PRINCETON HAZARD MITIGATION PLAN

2026 Update

Town of PRINCETON MASSACHUSETTS

Photo Courtesy of the Town of Princeton Fire Department

CENTRAL MASSACHUSETTS Regional Planning Commission

Adopted by the Select Board on February 25th, 2026

Prepared by
Local Hazard Mitigation Team
Town of Princeton, Massachusetts
&
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TOWN OF PRINCETON

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CERTIFICATE OF ADOPTION
SELECTBOARD
TOWN OF PRINCETON, MASSACHUSETTS

A RESOLUTION ADOPTING THE *PRINCETON HAZARD MITIGATION PLAN*

WHEREAS, the Town of Princeton established a Committee to prepare the 2025 update of the *Princeton Hazard Mitigation Plan*; and

WHEREAS, the updated *Princeton Hazard Mitigation Plan* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Princeton; and

WHEREAS, duly-noticed public meetings were held by the LOCAL HAZARD MITIGATION PLANNING TEAM on DATE and DATE; and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Princeton SELECTBOARD adopts the 2025 update of the *Princeton Hazard Mitigation Plan*, in accordance with M.G.L. 40 or the charter and bylaws of the Town of Princeton.

ADOPTED AND SIGNED this 25th day, February 2026.

Karen Cruise, Chair

Robert Cumming, V. Chair

Philip Gott, Clerk

ACKNOWLEDGEMENTS

This Acknowledgements section helps meet the following FEMA local mitigation plan requirements:

- *A1. "Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement 44 CFR § 201.6(c)(1))"*

This Hazard Mitigation Plan (HMP) update was funded by the Federal Emergency Management Agency (FEMA) via the Massachusetts Emergency Management Agency (MEMA). This report was prepared for the community of Princeton by the Central Massachusetts Regional Planning Commission (CMRPC).

The Princeton Selectboard extends its thanks to participants in the Local Hazard Mitigation Team for their time and hard work participating in this project. Core Team members include:

Paul Patricia, Police Department, Chief

Ricky Thebeau, Police Department, Lieutenant

Sean McKeon, Princeton Municipal Light Department, General Manager

Ace Thompson, Thomas Prince School, Principal

Sherry Patch, Town Administrator

Tom Sullivan, Town Tree Warden

Corey Burnham-Howard, Town Planning Board Member and Town Environmental Action Committee Chair

Louise Bowen, Town Administrator's Office, Administrative Assistant

Ben Metcalf, Highway Department, Highway Superintendent

Phil Connors, Town Citizen

John Bennett, Fire Department, Fire Chief

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

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Zachary Blais, Principal Planner, Environmental Planning

Matthew Franz, GISP, Director, GIS

Andrew Loew, Director, Community Development and Resiliency Planning

Trish Settles, AICP, Deputy Executive Director, Regional Collaboration and Community Planning

Thanks are also due to the Massachusetts Emergency Management Agency (MEMA) for guidance and feedback regarding this plan.

Contents

EXECUTIVE SUMMARY

The Town of Princeton's Hazard Mitigation Plan (HMP) identifies the natural hazards facing the town and provides existing measures and actionable strategies to mitigate the risks associated with natural hazards. This plan enables the town to lessen the impacts of natural hazards on infrastructure and residents before hazard events happen.

A local planning team consisting of representatives from various town departments and local organizations provided insight and knowledge into the town's vulnerabilities, priorities, and past history of natural hazard events. The planning team also distributed a public survey to understand the insights and experiences of the Princeton community. The Central Massachusetts Regional Planning Commission (CMRPC) provided technical assistance to the Town of Princeton to complete the plan update.

Ultimately, a mix of local input and data analysis informs the findings and recommendations of this plan. Specifically, the knowledge and experience from the local planning team and the local community, as well as a hazards analysis using past climate data and mapping technology conducted by CMRPC, inform this plan.

After a summary of the planning process, the plan provides a profile of Princeton, including an overview of critical infrastructure, facilities, and populations to protect from natural hazard events in Princeton. It then identifies and analyzes the natural hazards impacting Princeton, including: Flooding, Severe Snowstorms / Ice Storms / Nor'easters, Hurricanes, Severe Thunderstorms / Wind / Tornadoes, Wildfires, Earthquakes, Dam Failure, Drought, Extreme Temperatures, Invasive Species and other hazards that could affect the Town of Princeton.

The plan then summarizes existing protection measures, or the measures that the town is currently taking to mitigate the impacts of natural hazards.

Next, the plan provides mitigation strategies, or actionable measures that the town can take to mitigate the impacts of natural hazards before they happen. The planning team classified strategies into four categories: infrastructure, planning and coordination, education and outreach, and local regulations and planning.

Lastly, the plan includes an implementation and maintenance plan for the next five years, including various funding sources at the state and federal levels available for hazard mitigation projects.

In CMRPC's and the local planning team's analysis, the hazards that pose the largest risk to Princeton are wildfires, drought, and severe snowstorms / ice storms / Nor'easters. Princeton has unique vulnerabilities to these three hazards: It is heavily forested and mountainous (with Mount Wachusett being an asset to the town as well as a liability) with access to water being limited to cisterns and fire ponds, and the higher elevation means colder temperatures and more snow as well as more frequent snow. Wildfire and Drought go hand in hand, and subsequently these two hazards would likely act synergistically with each other and exacerbate the risks that either poses to the town. As part of this planning process, the planning team identified Wildfires early as being the chief hazard the town faces, and throughout this planning process, the Town of Princeton has taken a proactive stance, applying for grant funding through the Municipal Vulnerability Preparedness Action grant Program of FY26 to develop a Community Wildfire Protection Plan for Mount Wachusett and its surrounding forested areas prior to the full approval and adoption of this plan. These hazards and the others listed above are enumerated in section four of the plan, which also identifies the potential effects from climate change that may change the frequency or severity of these natural hazard events, based on the findings from the State of Massachusetts

Climate Assessment (2022) as well as other data sources.

Select key high-priority mitigation strategies that the local planning team included:

- Various physical improvements to culverts, cisterns, and town facilities
- Implement an all-hazards education campaign
- Purchase of a vehicle that can function as a heavy rescue communications center equipped with radios
- Cistern storage and capacity upgrades (especially on Worcester Road)
- Pursue funding for a public safety complex
- Build a water use dashboard for the town and fire department websites
- Write and implement a pest and landscape management plan

This list is not comprehensive, and the recommendation is that any reader review section seven of the plan for a complete list of the mitigation strategies identified.

The Federal Emergency Management Agency (FEMA) requires that localities maintain a hazard mitigation plan and update it every five years.

The U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA) Region 1 Mitigation Division has approved the *Princeton Hazard Mitigation Plan* effective **April 1, 2026** through **March 31, 2031** in accordance with the planning requirements of the Robert T. Stafford Relief and Emergency Assistance Act (Stafford Act), as amended; the National Flood Insurance Act of 1968, as amended; the National Dam Safety Program Act, as amended; and Title 44 Code of Federal Regulations (CFR) Part 201.

1.0 INTRODUCTION

1.1 DISASTER MITIGATION PLAN

Congress enacted the Disaster Mitigation Act of 2000 (DMA 2000) on October 10, 2000. Also known as the Stafford Act Amendments, this 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 in place in order to qualify for future federal disaster mitigation grants following a Presidential Disaster Declaration. Hazard Mitigation Plans emphasize measures that can be taken to reduce or prevent future disaster damage caused by natural hazards. In the context of natural hazard planning, Pre-Disaster Mitigation refers to any action that permanently reduces or eliminates long-term risks to human life and property.

1.2 PLAN PURPOSE

Section 1.2 helps meet the following FEMA local mitigation plan requirements:

- *A1. "Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction?" (Requirement 44 CFR § 201.6(c)(1))*

This plan identifies the natural hazards facing the Town of Princeton, assesses the vulnerabilities of the town's critical facilities, infrastructure, residents, and businesses to these hazards, and presents recommendations to mitigate the adverse effects of these hazards.

New England weather is renowned for its mercurial and dramatic nature. Central Massachusetts is susceptible to New England weather patterns, like late summer hurricanes, major winter blizzards, and summer droughts. These natural hazards occur frequently enough to be familiar scenes to residents of Princeton. The negative effects of these natural hazards on the built environment can lead to these events to be classified as natural disasters. As climate change continues to progress, the severity and frequency of natural hazards 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 Princeton 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.

1.3 PLANNING PROCESS

Section 1.3 helps meet the following FEMA local mitigation plan requirements:

- *A1. "Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction?" (Requirement 44 CFR § 201.6(c)(1));*
- *A2. "Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development as well as businesses, academia, and other private and non-profit interests to be involved in the planning process?" (Requirement 44 CFR § 201.6(b)(2)); and*
- *A3. "Does the plan document how the public was involved in the planning process during the drafting stage and prior to plan approval?" (Requirement 44 CFR § 201.6(b)(1))*

This Plan is funded through a Fiscal Year 2020 Building Resilient Infrastructure and Communities (BRIC) grant to the Town of Princeton from the Federal Emergency Management Agency (FEMA) through the Massachusetts Emergency Management Agency (MEMA).

The planning process in Princeton was composed of two distinct but related phases:

1. data collection and technical review, and
2. public input and planning.

The identification of natural hazards impacting the Town of Princeton was accomplished through a review of available information from various sources. These sources included federal and state reports and datasets, existing plans, and in some cases engineering documents. An assessment of risks and vulnerabilities was performed primarily using geographic information systems (GIS) to identify the infrastructure (critical facilities, public buildings, roads, neighborhoods, etc.) at the highest risk of being damaged by hazards, particularly flooding. Local knowledge as imparted by Town officials, staff, emergency management volunteers, and others was a critical element of this phase.

The second phase of the planning process was focused on outreach, public participation and input, and planning. This phase was critical to fostering awareness of the process among a wide range of local officials, coordinating updates to different plan elements in ways that included important stakeholders, and providing opportunities for public comment and input from a representative base of residents and other stakeholders, including community lifelines, in Princeton. Through community engagement, CMRPC was better able to gauge community priorities for mitigation and understand local resources as well as existing policies and procedures. With information from this phase of the planning process in hand, the local planning team was able to develop an informed list of mitigation strategies for the Town.

