Vulnerabilities could include damage to structures, damage to transportation and other infrastructure, and localized road closures, though our data review and the local planning team

[78] 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

noted no specific concerns. Injuries and casualties, while possible, would be unlikely given the low extent and impact of landslides in Millville.

Millville, like nearly all communities in the CMRPC region, has few areas with susceptibility for landscapes according to figure 4-16 in the 2018 State Hazard Mitigation and Climate Adaptation. Landslides are therefore considered low frequency events that may occur once in 50 to 100 years (a 1% to 2% chance of occurring per year).

5.0 EXISTING PROTECTION

The Town of Millville makes use of locally-controlled tools to mitigate the consequences of natural hazards, including: zoning regulations, planning, and physical improvements. The Town does not participate in any federal programs such as StormReady certification or Firewise community certification.

Millville has several no-cost or low-cost hazard mitigation capabilities in place. Land use zoning, subdivision regulations and an array of specific policies and regulations that include hazard mitigation best practices, such as limitations on development in floodplains, stormwater management, tree maintenance, etc. Millville also has appropriate staff dedicated to hazard mitigation-related work for a community of its size, including a Town Administrator, an Emergency Management Director, a Highway Department, and a Tree Warden.

Millville has several relevant plans in place, including a Comprehensive Emergency Management Plan and a Master Plan (2018). The Town also has dedicated volunteers who serve on Boards, Commissions and Committees and in other volunteer positions. The Town has a Local Emergency Planning Committee and has opted into fire protection mutual aid agreements through MEMA. Millville is also an active member community of the Central Massachusetts Regional Planning Commission (CMRPC) and can take advantage of no cost local technical assistance as needed provided by the professional planning staff at CMRPC.

The table in Section 7.0 describes existing mitigation protections in Millville. It includes a brief description of each activity as well as a subjective evaluation of its effectiveness and of any need for modifications.

5.1 EXISTING PROTECTION MATRIX

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
Participation in National Flood Insurance Program (NFIP)	Provides flood insurance for structures located in flood-prone areas. Also, communities participating in the NFIP have adopted and enforce ordinances, bylaws and regulations that meet or exceed FEMA requirements to reduce the risk of flooding.	Millville monitors building activity within the flood plain to ensure compliance with provisions of state building code.	Effective; There are no repetitive loss properties in Millville. Millville should seek to further limit development in the 100-year flood zones. It should work to score in the Community Rating System (CRS) under NFIP to enable its residents to obtain lower flood insurance rates. Millville should educate its residents about NFIP.
Floodplain Zoning District bylaw in place	Requires all development to be in compliance with state building code requirements for construction in floodplains	Millville has a floodplain overlay district (Chapter 100, Article VIII) in its Zoning By-law that limits development within FEMA FIRM-designated flood zones.	Effective; Millville should consider expansion of the district to include locally-identified flood-prone areas outside of FIRM flood zones.
Stormwater Management policy and regulations in place	Planning Board or Conservation Commission reviews projects for consistency with MA DEP standards. This helps ensure adequate on site retention and recharge.	Millville has a Stormwater Management By-law within its General By-laws (Chapter 80) that seeks to minimize the impacts of construction sites, new development and nonpoint source pollution to water resources via stormwater.	Effective; Millville should consider rejoining the Central Mass Regional Stormwater Coalition to ensure the town is up to date on the latest stormwater management best practices.
Local Open Space and Recreation Plan	Local plan identifying significant natural resources and identifying mechanisms to ensure their protection. Following Mass. Department of Conservation and Recreation guidance for development of	Millville adopted their latest Open Space and Recreation Plan update in 2018. The plan will remain active until July 2025.	Somewhat effective; Millville should use their plan to apply for DCS grants to improve recreation and protect open spaces. Where allowable, Millville should integrate hazard mitigation activities and recommendations in its open space planning or grant applications, especially with reference to

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
	OSRPs, this document does not focus on specific hazards. Open Space Plans can provide many tools. Towns must commit to making the land acquisitions and regulatory changes, giving increased attention to preserving undeveloped flood-prone areas and associated lands		preservation of wetlands and floodplains.
Local wetlands protection bylaw and regulations	Local bylaw enforced by the Conservation Commission building upon the State's Wetlands Protection Act and Regulations. Adds regulatory oversight provisions for development within the jurisdictional buffer zone, adding increased attention to alteration of wetlands and the opportunity to preserve capacity and quality.	Millville has a Wetlands Protection By-law within its General By-laws (Chapter 95) that seeks to protect wetlands and water resources through measures that exceed state requirements from MGL Chapter 131 Section 40 and regulations at 310 CMR 10.	Effective; Millville should consider how climate change or natural ecosystem factors like beavers might change the extent of wetlands in the future, and ensure that existing regulations ensure an adequate buffer zone given this uncertainty.
Drainage system maintenance and repair program	Plan to keep municipal drainage facilities (storm drains, culverts, etc.) in good order	Millville performs street sweeping and catch basin cleaning from April to November.	Effective; Millville should examine a public education program for residents on storm drain clearance and other best practices
Tree Trimming	Plan to ensure routine maintenance of trees to reduce likelihood of vegetative debris in response to storm events	Millville conducts roadside mowing from April-November to remove juvenile trees. Tree trimming (take-downs and clearing dead branches) takes place as needed (National Grid). The Town should consider increasing tree trimming funding to	Extensive recent trimming along Chestnut Hill Rd has been very effective at preventing outages; town should consider proactive trimming along all town roads.

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
		keep the plan on track and maintain proactive trimming townwide.	
Culvert Maintenance and Replacement	Maintain existing culverts through regular maintenance and (in some cases) beaver controls; replace/expand culverts where needed to allow for adequate stormwater flow.	The Town has historically repaired/replaced problem culverts and related drainage infrastructure following repeated flood events.	Somewhat effective; Current efforts are piecemeal and are limited by lack of resources and systematic approach. Millville should develop a prioritized inventory of problem culverts for use in seeking external financial support. Planning must comply with 2014 Mass. Wetlands Protection Act update; culverts may not simply be replaced in-kind.
Board of Health regular activities	Among several other responsibilities, the Millville Board of Health is responsible for oversight of all new or existing wells and septic systems including failures and repairs, monitoring safety of drinking water, receiving reports, and acting on reports of unsafe water.	The Board meets regularly to review local issues and permit requests.	The Board of Health in Millville is active and effective. Going forward, the Board should: - Continue to track water quality complaints and well-drilling permits, and notify Board of Selectmen of water quality issues as needed - Continue to track septic system permits and notify Board of Selectmen of septic field problems linked to environmental factors like isolated flooding

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
Fire Department community outreach	The Millville Fire Department makes a point to converse with homeowners about potential hazards when it responds to calls in the community.	The Millville Fire Department personally speaks with residents and hosts educational information on its section of the town's website.	Personal, local outreach is effective. The department may also consider providing information to residents and businesses specifically about generator safety and sump pump usage; Millville has seen generator safety problems during past floods when power was lost and homeowners switched to generator power for pumps.
Participation in emergency management training	Millville has access to a number of organizations that offer free trainings on emergency management. Staff have participated in various trainings in the past.	Participate in professional emergency management training opportunities offered by MEMA, the Central Region Homeland Security Advisory Council, and other organizations.	Effective; the Core Team recommended that these departments attend trainings regularly, as courses are offered.