The Princeton Hazard Mitigation Planning team, consisting of local staff, included:

Paul Patricia, Police Department, Chief

Ricky Thebeau, Police Department, Sergeant

Sean McKeon, Princeton Municipal Light Department, General Manager

Ace Thompson, Thomas Prince School, Principal

Sherry Patch, Town Administrator

Tom Sullivan, Town Tree Warden

Corey Burnham-Howard, Town Planning Board and Town Environmental Action Committee Chair

Louise Bowen, Town Administrator's Office, Administrative Assistant

Ben Metcalf, Highway Department, Highway Superintendent

Phil Connors, TITLE

John Bennett, Fire Department, Fire Chief

To discuss hazard areas, critical infrastructure and other assets, and plan priorities and strategies, the Hazard Mitigation Planning team met five times on July 31st, 2024, September 13th, 2024, November 7th, 2024, January 28th, 2025, and March 6th, 2025. Between meetings and during development of the draft and final plans, information and comments were shared among the local team and CMRPC. On November 7th, 2024, the Hazard Mitigation Planning team launched a public survey to gauge the concerns of residents, workers, visitors, and business owners with natural hazards in town. The survey was distributed on the town's website and social media pages, and the survey was advertised through the town news subscription, the Princeton Public Schools family communication, and flyers for and paper copies of the survey were distributed around town, including at the town hall, senior center, and the public library. A total of 78 responses were collected. Survey responses were discussed by the local planning team at its March 2025 meeting and helped inform the development and prioritization of the plan's mitigation strategies. Representatives from the surrounding communities of Sterling, Leominster, Westminster, Hubbardston, Rutland, and Holden were invited to comment on the draft plan during the public comment period in an effort gather input from surrounding communities who might have shared interests or concerns. As planning activities progressed, a public presentation was made by CMRPC and the local planning team on June 11th, 2025, at a hybrid Princeton Selectboard Meeting to provide a summary of key aspects of the draft plan before being finalized. The opportunity for public comment was emphasized during this presentation. The presentation was available for viewing during and after the meeting via GoToMeeting software. Materials and notes from this presentation and the public comment period are included in Appendix D and Appendix E, respectively. A full draft plan was provided to the town for distribution and made available online at CMRPC's website for public comment for two weeks from June 13th, 2025, through June 27th, 2025. Feedback from Selectboard members during the public presentation and from several town residents during the public comment period were received. This feedback was considered, and, where deemed appropriate by the local planning team, incorporated as final edits to the plan.

The final draft plan was submitted to MEMA for review on October 17, 2025, and was then relayed to FEMA for federal review. After receiving receipt of FEMA's notice of approval pending adoption on February 18th, 2026 the plan was formally adopted by vote of the Princeton Selectboard at the February 25th, 2026 meeting of the Selectboard. The Town received final approval from FEMA on April 1st, 2026.

The Princeton Planning Board is the primary town agency responsible for regulating development in the town. Feedback to the Planning Board was ensured through the participation of the Town Administrator and others involved with the Princeton Planning Board on the local hazard mitigation planning team. In addition, CMRPC, which is the state-designated Regional Planning Agency (RPA) for Princeton, works with all agencies that regulate development in its region; these agencies that CMRPC works with include both the municipal entities listed above and state

agencies such as the Department of Conservation and Recreation (Mass DCR) and the Department of Transportation (MassDOT). The regular collaboration between CMRPC and these municipal entities and state agencies ensured that the operational policies of any mitigation strategies or hazards identified by these entities and agencies were incorporated in this Princeton Hazard Mitigation Plan. The engagement of a diverse array of representatives, stakeholders, community lifelines, and organizations during the planning process promoted the creation of mitigation strategies for local recovery and resilience efforts in town. This hazard mitigation planning process included stakeholders from a broad range of sectors both inside and outside of local government. The inclusion of these stakeholders in the planning process is a critical step towards ensuring equitable, effective, and comprehensive risk reduction outcomes.

The following community lifelines were sent the full draft plan during the public comment period for their review and input. FEMA defines community lifelines as "the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.[1]"

Safety and Security Lifelines:

- Local Planning Team
- Fire Department
- Police Department
- Princeton Emergency Management
- Massachusetts Audubon Society
- Princeton Land Trust
- Massachusetts Department of Conservation and Recreation (DCR)
- Town of Westminster
- Town of Leominster
- Town of Hubbardston
- Town of Rutland
- Town of Holden
- Town of Sterling

Food, Water, and Shelter Lifelines:

- Thomas Prince School
- Wachusett Regional School District Central Office
- Wachusett Regional High School
- Princeton Senior Center
- Big Y (Holden)
- Wachusett Food Bank
- American Red Cross
- Worcester County Food Bank

[1] FEMA, "Local Mitigation Planning Policy Guide," FEMA.gov, Federal Emergency Management Agency, April 19, 2022, page 17, https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf.

Health and Medical Lifelines:

- St. Vincent's Hospital
- UMass Memorial Hospital

Communications Lifelines:

- Holden Regional Dispatch Center
- CodeRED
- Town Planning (if applicable)
- Wachusett Mountain Communications Facility

Transportation Lifelines:

- Massachusetts Department of Transportation (MassDOT)
- Sterling Regional Airport
- Worcester Regional Airport
- Central Massachusetts EMS AMBU Bus

Energy Lifelines:

- Princeton Municipal Light Department
- Nextera Energy
- Sterling Municipal Light Department

Hazardous Materials Lifelines:

- Massachusetts Department of Environmental Protection
- State Haz Mat team

Water Lifelines:

- Princeton Highway Department

2.0 Community Profile and Development Trends

2.1 Regional and Community Profile

The Central Massachusetts Regional Planning Commission (CMPRC) region occupies roughly 1,000 square miles in the southern two-thirds of Worcester County, Massachusetts. The City of Worcester, which is the second-largest city in Massachusetts and New England with a population of 206,518 according to the 2020 United States Census, is relatively in the central part of the region. Nearly 588,141 people live in the CMRPC Region, of whom 3,495 reside in Princeton.[2]

The CMRPC region is bordered to the west by the Central Massachusetts uplands, to the south by Rhode Island and Connecticut, to the east by the Boston Metropolitan Area, and to the north by the Montachusett Region in Northern Worcester County. The forty-community region has been divided for planning purposes into six sub-regions, as determined by shared characteristics and roadway corridors. Princeton is in the north sub-region consisting of Princeton and 6 other towns located north of Worcester, including Barre, Oakham, Paxton, Holden, Rutland, and West Boylston.

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 2024, the Worcester, MA area saw monthly mean temperatures ranging from 14.2 degrees Fahrenheit in February to 74.7 degrees Fahrenheit in July.[3] According to this same source, between 2003 and 2024, average annual precipitation in the Worcester, MA area has been relatively high at 51.32 inches,[4] and, between 1999-2000 and 2023-2024, average annual snowfall has been 70.7 inches.[5] Approximately 50 miles from the Atlantic coast, Princeton and its neighboring communities are subject to a variety of types of severe storms, including hurricanes, nor'easters, thunderstorms, and blizzards.

The Town of Princeton, Massachusetts, was incorporated in 1771.[6] Princeton is situated along key east-west corridors that indirectly connect the town to Worcester, as well as points east and west. Route 140 runs from north to south through town, while Routes 62 and 31 run across the town from the northeast and east, through the town center, and to the west and south, respectively. Routes 31 and 62 meet in the town center.

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[2] "P1: Race," Data.Census.gov, United States Census Bureau, accessed January 31, 2025, https://data.census.gov/table?q=princeton%20town%20Massachusetts.

[3] These Worcester area temperature estimates are based on data recorded at a weather station at Worcester Regional Airport. "Monthly Mean Avg Temperature for Worcester Area, MA (ThreadEx)," Weather.gov, National Oceanic and Atmospheric Association National Weather Service, accessed January 31, 2025, https://www.weather.gov/wrh/Climate?wfo=box.

[4] "Monthly Total Snowfall for Worcester Area, MA (ThreadEx)," Weather.gov, National Oceanic and Atmospheric Association National Weather Service, accessed January 31, 2025, https://www.weather.gov/wrh/Climate?wfo=box.

[5] These Worcester area snowfall estimates are based on data recorded at a weather station at Worcester Regional Airport.
"Monthly Total Snowfall for Worcester Area, MA (ThreadEx)," Weather.gov, National Oceanic and Atmospheric Association National Weather Service, accessed January 31, 2025, https://www.weather.gov/wrh/Climate?wfo=box.

[6] "Town History," town.princeton.ma.us, Town of Princeton, MA, accessed April 23, 2025, https://www.town.princeton.ma.us/about-princeton/pages/history

Princeton is bordered by Westminster and Leominster to the north, Hubbardston to the west, Rutland and Holden to the south, and Sterling to the east.

Princeton has a total area of 35.85 square miles[7] and a population of 3,495.[8] According to CMRPC's Community Snapshots (Princeton profile), Princeton's population is projected to continue growing at a consistent pace.[9] Princeton experienced the most population growth at the end of the 20th century: The town's population doubled (99% increase) between 1970 and 2000. Population growth has since slowed, with a 5% increase between 2000 and 2020.[10] Yet, Princeton is expected to grow by approximately 14% between 2020 and 2050, reaching a projected 3,974 residents. According to the 2020 US Census, 92.1% of Princeton's population identifies as white, 1.1% of the town's population identifies as Asian, 0.9% of the town's population identifies as Black or African American, 0.3% of the town's population identifies as some other race, and 5.5% of the town's population identifies as belonging to two or more races.[11] In addition, according to the 2020 Census, about 3.1% of Princeton residents identify as Latino or Hispanic. According to the same data, 18.9% of the town's population is under 18 years old, while 22.4% of the population is 65 years and over.[12]

The median age in town, according to the 2020 US Census, is 49.6 years old, which is significantly higher than the state's median age of 39.9.[13] At $150,577, the median household annual income in Princeton (according to 2022 American Community Survey 5-year estimates) is significantly higher than the state's median household annual income of $96,505 and Worcester County median household annual income of $88,524.[14] The unemployment rate was lower than the statewide average: In 2024, the average unemployment rate in Princeton was 3.4%[15] compared to 3.8% statewide.[16] The poverty rate in town (according to 2022 ACS 5-year estimates) is 4.4%, less than half of the Massachusetts poverty rate 9.9%) and the Worcester County poverty rate (10.0%)[17] With a median value of owner-occupied housing units of $496,400, according to 2022 ACS 5-year estimates, housing costs in town are relatively higher compared to in the state

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[7] "Town Data," town.princeton.ma.us, Town of Princeton, MA, accessed January 31, 2025, https://www.town.princeton.ma.us/about-princeton/pages/town-data

[8] "P1: Race," Data.Census.gov, United States Census Bureau, accessed January 31, 2025, https://data.census.gov/table?q=p1&g=060XX00US2502755395

[9] "Princeton," CMRPC.org, Central Massachusetts Regional Planning Commission, accessed January 31, 2025, https://cmrpc.org/data-center/community-snapshots/princeton/

[10] Ibid.

[11] "DP1: Profile of General Population and Housing Characteristics," Data.Census.gov, United States Census Bureau, accessed January 31, 2025, https://data.census.gov/table?q=dp1%20princeton%20town%20ma

[12] Ibid.

[13] Ibid.

[14] "S1903: Median Income in the Past 12 Months (in 2022 Inflation-Adjusted Dollars)," Data.Census.gov, United States Census Bureau, accessed January 31, 2025, https://data.census.gov/table?q=ACS%20s1903&g=060XX00US2502755395

[15] Massachusetts Department of Economic Research, "Municipal Employment Data: Princeton - 2010," lmi.dua.eol.mass.gov, March 2024, https://lmi.dua.eol.mass.gov/lmi/MunicipalEmploymentData/LmiTown?A=000175

[16] Massachusetts Department of Economic Research, "Labor Force and Unemployment Data – 2024," lmi.dua.eol.mass.gov, https://lmi.dua.eol.mass.gov/lmi/LaborForceAndUnemployment/LURResults?A=01&GA=000025&TF=2&Y=&Sopt=N&Dopt=TEXT

[17] "S1701: Poverty Status in the Past 12 Months," Data.Census.gov, United States Census Bureau, accessed January 31, 2025, https://data.census.gov/table?q=ACS%20s1701%20princeton%20ma

and to Worcester County, whose comparable numbers are $483,900 and $363,200, respectively.[18] According to 2022 ACS 5-year estimates, 94.6% of occupied homes in town are single-family homes (detached or attached), and 5.4% are multi-unit structures.[19] With a 6.0% vacancy rate according to the 2020 US Census, the vacancy rate in Princeton is relatively lower than the comparable rates in the state and Worcester County, which are 8.3% and 5.7%, respectively.[20] The housing stock in Princeton is relatively older, with 19.6% of homes being built before 1940, according to 2022 ACS 5-year estimates.[21]

[18] "DP04: Selected Housing Characteristics," Data.Census.gov, United States Census Bureau, accessed January 31, 2025, https://data.census.gov/table?q=ACS%20dp04%20princeton%20ma

[19] "S2504: Physical Housing Characteristics for Occupied Housing Units," Data.Census.gov, United States Census Bureau, accessed January 31, 2025, https://data.census.gov/table?q=ACS%20dp04%20princeton%20ma

[20] "DP1: Profile of General Population and Housing Characteristics," accessed January 31, 2025, https://data.census.gov/table?q=ACS%20dp04%20princeton%20ma

[21] "S2504: Physical Housing Characteristics for Occupied Housing Units," accessed January 31, 2025, https://data.census.gov/table?q=ACS%20s2504%20princeton%20ma

2.2 Development Trends

Section 2.2 helps meet the following FEMA local mitigation plan requirements:

- *C1. "Does the plan document each participant's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?" (Requirement 44 CFR § 201.6(c)(3)); and*
- E1. "Was the plan revised to reflect changes in development?" (Requirement 44 CFR § 201.6(d)(3))

The Town of Princeton is a rural community located by the southern portion of Wachusett Mountain and is known for its agriculture, open space, and conservation. These features of the town's character contribute to development and redevelopment patterns throughout the town.

There are no current or potential future commercial development projects since the 2016 plan update. Economic and regulatory factors contribute to this trend. Specifically, economic uncertainty and a small population and a small customer base, and the business and industrial zones in town have been primarily built up with residential developments.

If there were to be new development projects in town, all subdivisions and new developments would be rigorously reviewed by the Planning Board, Fire Department, Police Department, the Zoning Board of Appeals, and any other applicable departments, boards, and committees to ensure that new construction complies with bylaws and ensures emergency vehicle access.

Table 1 shows new construction residential building permits issued between 2016 and 2023. There is consistent new construction of single-family homes within this time period, though it is limited overall. From 2016 – 2023, the town issued 58 new residential construction permits. All residential permits were for single-family residences.[22]

Table 1: Number of New Construction Residential Building Permits Issued by Year in Princeton[23]

Year	Single Family Permits
2016	3
2017	7
2018	10
2019	8
2020	9
2021	7
2022	3
2023	11
2016 – 2023 Total	**58**

[22]"Housing Unit Building Permits for: PRINCETON TOWN, MA," Socds.huduser.gov, United States Department of Housing and Urban Development, accessed February 14, 2025, https://socds.huduser.gov/permits/.
[23] Ibid.

Between 2016 and 2023, the town issued an average of 7 permits per year. Residential development in town has slowed considerably in the 21st century when compared to 1980-2000, when housing growth averaged 22 dwelling units per year. All dwelling units built during this period were single family homes along existing roadways or served by newly constructed common driveways.

If the appropriate boards and departments formally approve a development, the town should give due consideration to the protection of natural resources. If there are proper resilience measures in construction, new development can be more resilient to natural hazards. For instance, the clearing of brushes and trees lessens the chance of wildfires near new development; buried powerlines can reduce risk of power loss from storm events; the usage of flood control measures such as drainage structures, rain gardens, swales and berms can reduce flood hazard risks in an area. However, new development built without the inclusion of hazard mitigation and resiliency in mind can increase the vulnerability to natural hazards; for instance, new construction in a defined floodplain or near a wildland interface, native plant removal, and wetland drainage can all exacerbate natural hazard risks to life and property. To that end, the consistent incorporation of resiliency measures in new development will be especially important in Princeton as climate change leads to increased natural hazard risk.

New developments could also cause an increase in storm runoff in localized areas of town; therefore, proper drainage infrastructure is necessary to mitigate possible disruption to surrounding properties, wetlands, streams, and aquifers. Modern construction processes help to mitigate this risk. For instance, erosion control measures help to prevent the sedimentation of surface water resources; stormwater drainage facilities mimic undeveloped conditions and cleanse contaminants; trees are trimmed back from structures and power lines; utility lines are underground; roads are wide enough to allow emergency vehicles to enter; there are modern building codes that increase natural hazard resiliency; and setbacks from wetlands are required.

The town, including various responsible boards and commissions, should ensure that new development processes take potential and known hazards into account and ensure that the mitigation of hazards occurs when needed. According to the Executive Office of Housing and Livable Communities, this would mean taking into account hazards more intentionally at the local and state level when considering housing or community investments and creating new initiatives that invest in adaptive measures. In addition, the state and municipalities must consider seriously the option of relocation or retreat from the areas of highest vulnerability.

Princeton utilizes various methods to ensure that new development conforms with current Massachusetts General Laws as well as the town's bylaws. The Planning Board, Conservation Commission, and Zoning Board of Appeals (ZBA) in town consider water resource and open space preservation in decision making and, in the case of the ZBA, when hearing and deciding on appeals. This consideration includes specific evaluation criteria that are relevant to natural hazards – including requirements for preventing and mitigating flooding and stormwater impacts. The town's Bylaws are amended and updated on an as needed basis to adapt to the needs of and the shifting forces that affect the town.

Any new developments in Princeton need to be in line with the state building code. On July 1st, 2020, Princeton codified the Stretch Energy Code based on the International Energy Conservation Code (IECC) 2009 building code created by the International Code Council.[24] This Stretch Energy

[24] "Massachusetts Building Energy Code Adoption by Municipality," Mass.gov, Massachusetts Department of Energy Resources, February 14, 2025, https://www.mass.gov/doc/building-energy-code-adoption-by-municipality/download.

Code provides a more energy efficient alternative to the base energy code for both new construction and existing buildings in Princeton, strengthening the town's climate resiliency and hazard mitigation capabilities.

As the population of Princeton grows and additional development occurs, officials should seek to further integrate hazard mitigation practices into the town's planning and development processes. At the time of the writing of this plan, the town is currently updating the Master Plan. However, the town has several other complete plans: Open Space and Recreation (2020), Municipal Vulnerability Preparedness Summary of Findings (2021), Housing Production Plan (2022), the Environmental Action Plan (2020), the Comprehensive Emergency Management Plan (2022), and the Ecotourism Economic Development Plan (2024). These planning processes give the town an opportunity to identify threats and prioritize strategies to address them. Climate change, according to current predictions, will lead to an increase in extreme storm events, including more rain in shorter amounts of time. The town is also seeking other planning opportunities, including Municipal Vulnerability Preparedness 2.0 and Action Grants. Planning for the future impacts of climate change is imperative to protect the citizens of Princeton.

3.0 Critical Facilities and Vulnerable Populations

A critical facility is defined as a building, structure, or location which:

- is vital to hazard response efforts,
- currently helps protect the community from hazards, and/or
- would create a secondary disaster if a hazard were to impact it.

3.1 Critical Facilities Within Princeton

This Critical Facilities List for the Town of Princeton has been created through the utilization of several online sources, several planning documents, and the knowledge and expertise of the local HMP planning team in town.

Planning documents and online resources which inform this plan include:

- Princeton's Comprehensive Emergency Management Plan,
- MassGIS data on dams,
- Massachusetts Department of Early Education and Care data on childcare facilities,
- Massachusetts Historical Commission data on historic sites,
- Employment data from the Massachusetts Department of Economic Research and the Massachusetts Department of Education, and
- CMRPC undertook critical infrastructure mapping 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.

Princeton's Local Hazard Mitigation Planning Team has broken this list of critical facilities into four categories:

- Emergency response facilities needed in the event of a disaster,
- Non-emergency response facilities that have been identified by the local HMP planning team (these facilities are not required in an emergency response event, but are considered essential for the everyday operation of Princeton),
- Dams, and
- Facilities that serve vulnerable populations and/or which the town 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 emergency response facilities and services as the highest priority facilities and services to protect in instances of natural and man-made hazards.

Table 4: Emergency Response Facilities in Princeton

Type	Name	Address	Details	Has Emergency Generator?
Police Station	Princeton Police Department	8 Town Hall Drive	This facility has been noted as vulnerable to basement flooding by the Local HMP planning team. The building itself is in need of repair.	Yes
Fire Station/Emergency Operation Centers (EOC)	Princeton Fire Station	8 Town Hall Drive	This facility has been noted as vulnerable to basement flooding by the HMP local planning team in town. The building itself is in need of repair.	Yes
	Princeton Fire Station 2 and EOC	11 Redemption Rock Trail	There are no noteworthy concerns regarding natural hazard impacts on this facility.	
Communications Facilities	Public Safety Communications Site, Mount Wachusett	499 Mountain Road	This facility has been noted as vulnerable to Wildfires by the Local HMP planning team. The access to this facility has also been noted as vulnerable to snowstorms and severe winter weather.	No
Highway Department	Highway Department Headquarters and Garage	110 E Princeton Road	The Local HMP planning team noted that this facility was struck by lightning which damaged the electricals leading out to the fuel pump. While this issue has since been resolved, the facility has a history of lightning strikes.	Yes

Type	Name	Address	Details	Has Emergency Generator?
Emergency Shelters	Thomas Prince School	170 Sterling Road	This shelter does not have air conditioning and is in a low-lying area which frequently floods. It has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis.	Yes
Primary Evacuation Routes	Redemption Rock Trail (Route 140)	Route 140	This route has been noted as vulnerable to locally identified wildfire hazards by CMRPC's GIS analysis. The route also crosses locally identified flooding and winter storm hazard areas as well as the 1% and 0.2% flood zones.	N/A
	E Princeton Road (Route 31)	Route 31	The western part of this route has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis and by the HMP local planning team in town.	N/A
	Sterling Road/Hubbardston Road (Route 62)	Route 62	This route has been noted as vulnerable to locally identified wildfire hazards by CMRPC's GIS analysis. The route also crosses locally identified flooding and winter storm hazard areas as well as the 1% and 0.2% flood zones.	N/A
	Mountain Road	Mountain Road	Locally identified by the hazard mitigation planning team as a possible evacuation route for nearby residents.	N/A

3.3 Category 2 – Non-Emergency Response Facilities

The town has identified these facilities as non-emergency facilities; however, they are considered essential for the everyday operation of Princeton.