6.0 STATUS OF MITIGATION MEASURES FROM 2016 PLAN

Town staff provided updates on the status of mitigation measures from Millville's 2016 Hazard Mitigation Plan. Certain measures were incomplete as of 2022 and deemed "still relevant". These actions were reviewed by the Core Team. Some actions were re-incorporated in the 2022 Hazard Mitigation Plan action strategy based on whether they could be completed in the next 5 years, and their perceived effectiveness (see *Section 7.6: Mitigation Strategies*).

2016 Task	2022 Status	2022 Notes	Include in 2022 Plan?
High Priority			
Drainage improvements in the Town Hall/EOC/Police Station area; repeated floods occur here during both Blackstone River flood events and long-duration rainstorms; impacts Town operations	Incomplete – the Old Town Hall was considered unfit for use since the 2016 plan, and town hall activities were moved to a new building, which decreased the urgency of this task.	Old Town Hall is known to have flooding in the basement, elevator shaft, boiler room, and emergency management room. The site became untenable due to a failing roof and mold concerns. It is no longer in use.	Yes, but will be incorporated into comprehensive stormwater infrastructure planning.
Continue drainage improvements in the 140s-160s Main Street area, which floods repeatedly and impacts several homes (floods assoc. with Hood Brook)	Incomplete; delayed due to interdepartmental nature of the project, coordination with MassDOT is necessary because it is state road.	This project has not been made a priority. The state repaved the road but did not feel as though additional repair is warranted yet. It is only problematic every few years.	Yes, but will be incorporated into comprehensive stormwater infrastructure planning.
Install emergency generator at Senior Center to provide town with more robust sheltering capability	Completed	Generator was installed and is working.	No
Feasibility study for permanent relocation of the EOC from vacated Town Hall to other existing or new facility	Incomplete – the town has not had the staff capacity to complete this study.	Town is currently using the fire station as the EOC. There is not enough room in the first station for this to be a permanent solution.	Yes

Feasibility study for replacement/ supplement of existing Central Street firefighting reservoir (Mansfield Pond) with Blackstone River pump station	Incomplete – the Fire Department has had some staff turnover, and the town has not had the staff capacity or budget to complete this task.	This is still something that FD wants to work on, river has a more constant supply of water. Cost is a potential barrier.	Yes
Upgrade generator and system controls at Central Street firefighting reservoir pump station	Incomplete – this is dependent on the water supply feasibility study which has not been completed. Cost is also a potential barrier to completing this task.	This is dependent on whether Millville decides to pursue a new water source. Cost is a potential barrier.	Yes
Continue to participate in National Flood Insurance Program (NFIP) (or other) training offered by the State and/or FEMA that addresses flood hazard planning and management	Delayed – Emergency Management Director was recently appointed and has not had the time to complete these supplemental trainings.		Yes
Evacuation Plan updates	Incomplete – the town needs to review whether changes to the Evacuation Plan are even necessary.	Town needs to review to see if changes are necessary.	Yes
Improve vegetation and debris management along P&W Railroad rights-of-way; wildfires are reported along P&W tracks in many communities	In progress - P&W has been clearing the plants on an on-going basis.	P&W has been clearing the plants on an on-going basis.	Yes
Town-wide tree trimming to protect above-ground utility wires from storm damage	On-going - The town actively trims trees.	The town actively trims trees.	Yes

Provide information to residents and businesses on tree trimming to help prevent power outages from storms	Incomplete – this task has not occurred due to limited staff capacity.	Has not occurred.	Yes
Provide information to residents and businesses on wildfire prevention and defensible spaces, esp. in areas distant from the fire department's reservoir	Incomplete – this task has not occurred to limited staff capacity.	FD will look into relevant materials to share with the community	Yes
Provide information to residents and businesses on generator safety and sump pump usage; Millville has seen generator safety problems during past floods when power was lost and homeowners switched to generator power for pumps	On-going – the Fire Department regularly posts information on Facebook about generator safety and sump pump safety during storms.	FD posts about generator safety and sump pump safety during storms. During on-calls FDs will also talk to homeowners about this.	Yes
Obtain additional electronic message boards for public communication before/during disasters	Incomplete – this task has not occurred due to cost and competing town spending priorities.	Still relevant – there are multiple ways into the center of town.	Yes
Monitor implementation of Hazard Mitigation Plan	On-going – the town reviews the Hazard Mitigation Plan on an as needed basis.		Yes
Medium Priority			
Drainage improvements on Kempton Road near power lines; occasional flooding impacts residence and possibly threatens power lines	Completed	Repaired that portion of the road, New England Power installed piping and caging that redirected the water due to flooding.	No

Drainage improvements on Chestnut Hill Road (near Oak Street); occasional roadway flooding	Delayed - this task has not occurred due to cost and competing town spending priorities. Manual maintenance and cleaning of drainage seems to make a significant positive impact.	Manual maintenance and cleaning of drainage seems to make a significant positive impact. However, this is not a long term fix as it tie consuming and creates additional labor costs.	Yes, but will be incorporated into comprehensive stormwater infrastructure planning.
Drainage improvements on Central Street (near RI state line); frequent roadway flooding from adjacent wetland impacts this evacuation route; possible need to increase road elevation	Completed	State grant funded repairs through a Complete Streets Grant in fall 2019	No
Drainage improvements on Ironstone Street; occasional roadway flooding assoc. with Blackstone River impacts residences and access to Town Center	Completed	The project is under current litigation. The homeowner does not feel as though the repairs were sufficient since there is still some flooding.	No
Inventory and prioritize replacement of problem culverts	On-going – the Highway Surveyor maintains records of road maintenance needs. The town had not the resources to undertake a more systematic inventory of its stormwater infrastructure.		Yes, but will be incorporated into comprehensive stormwater infrastructure planning.
Investigate/join the Central Massachusetts Stormwater Coalition to aid in public outreach and funding of drainage improvements	Completed	Millville joined CMRSWC but has not renewed their membership.	Yes
Collaborate with Providence & Worcester Railroad to study	Unknown - This task was assigned to P&W railroad –	This task was assigned to P&W railroad – they do not update	Yes