Table 5: Non-Emergency Response Facilities in Princeton

Type	Name	Address	Details	Has Emergency Generator?
	Draft Site	Esty Rd	Wes gates pond; PVC dry hydrant	No
	Draft Site	Hubbardston Rd	Hubbardston Rd; Steadman's; PVC dry hydrant. This draft site has been noted as vulnerable to identified 0.2% FEMA flood zones.	No
	Draft Site	24 Wheeler Rd	Spark's Pond; PVC dry hydrant	No
	Draft Site	Boylston Rd	School House Pond; PVC dry hydrant This draft site has been noted as being vulnerable to drought conditions in CMRPC's GIS Analysis.	No
	Draft Site	288 Brookstation Rd	Fife's; PVC dry hydrant	No
	Draft Site	42 Sterling Rd	Steel dry hydrant	No
	Draft Site	Stagecoach Rd	PVC dry hydrant	No
	Draft Site	Sharon Dr	Steel dry hydrant	No
	Draft Site	78 Coal Kiln Rd	Stevens; steel dry hydrant. This draft site has been noted as vulnerable to identified 0.2% FEMA flood zones.	No
	Draft Site	Main St	Main St Bridge; PVC dry hydrant. This draft site has been noted as vulnerable to identified 1% FEMA flood zones.	No
	Draft Site	263 Hubbardston Rd	Gas Plant This draft site has been noted as vulnerable to identified 0.2% FEMA flood zones.	No
	Draft Site	59 Beaman Rd	Beaman Pond; PVC dry hydrant	No
	Draft Site	64 Goodnow Rd	Dirt road before; turbo draft	
	Draft Site	46 Goodnow Rd	Floating strainer	No
	Draft Site	Scout Land Bridge	This draft site has been noted as vulnerable to identified 1% FEMA flood zones.	No

	Draft Site	294 Worcester Rd	Zottlie's; Floating strainer. This draft site has been noted as being vulnerable to drought conditions in CMRPC's GIS Analysis.	No
	Draft Site	Hobbs Rd	1 PVC 1 steel dry hydrant. This draft site has been noted as vulnerable to identified 1% FEMA flood zones and locally identified flood hazard areas	No
	Draft Site	11 Redemption Rock Trail	Station 2; PVC dry hydrant and pump	Yes
	Draft Site	214 E Princeton Rd	Lawson's; PVC dry hydrant	No
	Draft Site	10 Gates Rd	Fire Pond; floating strainer	No
Town Facilities	Town Hall	6 Town Hall Drive	This building being unreinforced masonry is at risk of earthquake damages.	Yes, the generator is new as of 2024 and only covers half of the building.
	Building Department	6 Town Hall Drive	This building being unreinforced masonry is at risk of earthquake damages.	See Above
	Senior Center	206 Worcester Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Public Library	2 Town Hall Drive	This building being unreinforced masonry is at risk of earthquake damages.	

Type	Name	Address	Details	Has Emergency Generator?
Utilities	Municipal Light Department	168 Worcester Road	This route has been noted as vulnerable by CMRPC's GIS analysis because it crosses locally identified wildfire and dam failure hazards as well as the 1% and 0.2% flood zones.	Yes
	Power Transmission Lines	N/A	This facility is both at risk of wildfires, and has a risk of causing wildfires in town	N/A
	CSX Rail Line Crossing	N/A	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No

3.4 Category 3 – Dams[25]

The third category of critical infrastructure sites in this plan is a listing of dams in Princeton and dams relevant to Princeton. Princeton has 8 dams within town, 2 significant hazard dams and 2 low hazard dams. Portions of Princeton are within the inundation zone of the Bickford Pond Dam (MA01021) which is a high hazard dam located in nearby Hubbardston.

Table 6: Dams in / of Concern Relating to Princeton

National ID	Dam Name	Owner	Regulatory Authority	Hazard Code	Notes
MA0252	Echo Lake Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	Significant Hazard	This dam has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis. The Local Planning team also noted a previous partial failure of the dam that has since been remediated. The dam itself is located in a wildfire hazard area identified by the local HMP team.
MA0318	Paradise Pond Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	Significant Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone. The local planning team has noted that Route 140 crosses through the inundation zone of this dam which could affect evacuation from the town should this dam fail.
MA0286	Tenny's Pond Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	Low Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is extremely close to the 1% flood zone.
MA0286	Snow's Pond Dam	Private	Non-Jurisdictional – Other	Low Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is extremely close to the .2% flood zone.
MA0177	Speckman Pond Dam	Private	Non-Jurisdictional – Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.

[25] "MassGIS Data: Dams," Mass.gov, Massachusetts Bureau of Geographic Information, February 2012, https://www.mass.gov/info-details/massgis-data-dams.

National ID	Dam Name	Owner	Regulatory Authority	Hazard Code	Notes
MA0177	Guest Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam is located in a locally identified wildfire hazard area
MA0233	Pool Dam	Town of Princeton	Office of Dam Safety	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA0286	Glockner's Pond Dam	Town of Princeton	Office of Dam Safety	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is extremely close to the .2% flood zone.
MA01021	Bickford Pond Dam (Hubbardston)	City of Fitchburg	Office of Dam Safety	High	There are no noteworthy concerns regarding natural hazard impacts on this dam. This dam was noted as a concern to the local HMP team due to it being a high hazard dam.

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

3.5 Category 4 – Facilities/Populations to Protect

The fourth category of critical infrastructure sites in this plan is facilities that serve vulnerable populations and/or which the town wishes to protect in the event of a disaster.

Table 7: Facilities and Populations to Protect in Princeton

Type	Name	Address	Details
Facilities for People with Special Needs, Apartment Complexes, Assisted Living Facilities, and Housing Authority Properties	Wachusett House	13 Boylston Avenue	This facility does not have onsite power generation in the event of an emergency.
	McLean Hospital Center	162 Mountain Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Princeton Senior Center	206 Worcester Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.
Schools/Daycares[26]	Wachusett Meadow Wildlife Sanctuary Preschool Programs	113 Goodnow Road	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.
	Thomas Prince School	170 Sterling Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Princeton Community Preschool	14 Mountain Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.
Faith Institutions	First Congregational Church	14 Mountain Road	There are no noteworthy concerns regarding natural hazard impacts on this church.
	Prince of Peace Parish	1 Worcester Road	There are no noteworthy concerns regarding natural hazard impacts on this church.
	Heritage Bible Chapel	182 Brooks Station Road	There are no noteworthy concerns regarding natural hazard impacts on this church.

[26] "Licensed Child Care Search," Childcare.Mass.gov, Massachusetts Department of Early Education and Care, accessed June 21, 2024, https://childcare.mass.gov/findchildcare.

Historic Buildings/Sites[27]	According to the Massachusetts Cultural Resources Information System (MACRIS) online database accessed in September 2024, there are 10 Areas, 216 Buildings, 2 Burial Grounds, 7 Objects, and 60 Structures listed in the MACRIS database in Princeton. 13 of these historic areas, 61 of these buildings, 1 of these burial grounds, 2 of these objects, and 8 of these structures lie within regulated or locally identified flood areas within town. The following historic sites were identified by the Princeton HMP Core Team as critical facilities or infrastructure: Town Hall, the Library, Town Hall Annex, and Mechanics Hall.

[27] "Search Results," Mhc-macris.net, Massachusetts Historical Commission, accessed February 14, 2025, https://mhc-macris.net/queryresults.

Employment Centers

Based on data obtained from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD)[28] and the Massachusetts Department of Elementary and Secondary Education[29] as well as the knowledge of local HMP committee members, the largest employers in Princeton are listed in the following table:

Table 8: Employment Centers in Princeton

Company name	Address	Number of Employees	NAICS Code
Wachusett Mountain Ski Area	Mountain Road	1,000 – 4,999	7211
Town of Princeton	Town Hall Drive	100 – 249	9211
Thomas Prince School	Sterling Road	100 – 249	6111
Business Lazo LLC	Hubbardston Road	50 – 99	5416
Krashes Fields Complex	E Princeton Road	20 – 49	7113
Mclean Hospital Center	Mountain Road	20 – 49	6222
Mountainside Ski Shop	Mountain Road	20 – 49	4591
Neads	Redemption Rock Trail S	20 – 49	6241
Princeton Fire Department	Town Hall Drive	20 – 49	9221
Princeton Police Department	Town Hall Drive	20 – 49	9221
Andrysick Land Surveying	Worcester Road	10 – 19	5413
Kwik Stop Convenience Store	Main Street	10 – 19	4451
Mass Audubon Society	Goodnow Road	10 – 19	4842
Pandolf – Perkins Co.	Worcester Road	10 – 19	2123
Sterling Concrete	Worcester Road	10 – 19	3273
Wachusett Mountain State	Mountain Road	10 – 19	7121
White Cape Inc.	Hubbardston Road	10 – 19	5132
B & B Plumbing & Heating Inc.	Rocky Pond Road	5 – 9	2382
DCRM Solutions	Mountain Road	5 – 9	5416
E B Carlson Marketing Inc.	Pine Hill Road	5 – 9	4239
Fidelity Co-Operative Bank	Worcester Road	5 – 9	5221
Princeton Highway Department	E Princeton Road	5 – 9	2373
Company name	**Address**	**Number of Employees**	**NAICS Code**

[28] "Largest 100 Employers in Princeton" Lmi.dua.eol.mass.gov, Massachusetts Department of Economic Research, accessed March 17, 2025, https://lmi.dua.eol.mass.gov/LMI/LargestEmployersArea/LEAResult?A=05&GA=000175.

[29] "School and District Profiles: Search Results – Wachusett," Profiles.doe.mass.edu, Massachusetts Department of Education, accessed March 17, 2025, https://profiles.doe.mass.edu/general/general.aspx?topNavID=1&leftNavId=100&orgcode=07750000&orgtypecode=5.