Blackstone River bridge replacement/retrofit options regarding earthquake, flood risks	they do not update Millville on hazard mitigation activities.	Millville on hazard mitigation activities.	
Review and update local plans and development review processes (planning, zoning, floodplain protections, stormwater management, conservation, etc.) to ensure new construction will not be affected by hazards	Ongoing – this task was discussed during the workshop held during the Hazard Mitigation Planning process. No gaps in bylaws or local plans were identified. This task was determined to be no longer relevant.	Discussed during CRB workshop and no gaps in bylaws or plans were identified at that time.	No
Complete an Open Space and Recreation Plan per Mass. DCR guidelines; emphasize mitigation-oriented actions where appropriate	Completed		No
Low Priority			
Investigate Community Rating System (CRS) benefits and requirements and decide whether to participate	Incomplete – no staff at Millville has completed this task and it was determined to no longer be a priority during the 2022 planning workshop.		No
Collaborate with pipeline owner regarding earthquake safety upgrades	Unknown - This task was assigned to Algonquin Gas – they do not update Millville on hazard mitigation activities so the town is unaware of any earthquake mitigation planning they may have undertaken since 2016.	This task was assigned to Algonquin Gas – they do not update Millville on hazard mitigation activities.	Yes

7.0 MITIGATION STRATEGY

The Millville hazard mitigation planning team developed a list of mitigation strategies (both new and previously identified by local officials) and prioritized them using the criteria described below. This list of factors is broadly derived from FEMA's STAPLE+E feasibility criteria.

7.1 OBJECTIVE

Objectives are based on background information on natural hazards in Millville, the list of critical infrastructure and facilities, and notes from the Community Resilience Building workshop, to generate a list of objectives for Millville's natural hazard mitigation strategy. Each objective includes one or more mitigation actions. General objectives for Millville include:

- Address current stormwater drainage issues and proactively incorporate resilience to extreme precipitation
- Address roadway erosion and maintenance issues and proactively incorporate resilience to extreme precipitation
- Reduce power outages
- Ensure availability of water for fire suppression
- Maintain readiness and response capacities of Millville's emergency services
- Support community quality of life
- Protect the natural environment and ecosystem services
- Protect water quality and public health
- Complete other actions that build community resilience

7.2 PRIORITY

Following the ranking of each strategy for its mitigation impact, real world considerations were brought back into the analysis to inform the priority ranking process. Factors considered in this step include costs and cost effectiveness (including eligibility and suitability for outside funding), timing, political and public support, and local administrative burden.

- High Priority – strategies that have obvious mitigation impacts that clearly justify their costs and to a large degree can be funded, can be completed in a timely fashion, can be administered effectively, and are locally supported
- Medium Priority – strategies that have some clear mitigation impacts that generally justify their costs and generally can be funded, can be completed in a timely fashion, can be administered effectively, and are locally supported
- Low Priority – strategies that have relatively low mitigation impacts that do not necessarily justify their costs and that may have difficulty being funded, completed in a timely fashion, administered effectively, and locally supported

Costs and cost effectiveness – in order to maximize the effect of mitigation efforts using limited funds, priority is given to low-cost strategies. For example, regular tree maintenance is a relatively low-cost operational strategy that can significantly reduce the length of time of power outages during a winter storm. Strategies that have clear and viable potential funding streams, such as FEMA's Hazard Mitigation Grant Program (HMGP), are also given higher priority.

Time required for completion - Projects that are faster to implement, either due to short work duration, current or near-term availability of funds, and/or ease of permitting or other regulatory procedures, are given higher priority.

Political and public support - Strategies are given higher priority if they have demonstrated political and/or public support through positive involvement by the public, prioritization in previous regional and local plans, initiatives that were locally initiated or adopted are given higher priority, or prioritization in the Community Resilience Building workshop process.

Administrative burden – Strategies that are realistically within the administrative capacity of the town and its available support network (CMRPC, Blackstone River Valley National Heritage Corridor, Blackstone Watershed Collaborative, etc.) are prioritized. Considerations include grant application requirements, grant administrative requirements (including audit requirements), procurement, and staff time to oversee projects.

Impact - The team's consideration of each strategy included an analysis of the mitigation impact each can provide, regardless of cost, political support, funding availability, and other constraints. The intent of this step is to separately evaluate the theoretical potential benefit of each strategy to answer the question: if cost were no object, what strategies have the most benefit? Factors considered in this analysis include the number of hazards each strategy helps mitigate (more hazards equals higher impact), the estimated benefit of the strategy in reducing loss of life and property (more benefit equals higher impact) based on the relevant hazard(s) as assessed in Chapter 4, and the geographic extent of each strategy's benefits (other factors being equal, a larger area equals higher impact).

- High Impact – actions that help mitigate several hazards, substantially reduce loss of life and property (including critical facilities and infrastructure), and/or aid a relatively large portion of the community
- Medium Impact – actions that help mitigate multiple hazards, somewhat reduce loss of life and property (including critical facilities and infrastructure), and/or aid a sizeable portion of the community
- Low Impact – actions that help mitigate a single hazard, lead to little or no reduction in loss of life and property (including critical facilities and infrastructure), and/or aid a highly localized area

7.3 ESTIMATED COST

Each implementation strategy is provided with a rough cost estimate based on available third party or internal estimates and past experience with similar projects. Each includes hard costs (construction

and materials), soft costs (engineering design, permitting, etc), and where appropriate Town staff time (valued at appx. $25/hour for grant applications, administration, etc). Projects that already have secured funding are noted. Detailed and current estimates were not generally available, so costs are summarized within the following ranges:

- Low – less than $50,000
- Medium – between $50,000 – $100,000
- High – over $100,000

7.4 TIMELINE

Each strategy is provided with an estimated length of time it will take for implementation. Where funding has been secured for a project, a specific future date is provided for when completion is expected. However, most projects do not currently have funding and thus it is difficult to know exactly when they will be completed. For these projects, an estimate is provided for the amount of time it will take to complete the project once funding becomes available. Strategies are grouped by 1-2 year timeframe, 3-5 year timeframe, 5+ year timeframe, and ongoing items.

7.5 STRATEGY TYPES

Mitigation strategies were broken into four broad categories to facilitate local implementation discussions, especially regarding budget considerations and roles/responsibilities:

Structure and Infrastructure Projects - Construct "bricks & mortar" infrastructure and building improvements in order to eliminate or reduce hazard threats, or to mitigate the impacts of hazards. Examples include drainage system improvement, dam repair, and generator installation. Structure and infrastructure improvements tend to have the greatest level of support at the local level, but are highly constrained by funding limits.

Preparedness, Coordination and Response Actions - Ensure that a framework exists to facilitate and coordinate the administration, enforcement and collaboration activities described in this plan. Integrate disaster prevention/mitigation and preparedness into every relevant aspect of town operations, including Police, Fire, EMD, EMS, DPW, Planning Board, Conservation Commission and Board of Selectmen; coordinate with neighboring communities where appropriate. Recommendations in this category tend toward standardizing and memorializing generally-practiced activities.

Education and Awareness Programs - Integrate education and outreach into the community to raise awareness of overall or hazard-specific risk and generate support for individual or community-wide efforts to reduce risk. Awareness and education seek to affect broad patterns of behavior, essentially altering a culture. Awareness-building activity tends to have a fairly slow effect, although in the end it can provide extraordinary benefits with relatively little cash outlay.

Local Plans and Regulations - Review and propose updates to local bylaws, ordinances and regulations to protect vulnerable resources and prevent further risk to those resources. Formally adopt these updates into the local regulatory framework. Review the effectiveness of past mitigation projects, programs procedures and policies. Incorporate mitigation planning into master plans, open space plans, capital improvement plans, facility plans, etc.

Planning and regulatory activity tends to provide extraordinary benefits with relatively little cash outlay. However, in smaller communities where planning activities are largely the purview of volunteers, outside assistance from the state or regional levels may be required to maximize its benefits. Political support may be difficult to achieve for some planning and regulatory measures, especially those that place new constraints on land use.

In addition to describing action items in each of these categories, for each strategy we also identify what hazard(s) it is intended to address, as described in *Section 0* of this plan. Each strategy also identifies the lead organization who serves as the primary point of contact for coordinating efforts associated with that item, and identifies potential funding sources for implementation. See *Section 8.4* for more information on potential funding.

7.6 MITIGATION STRATEGIES

Objective	Action Plan/Descriptions	Who agencies involved	Priority High/Med/Low	Estimated Cost High/Med/Low	Potential Funding Source	Timeline
Address current stormwater drainage issues and proactively incorporate resilience to extreme precipitation	Create a comprehensive, town-wide stormwater management plan	Highway department	High	Medium	MVP Action Grant	1-2 years (before road infrastructure plan)
	Reassess costs and benefits of joining the Central Massachusetts Regional Stormwater Coalition	Highway department	Medium	Low	No cost associated with this assessment	1-2 years
	Assess culverts using aquatic connectivity criteria (NAACC) to apply to DER culvert replacement program	Volunteers, Blackstone Watershed Collaborative	Low	Low	Volunteer time	1-2 years
Address roadway erosion and maintenance issues and proactively incorporate resilience to extreme precipitation	Create a comprehensive, town-wide roadway infrastructure plan to prioritize future maintenance and construction projects	Highway department	High	Medium	Rural and Small Town Development Fund, Local	1-2 years
	Address recurring erosion and drainage issues as prioritized by the Highway Surveyor, including near: the old Town Hall and police station, the 140s-160s Main	Highway department	High	High	MassWorks Infrastructure Grant, Chapter 90, TIP, Town Local	3-5 years

Objective	Action Plan/Descriptions	Who agencies involved	Priority High/Med/Low	Estimated Cost High/Med/Low	Potential Funding Source	Timeline
	Street area, Chestnut Hill Road (near Oak Street), and other locations documented in the 2022 Local Hazard map or Highway Department records					
Ensure availability of water for fire suppression	Feasibility study of other potential hydrant water sources, including tying into another town's hydrant system or pumping water from the Blackstone River, to determine the long-term use of Mansfield Pond as a water source	Fire Department	High	Low	Staff time	3-5 years
	If Mansfield Pond continues to be the hydrant water source in the long-term, upgrade the pond pump system	Fire Department	High	More information needed	USDA Community Facilities Direct Loan & Grant Program, Assistance to Firefighter Grants (AFG)	3-5 years
	Replace the fire suppression water tank at the Elementary School	Fire Department, Blackstone Regional School District	High	More information needed	USDA Community Facilities Direct Loan & Grant Program, BMRSD, Local Funding	1-2 years
	Clear vegetation and manage debris along P&W Railroad rights-of-way; wildfires are reported along	Genesee & Wyoming Inc. (P&W)	High	Low	Private funding	Yearly, or as needed

Objective	Action Plan/Descriptions	Who agencies involved	Priority High/Med/Low	Estimated Cost High/Med/Low	Potential Funding Source	Timeline
	P&W tracks in many communities					
	Provide information to residents and businesses on wildfire prevention and defensible spaces, esp. in areas distant from the fire department's reservoir	Fire Department	High	Low	Staff time	Yearly
Maintain readiness and response capacities of Millville's emergency services	Acquire new radios and new antenna to improve communication system for Millville's emergency services	Fire Department, Police Department	High	Medium	ARPA (police radios), Assistance to Firefighter Grants (AFG), Homeland Security Grants, USDA Community Facilities Direct Loan & Grant Program	1-2 years
	Feasibility study for permanent relocation of the EOC from fire station to other existing or new facility	Fire Department, Board of Selectmen	High	Low	Staff time	1-2 years
	Participate in training offered by the State and/or FEMA that addresses flood hazard planning and management	Emergency Management Director	High	Low	No cost associated	1-2 years
	Review evacuation plan and determine if updates are necessary	Emergency Management Director	High	Low	Staff time	1-2 years