United States Postal Service	Worcester Road	5 – 9	4911
Wellness Bar	Worcester Road	5 – 9	6219
Princeton Municipal Light Department	Worcester Road	5 – 9	9261

The local planning team also noted other large employers in town: The Barn, Mountainside Café, Monti's, and Hubbard's Farm. The employment data for these employers was unable to be verified at time of writing, however these employers are an important part of the local economy and have been noted here subsequently.

Environmental Justice and Vulnerable Populations

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice (EJ) Policy sets the state's definition for Environmental Justice areas. The policy states that EJ populations are groups within the larger populace that EEA has determined to be most at risk of being unaware of or unable to participate in environmental decision-making, to be most at risk of being unable to gain access to state environmental resources, or to be especially vulnerable. The policy also states that EJ areas are defined as U.S. Census Bureau census block groups (which are often the size of neighborhoods) 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 (according to American Community Survey 2020 5-year estimate data);
- Minorities comprise 40% or more of the population (according to 2020 US Census data);
- 25% or more of households lack English language proficiency (according to American Community Survey 2020 5-year estimate data); or
- Minorities comprise 25% or more of the population and the annual median household income of the municipality in which the block group is located does not exceed 150% of the statewide annual median household income (according to 2020 US Census data and 2020 5-year estimate American Community Survey data, respectively).

According to the EEA, there are no Environmental Justice areas in Princeton.[30] Although there are no EJ areas in town, it is still important for the town to consider EJ populations and other vulnerable community members in the hazard mitigation planning process. The local planning team noted different vulnerable populations in Princeton, including seniors, children under age 18, and people with disabilities. According to the 2020 US Census, 18.9% of the population is under the age of 18 and 22.4% of the population is 65 years and over.[31] According to 2022 ACS 5-year estimate data, approximately 4.5% of the population in town speaks a language other than English at home;[32] approximately 5.7% of the population in Princeton has a disability according to this same data.[33] This 2022 ACS 5-year estimate data also shows that about 4.4% of the town's population is living in poverty.[34]

Outreach to vulnerable community members was a vital part of the public outreach strategy for the Princeton Hazard Mitigation Plan. Paper HMP surveys were available at the town hall, library, and senior center, and CMRPC staff conducted a presentation at a hybrid community forum during the planning process. These measures allowed residents who lack access to reliable Internet service and/or who have difficulty using the Internet to have a chance to complete the survey as well as hear about the planning process.

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[30] "Massachusetts 2020 Environmental Justice Populations," Mass-eoeea.maps.arcgis.com, Massachusetts Executive Office of Energy and Environmental Affairs, February 14, 2025, https://mass-eoeea.maps.arcgis.com/apps/webappviewer/index.html?id=1d6f63e7762a48e5930de84ed4849212.

[31] "DP1: Profile of General Population and Housing Characteristics," Data.Census.gov, accessed February 14, 2025, dp1 princeton town ma - Census Bureau Tables

[32] "S1601: Language Spoken at Home," Data.Census.gov, United States Census Bureau, accessed February 14, 2025, https://data.census.gov/table?q=s1601%20princeton%20town%20ma

[33] "S1810: Disability Characteristics," Data.Census.gov, United States Census Bureau, accessed February 14, 2025, https://data.census.gov/table?q=s1810%20princeton%20town%20ma

[34] "S1701: Poverty Status in the Past 12 Months," Data.Census.gov, United States Census Bureau, accessed February 14, 2025, https://data.census.gov/table?q=s1701%20princeton%20town%20ma

4.0 HAZARD PROFILES, RISK ASSESSMENT, AND VULNERABILITIES

Sections 4.0-4.13 help meet the following FEMA local mitigation plan requirements:

- *A4. "Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information?" (Requirement 44 CFR § 201.6(b)(3);*
- B1. "Does the plan include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction? Does the plan also include information on previous occurrences of hazard events and on the probability of future hazard events?" (Requirement 44 CFR § 201.6(c)(2)(i);
- *B2. "Does the plan include a summary of the jurisdiction's vulnerability and the impacts on the community from the identified hazards? Does this summary also address NFIP-insured structures that have been repetitively damaged by floods?" (Requirement 44 CFR § 201.6(c)(2)(ii));*
- *C1. "Does the plan document each participant's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?" (Requirement 44 CFR § 201.6(c)(3));*
- *C2. "Does the plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate?" (Requirement 44 CFR § 201.6(c)(3)(ii));*
- *C4. "Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?" (Requirement 44 CFR § 201.6(c)(3)(ii)); and*
- *E1. "Was the plan revised to reflect changes in development?" (Requirement 44 CFR § 201.6(d)(3))*

The following section of this plan includes a summary of natural hazards that have affected or could affect Princeton in the future. Natural hazards are weather-related, climate-related, or other environmental processes which threaten people's lives as well as property and/or other valuable assets to human society. By examining historical data on natural hazard occurrences, as well as future projections on how climate change will interact with natural hazards, it is possible to approximate the future risk of natural hazards.

Historical documents relating to natural hazard occurrences, discussions with local officials and emergency management personnel, available hazard mapping and databases, and weather-related databases were used to develop the following list of the most significant identified natural hazards which affect Princeton:

- Flooding
- Severe Snowstorms / Ice Storms/ Nor'easters
- Hurricanes

- Severe Thunderstorms / Wind / Tornadoes
- Wildfires / Brushfires
- Earthquakes
- Dam Failure
- Drought
- Extreme Temperatures
- Invasive Species
- Other Hazards

4.1 State-wide Overview of Hazards

4.1.1 Massachusetts State Hazard Mitigation and Climate Adaptation Planning

The State of Massachusetts under Governor Healy's administration has updated the 2018 State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) pursuant to Executive Order 569. The 2023 ResilientMass Plan updates and expands upon the previous SHMCAP and outlines how the State of Massachusetts must prepare strategies to prevent, respond to, and mitigate natural hazards.[35] This plan incorporates climate change adaptation into a state-level hazard mitigation plan. The plan is also the document which makes Massachusetts eligible for federal disaster recovery and hazard mitigation funding. The plan is effective under FEMA from September 12, 2023 to September 13, 2028. The Massachusetts SHMCAP is a useful model for incorporating considerations relating to the effects of climate change into the natural hazard mitigation planning process.

4.1.2 Climate Change Interactions

As part of the SHMCAP planning process, the State of Massachusetts performed a statewide analysis which detailed the effects of climate change on the cities and towns of Massachusetts. This analysis was included in the 2022 Climate Change Assessment, which detailed the impacts of climate change on the Central Region of Massachusetts (which includes 55 cities and towns) along with the other regions of the state. This report refocuses climate change impact assessment away from the specific hazards and towards how the most urgent of those hazards would affect the Region in the following sectors: Human, Infrastructure, Natural Environment, Governance, and Economy. The hazards identified as having the most urgent impacts for Central Massachusetts are **Extremes in Temperature and Precipitation**, with wide fluctuations in both precipitation extremes (including both flooding and droughts) as well as extremes in temperatures (both in extremely hot days becoming more prevalent, as well as extreme lows in temperature) being anticipated to having the greatest future risk to the Central Region across these sectors.

The state plan, while being comprehensive, places different priorities on the impacts of climate change and natural hazards than this Princeton municipal plan. These different priorities are based more on the specificities of local conditions in Princeton rather than any contradictions with the state's analysis, and this local hazard mitigation planning effort was informed by the state planning process.

The following descriptions provide an overview of climate change impacts on the five sectors identified in the 2022 Climate Change Assessment.

- **Human Impacts**: The assessment identified a **Reduction in Food Safety and Security** and **Health and Cognitive Effects** from extreme heat as the most urgent human sector climate change impacts for the Central Region. The reduction in food safety and security is likely to occur at all levels of production and distribution because of both extreme heat and extreme cold causing spoilage, power outages, and extremes in precipitation creating a more unpredictable environment for the growth of produce.

[35] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," Mass.gov, Massachusetts Executive Office of Energy and Environmental Affairs, accessed February 14, 2025, https://www.mass.gov/info-details/2023-resilientmass-plan.

According to multiple studies, reductions in crop yields across the state and within the Region are anticipated to occur; research has shown that key commodity crop yields in the Central Region could decline by 12 percent by 2030.[36] These impacts to the regional food supply chain are expected to be similar to impacts on state and national crop yields and food distribution patterns. While our food supply networks are currently expected to be able to withstand these shocks, the increases in food prices which these shocks will cause will correspondingly lead to an increase in food insecurity within the Central Region.

The impacts of extreme temperatures are also projected to have a significant impact on health and cognition within the Central Region, particularly in our more urbanized areas. Currently, three annual premature deaths are attributed to extreme temperature in the Region, but approximately 35 additional premature deaths per year are expected in the Region because of climate change by the end of the century,[37] assuming that no new mitigation measures are taken to reduce the threat of temperature extremes. The negative impacts of extreme heat on people's physical and cognitive health can cause declines in learning outcomes, declines in workplace productivity, and increases in the usage of and strain upon emergency rooms dealing with heat related illnesses and injuries.

Additional Human Sector impacts identified in the 2022 Massachusetts Climate Change Assessment include: Increases in Mental Health Stressors; Increases in Vector Borne Disease Incidence and Bacterial Infections; Damage to Cultural Resources; Health Effects from Aeroallergens and Mold; Emergency Service Response Delays and Evacuation Disruptions; Health Effects of Extreme Storms and Power Outages; and Health Effects from Degraded Air Quality.

- **Infrastructure Impacts**: The assessment identified the **Loss of Urban Tree Cover** and **Damage to Electric Transmission and Distribution Infrastructure** as the most urgent infrastructure sector climate change impacts for the Central Region. Urban Trees face a broad range of climate impacts and stressors, including increasing extreme weather activity, increasing threats from invasive pests and diseases, and reduced water and soil quality; all of these impacts and stressors correspond to an increased rate of tree mortality and therefore increased urban forest management costs for municipalities. Central Massachusetts has both urban and suburban centers where projected temperature increases make urban tree coverage particularly valuable at reducing the Heat Island Effect. A prime example of a community which could benefit from increased tree coverage is the City of Worcester, which is the state's second most populous city. 75 percent of the city's area falls within state-designated environmental justice block groups, but the city has relatively low canopy coverage and is at disproportionate risk for urban tree loss.[38]

[36] Estimates derived from application of data from the following two sources:
USEPA, "Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment," U.S. Environmental Protection Agency, 2017, EPA 430-R-17-001; Robert H. Beach et al., "Climate change impacts on US agriculture and forestry: benefits of global climate stabilization," *Environmental Research Letters* 10, no. 9 (2015). doi:10.1088/1748-9326/10/9/095004.

[37] Estimates derived from application of David Mills et al., "Climate change impacts on extreme temperature mortality in select metropolitan areas in the United States.," *Climatic Change* 131 (2014): 83-95. https://doi.org/10.1007/s10584-014-1154-8.