Objective	Action Plan/Descriptions	Who agencies involved	Priority High/Med/Low	Estimated Cost High/Med/Low	Potential Funding Source	Timeline
	Obtain additional electronic message boards for public communication before/during disasters	Emergency Management Director, Fire Department, Police Department	High	Low	Homeland Security Grant (Interoperable Communications Investment Proposal)	1-2 years
	Prepare a spill kit and stay up to date on relevant hazardous materials trainings to maintain readiness for a potential train derailment	Fire Department	Medium	Low	Staff time, Local funding	1-2 years, with ongoing training as needed
	As funding allows, add more full-time fire staff to cover additional days and hours to reduce ambulance response times	Fire Department	Medium	Medium	Local	Timing is dependent on the availability of town funding as determined by yearly the yearly budgeting process
Protect the natural environment and ecosystem services	Use future Open Space and Recreation Plan update to assess the potential for conserving floodplain and conserving area around wetlands and other streams that may become floodplains in the future	Open Space and Recreation Committee	Low	Low	No cost associated with this activity	3-5 years
	Encourage routine private well testing	Board of Health	Medium	Low	No cost associated with this activity	Yearly

Objective	Action Plan/Descriptions	Who agencies involved	Priority High/Med/Low	Estimated Cost High/Med/Low	Potential Funding Source	Timeline
Protect water quality and public health	Maintain close contact with the P&W railway and ask them to provide MSDS sheets	Genesee & Wyoming Inc. (P&W)	Medium	Low	Staff time	Yearly outreach to P&W railway
	Work with CMRPC to identify brownfields	Planning, Town Administrator	Low	Low	CMRPC's EPA Brownfields grant, staff time	As needed
Reduce power outages	Provide information to residents and businesses on tree trimming to help prevent power outages from storms	Tree Warden	High	Low	Staff time	Ongoing, but with initial outreach within 1-2 years
	Create a town-wide forest management plan that accounts for invasive pests other ecological shifts related to climate change	Tree Warden	Medium	More information needed	MVP Action Grant	3-5 years
Support community quality of life	Invest in a basketball court and other recreational spaces for town youth	Parks and Recreation Committee, Board of Selectmen	High	More information needed	ARPA, PARC grant, local funding	1-2 years
	Maintain relationship with the Department of Conservation and Recreation regarding the Blackstone River Bikeway	Town Administrator	Medium	Low	Staff time	Ongoing-check-in yearly or as needed
Other actions that build community resilience	Monitor implementation of Hazard Mitigation Plan	Emergency Management Director, All Town Departments	High	Low	Staff time	Ongoing – annual review by EMD, who may call a larger meetings as needed

Objective	Action Plan/Descriptions	Who agencies involved	Priority High/Med/Low	Estimated Cost High/Med/Low	Potential Funding Source	Timeline
	Research the costs and benefits of installing a solar field over the closed landfill	Planning, Town Administrator, CMRPC	Medium	Low	Staff time	1-2 years
	Collaborate with Providence & Worcester Railroad to study Blackstone River bridge replacement/retrofit options regarding earthquake, flood risks	Genesee & Wyoming Inc. (P&W), Town	Medium	More information needed	Staff time	3-5 years
	Collaborate with pipeline owner regarding earthquake safety upgrades	Algonquin Gas, Town	Low	More information needed	Staff time	3-5 years

8.0 PLAN ADOPTION, IMPLEMENTATION, AND MAINTENANCE

8.1 PLAN ADOPTION

Update paragraph after plan finalization

A public meeting was held on MONTH ##, YEAR as part of the Board of Selectmen's meeting in order detail the planning process to date and to solicit comments and feedback from the public on the draft Millville Hazard Mitigation Plan then being developed. The draft plan was provided to the Town for distribution and posted on CMRPC's website from April 21, 2022 for public review and input. The Plan was then submitted to the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA) for their review. Upon receiving conditional approval of the plan by FEMA, the final plan was presented to the Millville Board of Selectmen and certified on [Insert Date].

8.2 PLAN IMPLEMENTATION

The Town of Millville has taken steps to implement findings from the 2016 Hazard Mitigation Plan into the following policy, programmatic areas and plans: the 2018 Open Space and Recreation Plan and 2018 Master Plan (Action PFS6 – fire-control improvements).

The implementation of the 2022 plan update began upon its formal adoption by the Board of Selectmen and approval by MEMA and FEMA. Those Town departments and boards responsible for ensuring the development of policies, ordinance revisions, and programs as described in *Section 5.0* and *Section 6.0* of this plan will be notified of their responsibilities immediately following approval. The Hazard Mitigation Team will oversee the implementation of the plan.

Incorporation with Other Planning Documents

Existing plans, studies, reports and municipal documents were incorporated throughout the planning process. This included a review and incorporation of significant information from the following key documents:

> ***Millville Comprehensive Emergency Management Plan*** (particularly the Critical Infrastructure Section) – the Critical Infrastructure section was used to help identify infrastructure components in Town that have been identified as crucial to the function of the Town; this resource was also used to identify potentially vulnerable populations and potential emergency response shortcomings.
>
> ***Regional Evacuation Plan*** – Funded by Homeland Security via the Commonwealth of Massachusetts and the Central Regional Homeland Security Advisory Council, the regional evacuation plan prepared by CMRPC was used to identify evacuation routes and shelters.
>
> ***Millville Zoning Bylaw*** – Zoning was used to gather identify those actions that the town is already taking that are reducing the potential impacts of a natural hazard (i.e. floodplain regulations) to avoid duplicating existing successful efforts.

Millville Master Plan (2018) – The Town is currently updating its Master Plan. We encourage the Master Plan committee to incorporate the recommendations provided by the Millville Local Hazard Mitigation Team in the final Millville Master Plan.

***Millville Open Space and Recreation Plan* (2018) –** this Plan was used to identify the natural context within which mitigation planning would take place. This proved useful insofar as it identified water bodies, rivers, streams, open spaces, as well as population trends. This was included to ensure that the Town's mitigation efforts would be sensitive to the surrounding environment.

Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018) - This plan was used to ensure that the town's HMP was consistent with the State's Plan.

After this plan is approved by both FEMA and the local government, links to the plan will be emailed to all Town staff, boards, and committees, with a reminder to review the plan periodically and work to incorporate its contents, especially the action plan, into other planning processes and documents. In addition, during annual monitoring meetings for the Hazard Mitigation Plan implementation process, the Hazard Mitigation Team will review whether any of these plans are in the process of being updated. If so, the Hazard Mitigation Team will remind people working on these plans, policies, etc., of the Hazard Mitigation plan, and urge them to incorporate the Hazard Mitigation plan into their efforts. The Hazard Mitigation Team will also review current Town programs and policies to ensure that they are consistent with the mitigation strategies described in this plan. The Hazard Mitigation Plan will also be incorporated into updates of the Town's Comprehensive Emergency Management Plan.

8.3 PLAN MONITORING AND EVALUATION

The Town's Emergency Management Director will call meetings of all responsible parties to review plan progress as needed, based on occurrence of hazard events. The public will be notified of these meetings in advance through a posting of the agenda at Town Hall. Responsible parties identified for specific mitigation actions will be asked to submit their reports in advance of the meeting.

Meetings will involve evaluation and assessment of the plan, regarding its effectiveness at achieving the plan's goals and stated purpose. The following questions will serve as the criteria that is used to evaluate the plan:

PLAN MISSION AND GOAL

- Is the Plan's stated goal and mission still accurate and up to date, reflecting any changes to local hazard mitigation activities?
- Are there any changes or improvements that can be made to the goal and mission?

HAZARD IDENTIFICATION AND RISK ASSESSMENT

- Have there been any new occurrences of hazard events since the plan was last reviewed? If so, these hazards should be incorporated into the Hazard Identification and Risk Assessment.
- Have any new occurrences of hazards varied from previous occurrences in terms of their extent or impact? If so, the stated impact, extent, probability of future occurrence, or overall assessment of risk and vulnerability should be edited to reflect these changes.
- Is there any new data available from local, state, or Federal sources about the impact of previous hazard events, or any new data for the probability of future occurrences? If so, this information should be incorporated into the plan.

EXISTING MITIGATION STRATEGIES

- Are the current strategies effectively mitigating the effect of any recent hazard events?
- Has there been any damage to property since the plan was last reviewed?
- How could the existing mitigation strategies be improved upon to reduce the impact from recent occurrences of hazards? If there are improvements, these should be incorporated into the plan.

PROPOSED MITIGATION STRATEGIES

- What progress has been accomplished for each of the previously identified proposed mitigation strategies?
- How have any recently completed mitigation strategies affected the Town's vulnerability and impact from hazards that have occurred since the strategy was completed?
- Should the criteria for prioritizing the proposed mitigation strategies be altered in any way?
- Should the priority given to individual mitigation strategies be changed, based on any recent changes to financial and staffing resources, or recent hazard events?

REVIEW OF THE PLAN AND INTEGRATION WITH OTHER PLANNING DOCUMENTS

- Is the current process for reviewing the Hazard Mitigation Plan effective? Could it be improved?
- Are there any Town plans in the process of being updated that should have the content of this Hazard Mitigation Plan incorporated into them?
- How can the current Hazard Mitigation Plan be better integrated with other Town planning tools and operational procedures, including the zoning bylaw, the Comprehensive Emergency Management Plan, and the Capital Improvement Plan?

Following these discussions, it is anticipated that the planning team may decide to reassign the roles and responsibilities for implementing mitigation strategies to different Town departments and/or revise the goals and objectives contained in the plan. The team will review and update the Hazard Mitigation Plan every five years.

Public participation will be a critical component of the Hazard Mitigation Plan maintenance process. The Hazard Mitigation Team will hold all meetings in accordance with Massachusetts open meeting laws and the public invited to attend. The public will be notified of any changes to the Plan via the meeting notices board at Town Hall, and copies of the revised Plan will be made available to the public at Town Hall.

8.4 POTENTIAL FEDERAL AND STATE FUNDING SOURCES

8.4.1 FEDERAL FUNDING SOURCES

The following is a summary of the programs which are the primary source for federal funding of hazard mitigation projects and activities in Massachusetts:

Table 26: Federal Hazard Mitigation Funding

Program	Type of Assistance	Availability	Managing Agency	Funding Source
National Flood Insurance Program (NFIP)	Pre-disaster insurance	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner, FEMA
Community Rating System (CRS) (Part of the NFIP)	Flood insurance discounts	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner
Flood Mitigation Assistance (FMA) Program	Cost share grants for pre- disaster planning & projects	Annual pre-disaster grant program	MEMA	75% FEMA/ 25% non- federal
Hazard Mitigation Grant Program (HMGP)	Post-disaster cost-share grants	Post disaster program	MEMA	75% FEMA/ 25% non- federal
Building Resilient Infrastructure and Communities	National, competitive grant program for projects & planning	Annual, pre-disaster mitigation program	MEMA	75% FEMA/ 25% non- federal
Assistance to Firefighters Grants (AFG)	Training & equipment for wildfire-related hazards	Annual	FEMA	FEMA
Small Business Administration (SBA) Mitigation Loans	Pre- & Post- disaster loans to qualified applicants	Ongoing	MEMA	Small Business Administration
Public Assistance	Post-disaster aid to state & local governments	Post Disaster	MEMA	FEMA/ plus a non-federal share

The FEMA web pages identify several funding opportunities. Please refer to https://www.fema.gov/grants. Some programs are described in more detail below:

HAZARD MITIGATION ASSISTANCE

The HMA grant programs provide funding opportunities for pre- and post-disaster mitigation. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to Natural Hazards. Brief descriptions of the HMA grant programs can be found below. For more information on the individual programs, or to see information related to a specific Fiscal Year, please click on one of the program links.

Hazard Mitigation Grant Program (HMGP)

HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities. Please refer to http://www.fema.gov/hazard-mitigation-grant-program for additional information.

HMGP funds may be used to fund projects that will reduce or eliminate the losses from future disasters. Projects must provide a long-term solution to a problem, for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. Examples of projects include, but are not limited to:

- Acquisition of real property for willing sellers and demolition or relocation of buildings to convert the property to open space use
- Retrofitting structures and facilities to minimize damages from high winds, earthquake, flood, wildfire, or other natural hazards
- Elevation of flood prone structures
- Development and initial implementation of vegetative management programs
- Minor flood control projects that do not duplicate the flood prevention activities of other Federal agencies
- Localized flood control projects, such as certain ring levees and floodwall systems, that are designed specifically to protect critical facilities
- Post-disaster building code related activities that support building code officials during the reconstruction process

Building Resilient Infrastructure and Communities (BRIC)

The Building Resilient Infrastructure and Communities program aims to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. Examples of BRIC projects are ones that demonstrate innovative approaches to partnerships, such as shared funding mechanisms, and/or project design. For example, an innovative project may bring multiple funding sources or in-kind resources from a range of private and public sector partners. Or an innovative project may offer multiple benefits to a community in addition to the benefit of risk reduction. The BRIC program is replacing the Pre-Disaster Mitigation

grant program. More information on the BRIC program can be found here: https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities.