[38] "2022 Massachusetts Climate Change Assessment," Mass.gov, Massachusetts Executive Office of Energy and Environmental Affairs and Massachusetts Emergency Management Agency, December 2022, https://www.mass.gov/doc/2022-massachusetts-climate-change-assessment-december-2022-volume-iii-

Across the Central Region, damage to electric transmission and distribution infrastructure is projected to cost orders of magnitude more in the coming decades, with additional annual costs projected to grow to $6 million by 2030; $12 million by 2050; $19 million by 2070; and $28 million by 2090.[39] These costs are anticipated to be caused by the need for repair activities in response to climate-related damages and failures, and they take into account a wide range of climate stressors beyond extremes in temperature and precipitation.

Additional Infrastructure Sector impacts identified in the 2022 Massachusetts Climate Change Assessment include: **Damage to Roads and Loss of Road Service; Reduction in Clean Water Supply; Increased Risk of Dam Overtopping or Failure; Loss of Energy Production and Resources; Damage to Inland Buildings; and Damages to Rails and Loss of Rail/Transit Service.**

- **Natural Environment Impacts**: The assessment identified **Freshwater Ecosystem Degradation** and **Forest Health Degradation** as the most urgent natural environment sector climate change impacts in the Central Region. Increased nutrient load and harmful algal bloom growth in freshwater ecosystems from increased precipitation runoff as well as increased concentrations of contaminants in these ecosystems under drought conditions are both exacerbated by climate extremes. In addition, shifts in habitat caused by increased average air and water temperatures especially threaten the cold-water habitats and fisheries of the Central Region.

  The effect of climate change on the Region's forests is harder to predict, but the potential for significant forest ecosystem loss in the Region caused by climate change cannot be understated. Statewide, a third of tree species are classified by the U.S. Forest Service as having low capacity for adapting to projected climate change, and an increased frequency of extreme events poses an additional threat to forests in the Central Region.[40]

  Additional Natural Environment Sector impacts identified in the 2022 Massachusetts Climate Change Assessment include: **Shifting Distribution of Native and Invasive Species and Soil Erosion.**

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regional-reports/download, pages RS36-RS37.

[39] Estimates derived from application of Charles Fant et al., "Climate change impacts and costs to U.S. electricity transmission and distribution infrastructure," *Energy*, 195 (2020). https://doi.org/10.1016/j.energy.2020.116899.

[40] Estimates derived from application of US Forest Service Tree Atlas for Massachusetts.
Northern Research Station Landscape Change Research Group: Iverson, Peters, Prasad, Matthews. "Massachusetts - Climate Change Atlas Tree Species: Current and Potential Future Habitat, Capability, and Migration," Fs.usda.gov, United States Department of Agriculture Forest Service, September 2022, https://www.fs.usda.gov/nrs/atlas/combined/resources/summaries/states/Massachusetts.pdf; "Climate Change Atlas," Fs.usda.gov, United States Department of Agriculture Forest Service, accessed February 14, 2025, https://www.fs.usda.gov/nrs/atlas/combined/resources/summaries/states.

- **Governance Impacts**: As is true for other parts of the state, the assessment identified **Increase in Costs of Responding to Climate Migration**; an **Increase in Demand for State and Municipal Government Services**; and a **Reduction in State and Municipal Revenues** caused by climate change as the most urgent governance sector climate change impacts in the Central Region. Climate Migration, whether forced or voluntary, is already being felt by Massachusetts communities; it has been identified by the state as an impact which causes major consequences and will be the most difficult climate change impact to adapt to in the Central Region. Urban centers, particularly in and around Worcester, as well as towns serviced by state and regional transit services, are likely to become receiving zones for climate migration based on the relative assessment of climate hazards nationwide. The new influx of population caused by climate migration is expected to increase demand for government services. The need to increase government expenditures to maintain the current level of service for the existing population in addition to climate migrants and refugees is expected to be a significant stressor for local governments. Increased needs for MassHealth, food security support, and emergency services are expected in the Central Region due to population growth caused by climate migration in addition to other climate change impacts.

  Many climate change impacts are expected to be concentrated in low-income areas. Existing inequalities in the Region may become exacerbated if steps are not taken to prepare for these impacts, as an influx of climate migrants and refugees may increase demand for and place strain on public services.

  An increase in natural hazard impacts due to climate change is expected to increase disruptions to state and municipal revenue generation in the Region; these disruptions may include property tax and sales tax losses caused by interruptions to business and the economy.

  Additional Governance Sector impacts identified in the 2022 Massachusetts Climate Change Assessment include: **an Increased Need for State and Municipal Policy Review and Adaptation Coordination and Damage to Inland State and Municipal Buildings.**

- **Economic Impacts**: The assessment identified a **Reduced Ability to Work** and a **Decrease in Agricultural Productivity** caused by climate change as the most urgent economic sector climate change impacts in the Central Region. Both of these impacts relate to an increase in dangerous temperature extremes causing a decrease in workers' abilities to work; these impacts also relate to other natural hazards affecting workers' abilities to get to the job safely and increases in illnesses among workers caused by primary or secondary effects of natural hazards and climate change. Workers in the Region in high-risk industries (those exposed to outdoor conditions) are projected to lose 31 hours of work per worker per year by 2050 and 128 hours of work per worker

per year by 2090; these projected losses in work hours by the end of the century are the highest in the Commonwealth.[41]

While the agricultural sector is a small part in the Central Region's economy, the impacts to this sector of the economy through climate change-induced lower crop yields have the potential to severely disrupt the local economy and regional food systems. Key commodity crop yields in the Central Massachusetts Region could decline by 12 percent by 2030 and by 14 percent by 2070; these declines in key commodity crop yields carry potentially disproportionate impacts on the local economies that rely on agricultural production and the individual farm workers and employers who work in this sector.[42]

Additionally, though not identified as the one of the most urgent economic sector climate change impacts in the region in the state's assessment, the expected **Reduction in Availability of Affordably Priced Housing** has become a more prevalent issue in communities throughout the state, including Princeton, since the assessment was released. As affordable properties are typically situated in more hazard-prone areas, climate change-induced natural hazard impacts may lead to a decrease in the supply of affordable housing over time. Also, as increases in demand for housing continue in the region due to a disproportionate economic impact on working families from climate change-induced natural hazard, the overall resiliency of the region to shocks will also decrease.

Additional Economic Sector impacts identified in the 2022 Massachusetts Climate Change Assessment include: **Damage to Tourist Attractions and Recreation Amenities and Economic Losses from Commercial Structure Damage and Business Interruptions.**

During the local Hazard Mitigation Planning process, the local HMP planning team in Princeton noted that their chief concerns related to the natural hazard impacts of climate change are Drought, Wildfire, Flooding, and Severe Snowstorms/Ice Storms/Nor'easters; these concerns are in concurrence with the state assessment.

[41] Estimates derived from application of Matthew Neidell et al., "Temperature and work: Time allocated to work under varying climate and labor market conditions," *PloS One*, 16, no. 8 (2021), https://doi.org/10.1371/journal.pone.0254224.

[42] Estimates derived from application of USEPA (2017) and Beach et al. (2015)

4.1.3 Previous Federally Declared Disasters and Massachusetts State of Emergency Declarations in Worcester County

From 2018 to the present, the following Federally Declared Disasters and Massachusetts State of Emergency Declarations have occurred in Worcester County:

Table 9: Previous Federally Declared Disasters and Massachusetts State of Emergency Declarations in Worcester County[43]

Disaster Declaration	Disaster Type	Incident Period	Declaration Date
Massachusetts Severe Storms and Flooding (DR-4780-MA)	Flooding	September 11, 2023 - September 13, 2023	May 15, 2024
Massachusetts Hurricane Lee (EM-3599-MA)	Hurricane	September 15, 2023 - September 17, 2023	September 15, 2023
Shelter Capacity Crisis	Not a Natural Hazard	August 8, 2023 - Present	August 8, 2023
Massachusetts Covid-19 Pandemic (DR-4496-MA)	Pandemic	January 20, 2020 - May 11, 2023	March 27, 2020
Massachusetts Severe Winter Storm and Snowstorm (DR-4379-MA)	Snow	March 13, 2018 - March 14, 2018	July 19, 2018

[43] "Disaster Declarations for States and Counties," FEMA.gov, Federal Emergency Management Agency, accessed September 16, 2024, https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties; "State of Emergency Information," Mass.gov, Massachusetts Emergency Management Agency, accessed December 12, 2024, https://www.mass.gov/info-details/state-of-emergency-information.

All of the disaster occurrences described in the above table were both Federal Disaster Declarations and Massachusetts State of Emergency Declarations with the exception of the Shelter Capacity Crisis, which is a Massachusetts State of Emergency Declaration but not a Federal Disaster Declaration, and the March 13th-14th, 2018 Severe Winter Storm and Snowstorm, which was a Federal Disaster Declaration but not a Massachusetts State of Emergency Declaration.

The majority of these disaster occurrences directly relate to the natural hazard concerns of towns within Worcester County; flooding from rain events and other extremes in precipitation (such as snowfall events) are the chief concerns of residents and local hazard mitigation planners alike in the region.

4.2 Natural Hazard Identification and Analysis

This section of the plan examines the hazards in the Massachusetts SHMCAP which are identified as likely to affect Princeton. This analysis is organized into the following sections: Hazard Description, Location, Extent, Previous Occurrences, Probability of Future Events, Impact, Exposure, Potential Climate Change Effects, Vulnerability, and Mitigation Strategies. A description of each of these sections of the analysis and the risk assessment summary table which includes each hazard identified are provided below.

4.2.1 Hazard Description

The natural hazards identified for Princeton are:

- Flooding,
- Severe Snowstorms / Ice Storms / Nor'easters,
- Hurricanes,
- Severe Thunderstorms / Wind / Tornadoes,
- Wildfire / Brushfire,
- Earthquakes,
- Dam Failure,
- Drought,
- Extreme Temperatures, and
- Invasive Species.

Many of these hazards result in similar impacts to a community. For example, hurricanes, tornadoes and severe snowstorms all may cause wind-related damage.

4.2.2 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 of the planning area, such as a floodplain or area that is susceptible to wildfires. Location classifications (large, medium, or small) are based on the area that would potentially be affected by the hazard, on the following scale:

Table 10: 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

4.2.3 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.

4.2.4 Previous Occurrences

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

4.2.5 Probability of Future Events

The likelihood of future events occurring in the planning area for each natural hazard was classified according to the following scale:

Table 11: 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

4.2.6 Impact

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

Table 12: 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 to quality of life. Temporary shutdown of facilities.

4.2.7 Exposure

Certain features of a community's infrastructure, society, and environment may face more of, or may be disproportionately impacted by, natural hazards; these features therefore can be described as experiencing increased exposure to natural hazards. Some of these features may be documented in the list of critical facilities and vulnerable populations in Section 3.

4.2.8 Potential Climate Change Effects

Each natural hazard is influenced by one or more of the climate change interactions listed in Section 4.1.2 Climate Change Interactions. Climate change interactions can modify the location, extent, and/or probability of future events depending on the hazard. The hazard risk assessment table in section 4.2.11 of this plan lists climate change interactions as described by the 2023 ResilientMass Plan.

4.2.9 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

This ranking is qualitative and is based, in part, on the local HMP planning team's knowledge of past experiences with each 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 in Princeton can be applied to expected natural hazards, regardless of their unpredictability.

4.2.10 Mitigation Strategies

Based on meetings with the local planning team, a selection of mitigation strategies that address the specific hazard is included at the end of each hazard analysis section.

4.2.11 Risk Assessment

Table 13: Hazard Risk Assessment for Each Natural Hazard in Princeton

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	4
Severe Snowstorms / Ice Storms / Nor'easters	Large	Very High	Minor	Increase extent; increase probability	2
Hurricanes	Large	Low	Minor	Increase extent; increase frequency	4
Severe Thunderstorms / Wind	Small	Moderate	Minor for severe thunderstorms; Limited for severe wind	Unclear	2
Tornadoes	Small	Very Low	Limited	Unclear	3

Type of Hazard	Location of Occurrence	Probability of Future Events	Impact	Potential Climate Change Effects	Hazard Risk Index Rating
Wildfire	Large	High	Critical	Increase extent; increase frequency	1
Earthquakes	Large	Very Low	Minor	None	5
Dam Failure	Small	Very Low	Limited	Indirect effects related to flooding	4
Drought	Large	Moderate	Critical	Increase extent; increase frequency	2
Extreme Temperatures	Large	Moderate	Minor	Increase frequency; increase duration	3
Invasive Species	Large	Very High	Critical	Increase in range and severity of invasive species	3

Source: based on Massachusetts Resilient Mass Plan 2023;[44] modified to reflect conditions in Princeton.

4.2.11 Natural Hazard Impacts from Changes in Future Conditions

The following table summarizes how changes in future conditions, including changes in population, changes in land use and development, and climate change could potentially change natural hazard impacts on people and vulnerable community assets in Princeton. According to CMRPC's Community Snapshots for the town of Princeton, by 2030 the town's population is expected to grow by 6.7%,

[44] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

from 2,495 to 3,728.[45] The town's largest population cohorts fall within the age range of 50 to 69 years of age, with its fifth largest cohort being in the 5-9 age bracket.[46] This indicates that Princeton is a bedroom community with an aging population that is unlikely to move away from town. As this cohort continues to age, we will likely see an increase in vulnerability in Princeton's older population.

Table 14: Natural Hazard Impacts from Changes in Potential Future Conditions

Type of Hazard	Impacts from Changes in Population	Impacts from Changes in Land Use and Development	Impacts from Climate Change
Flooding	There are no anticipated impacts from changes in population on the impacts of flooding in Princeton.	If commercial and industrial development continues to be built in town and/or the pace of residential development in town increases from its currently low level, the Town will face increased flooding risk (and therefore increased risk from hurricanes and severe thunderstorms) if these developments are built near the 100-year, 500-year, and locally identified flooding hazard areas and/or have large amounts of impervious surface.	The Town may no longer be able to safely develop in areas of town that experience frequent flooding, so the Town may need to change its zoning bylaw to emphasize stormwater resilience. New areas of town may be subject to severe and/or frequent flooding. Dams in town may face more pressure from flooding.

[45] Central Massachusetts Regional Planning Commission. (2024, July 5). *Princeton*. Community Snapshots. https://cmrpc.org/data-center/community-snapshots/princeton/
[46] Ibid

Type of Hazard	Impacts from Changes in Population	Impacts from Changes in Land Use and Development	Impacts from Climate Change
Severe Snowstorms / Ice Storms / Nor'easters	As the town's population continues to increase, so too will the risk from snowstorms and ice storms.	If developments with flat roofs are built in town in the future, the Town will face increased snow and ice load risk.	An increase in wintertime rains may lead to more frequent occurrences of hazardous roadway conditions. Snow and ice storms will become less frequent but will become more severe when they occur; this may lead to a need for more sheltering infrastructure in town.
Hurricanes	There are no anticipated impacts from changes in population on the impacts of hurricanes in Princeton.	If most developments in town continue to not be built to Zone 1 Design Wind Speed Codes, the Town will continue to face increased risk from hurricanes.	More intense hurricanes may lead to the need to increase stormwater resilience measures in the Town's zoning bylaw and the need for more sheltering infrastructure in town.
Severe Thunderstorms / Wind	There are no anticipated impacts from changes in population on the impacts of severe thunderstorms/wind in Princeton	If most developments in town continue to not be built to Zone 1 Design Wind Speed Codes, the Town will continue to face increased risk from severe thunderstorms and wind.	More intense severe thunderstorm and wind events may lead to the need to increase stormwater resilience measures in the Town's zoning bylaw and the need for more sheltering infrastructure in town.

Type of Hazard	Impacts from Changes in Population	Impacts from Changes in Land Use and Development	Impacts from Climate Change
Tornadoes	There are no anticipated impacts from changes in population on the impacts of tornadoes in Princeton.	If most developments in town continue to not be built to Zone 1 Design Wind Speed Codes, the Town will continue to face increased risk from tornadoes.	More research needs to be conducted on the anticipated climate change impacts of tornadoes in Princeton, but some studies indicate that the number of days with tornadoes will decrease but the number of tornadoes on these days will increase.[47]
Wildfire	If the town continues to grow, there is very little developable land that is far away from existing woodlands and forests. Subsequently, unless the population grows in already developed areas of town the increase in wildland urban interface/intermix will correspondingly increase the risk of wildfires to the community.	If commercial and industrial development continues to be built in town and/or the pace of residential development in town increases from its currently low level, the Town will face increased wildfire risk if these developments are built near the densely forested areas of the wildland-urban interface.	The Town may no longer be able to safely develop near densely forested areas in the wildland-urban interface. The Town may have less access to water to fight wildfires due to the increased prevalence of drought. Wildfire-related air quality risks may become more prevalent in town.
Earthquakes	The Princeton Public Library and the Princeton Town Hall have been identified as vulnerable to earthquakes by CMRPC's GIS analysis; if more adults and young people frequent these sites the Town would be at higher risk in the case of earthquakes occurring.	If many developments in town continue to not be built to the Massachusetts State Building Code's seismic standards, the Town may continue to face increased risk from earthquakes.	There are no anticipated climate change impacts on earthquakes in Princeton.

[47] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," page 5.1-56.

Type of Hazard	Impacts from Changes in Population	Impacts from Changes in Land Use and Development	Impacts from Climate Change
Dam Failure	There are no anticipated impacts from changes in population on the impacts of dam failure in Princeton.	If new developments in town are built in the potential inundation zones of dams, the Town will face increased risks from potential dam failure.	Dams in town may face more pressure from flooding, and therefore will face a higher risk of overtopping.
Drought	As population increases in Princeton so too will water demand. Since Princeton is entirely on private wells this naturally will lead to a competition for a finite amount of groundwater, which decreases	If commercial and industrial development is built in and/or the pace of residential development in town increases from its currently low level in areas of town the Town will face increased risk from wells drying out during drought.	Water in Princeton may become harder or impossible to get without drilling deeper wells. This affects not only town drinking water availability, but also availability of water for firefighting, as all hydrants in town are cistern, fire pond, or river fed. The Town may see an increase in population, with people from parts of the country facing more severe drought impacts moving to the northeast.

Type of Hazard	Impacts from Changes in Population	Impacts from Changes in Land Use and Development	Impacts from Climate Change
Extreme Temperatures	As the Town's population ages, the Town will face increased risk from extreme temperatures, as older adults are more vulnerable to extremely hot and cold conditions.	If the town does not sufficiently prioritize artificial and/or passive/natural heating and cooling measures, both inside and outside, as the Town's development pattern changes in the future, the Town will face increased risk from extreme temperatures.	Growing seasons, ecosystem types, and migratory patterns in Princeton will shift, and farmers and wildlife may be forced to adapt. More intense extreme heat events will lead to a need for more sheltering infrastructure in town, and residents and businesses in town may need to alter work patterns due to more frequent and severe extreme heat events. Princeton may see an increase in population, with people from parts of the country facing more severe extreme heat impacts moving to the northeast.
Invasive Species	There are no anticipated impacts from changes in population on the impacts of invasive species in Princeton.	If the town does not sufficiently prioritize the control of invasive species when new developments and changes in land use encroach on wild areas, the town will face increased risk from invasive species.	Changing climatic conditions, including warming temperatures, may assist invasive species in outcompeting native species in town. Invasive species may take advantage of climatic shocks and disturbances and may be more easily able to damage agricultural crops. Invasive vegetation species may be more easily able to build up as fuel that can increase the town's wildfire risk.

Princeton has grown steadily in population in recent decades. The town has a high population of older adults between 50 and 69 years old, with the town's largest five-year age cohort being adults between 55 and 59 years old. The town's largest five-year age cohort of people under 40 years old is children between 5-9 years old. [48] This indicates that this town functions as a bedroom community for older parents and grandparents with young children. If many older adults continue to live in town after they retire, the town's number of retirement-age residents facing increased vulnerability to natural hazard impacts will rise. If a greater number of families with school-aged children choose to live in town in the future, the town's number of young residents facing increased vulnerability to natural

[48] "Princeton," CMRPC.org, Central Massachusetts Regional Planning Commission, accessed May 28, 2025, https://cmrpc.org/data-center/community-snapshots/princeton/

hazards will rise. If the proportion of new construction built in vulnerable areas in town remains the same, the town's vulnerability to natural hazards will slightly increase over time if the population continues to increase.

4.3 FLOODING

The local HMP planning team identified flooding as one of the most prevalent natural hazards in Princeton. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Global climate change has the potential to exacerbate the hazards which cause flooding over time by leading to 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 Princeton, 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 Princeton are closely associated with the 1% (or 100-year) flood areas identified by FEMA. According to a GIS analysis performed by CMRPC, there are 324 parcels in Princeton that are susceptible to 1% (100-year) floods, with 103 of them containing structures. See below for a discussion of previous flood occurrences in town and their locations. Building footprints that overlap with flood zones may be impacted by flooding, especially if residents and building owners do not act to mitigate their personal flood risk. Despite Princeton having numerous flooding problems, most of Princeton is upland and built away from rivers and ponds. Princeton's affected area from this hazard, or its location, is considered "small" (less than 10% of the Town). Map 2 in Appendix A illustrates the FEMA FIRM 1% flood zones in town as well as locally identified flooding areas.

The 2023 Worcester County Flood Insurance Study from FEMA lists the following flooding sources which impact Princeton:

- Zone A Flooding Sources of the Nashua and Chicopee River Watersheds.