The Massachusetts Emergency Management Agency (MEMA) coordinates BRIC applications for municipalities within the Commonwealth. Links to MEMA resources and BRIC application materials can be found here: https://www.mass.gov/service-details/building-resilient-infrastructure-and-communities-bric-flood-mitigation-assistance-fma-grant-programs.

FLOOD MITIGATION ASSISTANCE (FMA)

Flood Mitigation Assistance (FMA) provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program. Please refer to the FMA website: http://www.fema.gov/flood-mitigation-assistance-grant-program.

Three types of FMA grants are available to States and communities:

- **Project Scoping Grants** are designed to develop mitigation strategies and obtain data to prioritize, select, and develop complete applications in a timely manner that result in either an improvement in the capability to identify appropriate mitigation projects or in the development of an application-ready mitigation project for FMA or another.
- **Planning Grants** to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grants.
- **Technical Assistance Grants** are awards of up to $50,000 federal cost share for Recipients to which FEMA obligated at least $1 million federal share the previous FMA cycle.
- **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.

MEMA coordinates FMA applications for municipalities within the Commonwealth. Links to MEMA resources and FMA application materials can be found here: https://www.mass.gov/service-details/building-resilient-infrastructure-and-communities-bric-flood-mitigation-assistance-fma-grant-programs.

DISASTER ASSISTANCE

Disaster assistance is money or direct assistance to individuals, families and businesses in an area whose property has been damaged or destroyed and whose losses are not covered by insurance. It is meant to help with critical expenses that cannot be covered in other ways. This assistance is not intended to restore damaged property to its condition before the disaster. While some housing assistance funds are available through FEMA's Individuals and Households Program, most disaster assistance from the Federal government is in the form of loans administered by the Small Business Administration.

Disaster Assistance Available from FEMA

In the event of a Declaration of Disaster, assistance from FEMA is grouped in 3 categories:

A. Housing Needs
   - **Temporary Housing** (a place to live for a limited period of time): Money is available to rent a different place to live, or a government provided housing unit when rental properties are not available.
   - **Repair**: Money is available to homeowners to repair damage from the disaster to their primary residence that is not covered by insurance. The goal is to make the damaged home safe, sanitary, and functional.
   - **Replacement**: Money is available to homeowners to replace their home destroyed in the disaster that is not covered by insurance. The goal is to help the homeowner with the cost of replacing their destroyed home.
   - **Permanent Housing Construction**: Direct assistance or money for the construction of a home. This type of help occurs only in insular areas or remote locations specified by FEMA, where no other type of housing assistance is possible.

B. Other than Housing Needs

Money is available for necessary expenses and serious needs caused by the disaster, including:

- Disaster-related medical and dental costs.
- Disaster-related funeral and burial cost.
- Clothing; household items (room furnishings, appliances); tools (specialized or protective clothing and equipment) required for your job; necessary educational materials (computers, school books, supplies)
- Fuels for primary heat source (heating oil, gas).
- Clean-up items (wet/dry vacuum, dehumidifier).
- Disaster damaged vehicle.
- Moving and storage expenses related to the disaster (moving and storing property to avoid additional disaster damage while disaster-related repairs are being made to the home).
- Other necessary expenses or serious needs as determined by FEMA.
- Other expenses that are authorized by law.

C. Additional Services
   - Crisis Counseling
   - Disaster Unemployment Assistance
   - Legal Services
   - Special Tax Considerations

ASSISTANCE TO FIREFIGHTERS GRANTS

The FEMA Assistance to Firefighters Grants (AFG) program provides funds to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience. Under AFG, funds may be available for equipment, vehicles and/or training that can be used to mitigate and/or respond to wildfire-related hazards. AFG also has a Fire Prevention and Safety (FPS) component which funds public outreach

programs and prevention activities, which can emphasize wildfire mitigation. Please refer to: https://www.fema.gov/welcome-assistance-firefighters-grant-program.

DISASTER LOANS AVAILABLE FROM THE SMALL BUSINESS ADMINISTRATION

The U.S. Small Business Administration (SBA) can make federally subsidized loans to repair or replace homes, personal property or businesses that sustained damages not covered by insurance. The Small Business Administration can provide three types of disaster loans to qualified homeowners and businesses:

- Physical damage loans: Loans to cover repairs and replacement of physical assets damaged in a declared disaster.
- Mitigation assistance: Funding to cover small business operating expenses after a declared disaster.
- Economic injury disaster loans: This loan provides economic relief to small businesses and nonprofit organizations that have suffered damage to their home or personal property.
- Military reservist loans: SBA provides loans to help eligible small businesses with operating expenses to make up for employees on active duty leave.

For many individuals the SBA disaster loan program is the primary form of disaster assistance. Please find more information about this loan program here: https://www.sba.gov/funding-programs/disaster-assistance.

DISASTER ASSISTANCE FROM OTHER ORGANIZATIONS AND ENTITIES

DisasterAssistance.gov is a secure, user-friendly U.S. Government web portal that consolidates disaster assistance information in one place. If individuals need assistance following a presidentially declared disaster— which has been designated for individual assistance— they can now to go to DisasterAssistance.gov to register online. Local resource information to help keep citizens safe during an emergency is also available. Currently, 17 U.S. Government agencies, which sponsor almost 70 forms of assistance, contribute to the portal.

DisasterAssistance.gov speeds the application process by feeding common data to multiple online applications. Application information is shared only with those agencies individuals identify and is protected by the highest levels of security. DisasterAssistance.gov will continue to expand to include forms of assistance available at the federal, state, tribal, regional and local levels.

8.4.2 STATE FUNDING SOURCES

The following is a summary of state funding opportunities for hazard mitigation projects and activities in Massachusetts:

Table 27: State Hazard Mitigation Funding

Program	Type of Assistance	Availability	Managing Agency	Funding Source
604b	Grants focused on nonpoint source pollution assessment and watershed planning	Annual	Mass DEP	State funding
Chapter 90	Reimbursable grants	On-going	Mass DOT	State funding
Community Development Block Grants	Competitive community development grants	Annual grant program	HCD	US Department of Housing and Urban Development
Community Preservation Act (CPA)	Grants for local projects that preserve local open space or historic sites, create affordable housing, or develop outdoor recreational facilities	Annual program	Department of Revenue (DOR)	Statewide Community Preservation Trust Fund / local Community Preservation Fund
Culvert Replacement Municipal Assistance Grant Program	Competitive grants for replacing an undersized, perched, and/or degraded culvert located in an area of high ecological value	Annual program	DER	State funding
Dam and Seawall Repair or Removal Program	Competitive grants for dam and seawall repair and removal, as well as construction loans	Annual program	EEA	State funding
Division of Ecological Restoration Priority Project	Competitive grants for wetland and river restoration projects	Annual Program	DER	State funding
Land and Recreation Grants and Loans	Varies, though primarily grant funding	Varies, generally annually	EEA Division of Conservation Services	Varies
Mass Works	Competitive infrastructure grants	Annual	EOHED	State funding
Municipal Small Bridge Program	Competitive grants for small bridge replacement, preservation, and rehabilitation projects	Annual	Mass DOT	State funding
Municipal Vulnerability Preparedness Action Grants	Competitive climate adaptation grants	Annual grant program	EEA	75% EEA/ 25% non-state match

Planning Assistance Grants	Competitive grants that support efforts to plan, regulate (zone), and act to conserve and develop land consistent with the Massachusetts' Sustainable Development Principles	Annual grant program	EEA	75% EEA / 25% non-state match
Section 319 Nonpoint Source Competitive Grants Program	Competitive grant program funding projects that address the prevention, control, and abatement of nonpoint source (NPS) pollution	Annual grant program	Mass DEP	State funding
Special appropriations and legislative earmarks	Varies	Infrequent, after natural disasters or legislature vote	State Legislature	State funding
State Revolving Fund	Low-interest loans	Annual program	Mass DEP	Municipal funding with state loan

The Community Grant Funder web page includes the municipal grant programs listed above, as well as other funding opportunities: https://www.mass.gov/lists/community-grant-finder. Some programs in Table 27 are described in more detail on the following pages.

CHAPTER 90 FUNDS

This statewide program reimburses communities for roadway projects, such as resurfacing and related work and other work incidental to the above such as preliminary engineering including State Aid/Consultant Design Agreements, right-of-way acquisition, shoulders, side road approaches, landscaping and tree planting, roadside drainage, structures (including bridges), sidewalks, traffic control and service facilities, street lighting (excluding operating costs), and for such other purposes as the Department may specifically authorize. Maintaining and upgrading critical infrastructure and evacuation routes is an important component of hazard mitigation. Chapter 90 funds could be used for roadway improvements.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

CDBG remains the principal source of revenue for communities to use in identifying solutions to address physical, economic, and social deterioration in lower-income neighborhoods and communities. CDBG is primarily a housing and community development program administered through the Executive Office of Housing and Community Development (HCD). The program can fund certain critical infrastructure projects, and necessary housing improvements that benefit populations that may be more vulnerable to certain natural hazards. The program can also fund the rehabilitation of municipal buildings such as town halls, which in many cases, also serve as Emergency Operations Centers for their communities.

COMMUNITY PRESERVATION ACT (CPA)

The Community Preservation Act (CPA) is a smart growth tool that helps communities preserve open space and historic sites, create affordable housing, and develop outdoor recreational facilities. CPA also helps strengthen the state and local economies by expanding housing opportunities and construction jobs for the commonwealth's workforce, and by supporting the tourism industry through preservation of the commonwealth's historic and natural resources. All communities in Massachusetts pay into statewide Community Preservation Trust fund through a real estate excise tax. However, communities must set up a local Community Preservation Fund and governing committee to utilize the trust fund. CPA projects can build local resilience by protecting open spaces, and by creating affordable housing, which benefits residents who may be most vulnerable to natural hazards. More information on the CPA program can be found here: https://www.communitypreservation.org/about.

DAM AND SEAWALL REPAIR OR REMOVAL PROGRAM

The EEA funds projects for the repair and removal of dams, levees, seawalls, and other forms of inland and coastal flood control. For additional information, please refer to https://www.mass.gov/service-details/dam-and-seawall-repair-or-removal-program-grants-and-funds.

DER PRIORITY PROJECTS

The Division of Ecological Restoration selects wetland and river restoration projects through a state-wide, competitive process. DER chooses high-priority projects that bring significant ecological and community benefits to the commonwealth. DER's most recent call for applications solicited projects located in Massachusetts that focus on cranberry bog wetland restoration, dam removal and river restoration, coastal wetland restoration projects, or a combination of these topics. More information on the Priority Projects program can be found here: https://www.mass.gov/how-to/become-a-der-priority-project. This program can be used to remove significant or high hazards dams that communities no longer want to maintain, which may improve the health and resilience of aquatic systems.

LAND AND RECREATION GRANTS AND LOANS

The Division of Conservation Services (DCS) manages several grant or loan programs that enable land preservation, natural resources conservation, and public recreation. Municipalities with an active Open Space and Recreation Plan are generally eligible to apply for these programs. Preserving natural open space can buffer natural systems from development impacts, protect open spaces from future development, and maintain ecosystem services like natural flood mitigation. The full list of DCS grant programs can be found here: https://www.mass.gov/land-and-recreation-grants-loans/need-to-know.

MASSWORKS INFRASTRUCTURE PROGRAM

The MassWorks Infrastructure Program provides a one-stop shop for municipalities and other eligible public entities seeking public infrastructure funding to support economic development and job creation. Although not specific to natural hazards per se, these infrastructure enhancements under MassWorks could also address identified needs for hazard mitigation. The MassWorks Infrastructure Program is administered by the Executive Office of Housing and Economic Development, in cooperation with the Department of Transportation and Executive Office for Administration & Finance. Please refer to http://www.mass.gov/hed/economic/eohed/pro/infrastructure/massworks/ for additional information.

MUNICIPAL VULNERABILITY PREPAREDNESS ACTION GRANT PROGRAM

The MVP Action Grant offers financial resources to municipalities that are 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. Towns are eligible for this competitive grant program after successfully completing an MVP planning grant. A variety of project types are eligible for funding, but projects must address local vulnerabilities to climate change and incorporate MVP Core Principles. Grant application information can be found here: https://www.mass.gov/service-details/mvp-action-grant. MVP Core Principles can be found here: https://www.mass.gov/doc/mvp-core-principles/download.

SPECIAL APPROPRIATIONS AND LEGISLATIVE EARMARKS

Although there is no separate state disaster relief fund in Massachusetts, the state legislature may enact special appropriations for those communities sustaining damages following a natural disaster that are not large enough for a Presidential disaster declaration. Since 2011, Massachusetts has issued 12 state of emergency declarations. Additionally, individual legislators may seek specific project funding for projects through the legislative budgeting and appropriations process.

STATE REVOLVING FUND

This statewide loan program through the Massachusetts Department of Environmental Protection assists communities in funding local drinking water, wastewater, and storm water infrastructure improvements.