The 2023 Worcester County FIS also notes that the causes of severe flooding in the county include hurricanes, melting snow in combination with rain in the spring, heavy thunderstorms and resulting rapid downstream runoff, ice jams, and the accumulation of debris at bridges. In addition, the study notes that flooding can occur in any season in the county, but that major flooding is less common in the summer than in other seasons.[49]

FEMA Flood Zones

FEMA creates and manages Flood Insurance Rate Maps (FIRMs) that identify local Special Flood Hazard Areas (SFHAs). These SFHAs 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 1% 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 outside of the 1% flood zone that will be inundated by a flood event with between a 1% and a .2% chance of occurring in any year. These areas are also known as the 0.2% flood zone.

[49] Federal Emergency Management Agency, "Flood Insurance Study: Worcester County, Massachusetts (All Jurisdictions)," Map1.msc.fema.gov., FEMA Flood Map Service Center, accessed May 28, 2025, https://map1.msc.fema.gov/mipdata/25027CV001C.pdf?LOC=2cdcfcb8d29a9ba73c75a69614806808.

As of September 2022, the Town of Princeton has no repetitive loss structures according to FEMA's National Flood Insurance Program (NFIP). As defined by the NFIP, a repetitive loss property is any property which the NFIP has paid out two or more flood claims of $1,000 or more for in any given 10-year period since 1978. For more information on repetitive loss properties, see https://www.fema.gov/repetitive-flood-claims-grant-program-fact-sheet. The Town of Princeton has 2 NFIP policy holders in town, and the NFIP insures up to $700,000.00 of property in the town. NFIP has paid out one claim in total to policy holders in Princeton.[50]

Extent

The average annual precipitation for the closest weather station to Princeton (which is located at the Fitchburg Municipal Airport) has been 45.47 inches for the period from 2017 to 2024.[51] Water levels in Princeton's rivers, streams, and wetlands rise and fall seasonally and rise during high rainfall events. High water levels in town 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 in town are highly variable, but for the period between 2017 and 2024, Princeton received on average the most precipitation in the months of July, September, October, and December; July was also uncharacteristically rainy in 2021 and 2023, in a deviation from expected norms. At any time, heavy rainfall may create conditions that raise water levels in rivers and streams above bank full stage; this results in overflow which floods adjacent lands.

Based on past records and the knowledge and experience of members of the Princeton Hazard Mitigation Planning Team as well as town residents, the extent of the impact of localized flooding would be "minor" in town.

Previous Occurrences

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

- Route 140
- East Princeton Road
- Beaman Road at Fire Station 2
- Mirick Road
- The Intersection of Beaman and Mirick Roads
- Sterling Road

Most of the flood hazard areas listed here were identified due to known past occurrences in the

[50] "Community Overview: Princeton, Town of," NFIP Community Information System, accessed May 28, 2025.
[51] The calculation of this average does not incorporate data from the year 2021, as precipitation data for January 2021 is missing for this station.
"Monthly Total Precipitation for Fitchburg Municipal AP, MA (ThreadEx)," Weather.gov, National Oceanic and Atmospheric Association National Weather Service, accessed September 16, 2025, https://www.weather.gov/wrh/climate?wfo=box

respective areas. 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 in town have experienced erosion and stormwater drainage failures. The Hazard Mitigation Planning Team noted that most of the flooding locations above were affected during a strong rainstorm in 2023, and the intersection of Beaman and Mirick roads have been affected by a nearby beaver dam

It is important to note that many of these areas are near or along evacuation routes (particularly route 140) and cause concern in cases of evacuation from affected parts of town.

In the past 10 years, there have been a number of flooding events that have occurred in and around Princeton;[52] major events near and/or in town described as part of the National Oceanic and Atmospheric Administration (NOAA)'s National Centers for Environmental Information (NCEI) database are listed below:

- 7/01/2013 – Flash Flood: A series of shortwaves moved along a stationary boundary to the west of Southern New England, igniting showers and thunderstorms. An atmosphere characterized by low CAPE and decent deep layer shear resulted in showers and thunderstorms producing heavy rain and rotating thunderstorms.
- 7/27/2014 – Flash Flood: An upper level disturbance moving out of the Great Lakes initiated showers and thunderstorms over New York and New England. Enough instability was present in the region for some of these storms to become severe, producing strong to damaging winds and at least one funnel cloud.
- 08/15/2015 – Flood: A weak cold front moving through southern New England brought showers and thunderstorms to the region. These storms produced hail and damaging winds as well as some poor drainage street flooding.
- 7/22/2016 – Flood: A cold front moved through southern New England and when coupled with the existing heat and humidity, resulted in showers and thunderstorms developing over much of the area late in the day and continuing into the evening and overnight hours.
- 10/21/2016 – Flash Flood: Low pressure tracking toward southern New England tapped into a plume of tropical moisture and produced torrential rainfall over parts of central and northeast Massachusetts in the matter of a few hours. This resulted in prolific urban flash flooding in the greater Worcester area and significant urban flooding in greater Boston. The highest single rainfall total from this event was within the City of Worcester, where a Skywarn Spotter reported 5.24 inches of rainfall.
- 06/27/2017 – Flood: A disturbance at mid-levels in the atmosphere moved from the Great Lakes across New England during the afternoon and evening. This along with daytime heating through partly sunny skies allowed afternoon and evening

[52] "Storm Events Database Search Results for Worcester County, Massachusetts," NCDC.NOAA.gov, National Oceanic and Atmospheric Administration National Centers for Environmental Information, accessed April 23, 2025, https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Flash+Flood&eventType=%28Z%29+Flood&eventType=%28C%29+Heavy+Rain&beginDate_mm=11&beginDate_dd=01&beginDate_yyyy=2000&endDate_mm=11&endDate_dd=30&endDate_yyyy=2023&county=WORCESTER%3A27&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=25%2CMASSACHUSETTS.

thunderstorms to develop.

- 10/24/2017 – Flood: Low pressure moved north through the Great Lakes. This swung a cold front slowly east into Southern New England on October 25. The front stalled over the region during the 25th before moving off to the east on the 26th. Strong low-level winds brought a flow of tropical moisture ahead of the front. The strong winds aloft were brought to the surface in damaging wind gusts, with speeds reaching 45 to 55 mph. The tropical moisture was converted to heavy downpours, with storm rainfall totals ranging from 2 inches to 6 1/2 inches. This brought widespread urban and poor drainage flooding.
- 7/17/2018 – Flash Flood: A cold front moved east from the Great Lakes, crossing Massachusetts during the night of the 17th. The thunderstorms brought strong wind gusts and wind damage during the afternoon and evening. Thunderstorms also brought downpours in Western, Central, and Northeast Massachusetts. Two to four inches of rain fell from Westfield through Worcester to Boston.
- 08/11/2018 – Flood: A cold front stalled over Southern New England on the 11th. Low pressure from the Midwest then moved slowly east along the front. The weather system drew upon warm and very humid air to create showers with local downpours, resulting in rainfall amounts of two to five inches in Northern Massachusetts on August 11th and 12th.
- 06/28/2020 – Severe thunderstorms and flooding: Severe thunderstorms and flash flooding occurred across MA during the afternoon and evening hours. A Flash Flood Emergency occurred in the Norwood, MA area. A car was stuck in flooding on Princeton Road at the Princeton Road Bridge.
- 07/23/2020 – Severe thunderstorm and flooding: The severe thunderstorms were slow-moving and produced torrential downpours, which led to significant flooding, especially in urban areas of northeast Massachusetts. In Princeton, a tree was down on Mountain Road.
- 8/23/2020 – Flash Flood: Diurnally driven thunderstorms brought wind damage, hail, and some flooding to mainly western and central Massachusetts.
- 9/11/2023 – Flash Flood: A deamplifying mid level shortwave with dewpoints in the 70s and decent instability brought scattered thunderstorms and widespread flash flooding to Massachusetts, including Princeton. There were many streets closed, many cars stranded in flood waters, and several houses with flooded basements or first floors.

Probability of Future Events

Based upon previous data, there is a "moderate" probability (a 10% to 40% chance) of localized flooding occurring in Princeton in the next year. This represents a slight increase as compared to the last HMP update in town due to increased precipitation driven by climate

change.

IMPACT

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

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 damage to the community from a .2% annual chance flood event, assuming a 1 square mile data resolution.

Table 14: HAZUS Potential Damages to Princeton from .2% Annual Chance Flood Event

	.2% annual chance flood event
Building Characteristics	
Estimated total number of buildings in Princeton	1,282
Estimated total building replacement value (2024 $)	$740,038,000
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
Debris	
Building debris generated (tons)	11
Tree debris generated (tons)	0
# of truckloads to clear building debris	1
Population Needs	
# of households displaced	7
# of people seeking public shelter	5
Value of Damages	
Total property damage (buildings and content)	$640,000.00
Total losses due to business interruption	$430,000.00
Total Economic loss	**$1,060,000.00**

Though there are no recorded instances of a flood event of this size in Princeton, this model shows 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 the region experiences a period of more intense and frequent storms. For more information on the HAZUS-MH software, go to http://www.fema.gov/hazus-software.

EXPOSURE

Certain features of Princeton's infrastructure, society, and environment may face more flooding, or may 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. 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 residences due to age, health concerns, or lack of a vehicle;
- Flood-prone municipal buildings and critical infrastructure 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 needed 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; and
- Sides of roadways, which may be eroded due to excessive rainfall. Lack of funding to make road repairs may compound this issue.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 State Hazard Mitigation and Climate Adaptation Plan, climate change effects coupled with changes in development and population density can increase the risk of flooding from precipitation. As noted earlier in this plan, the Central Region is most likely to be impacted by extremes in precipitation in the following ways:

- Climate change is projected to increase the variability of precipitation events in any given year, including the potential for extreme precipitation events. Instances of inland flooding, river overflows, and pressure on dams may result; and
- Projected changes in precipitation patterns in all seasons, as well as higher frequency of extreme weather (including hurricanes and nor'easters), will change patterns of river flow and increase the frequency and severity of inland riverine flooding.

In summary, climate change is likely to increase the extent and probability of future flood events in Princeton, which will make it more likely for multiple storms in a short duration to cause cumulative damage; these impacts can affect land use and development by causing the Town's

government to zone for increased stormwater resilience.

VULNERABILITY

Based on this analysis and the assessment of the Princeton Local HMP Planning Team, Princeton faces a hazard index rating of "4 – low risk" from flooding. Princeton's location in the uplands above Worcester, as well as its current development patterns prioritizing building away from the floodplain makes the risk of flooding in Princeton much less than it would be for towns downhill with more development.

MITIGATION STRATEGIES

The Town of Princeton is currently able to effectively respond to flooding through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities for the Town to expand upon its existing capabilities to mitigate and respond to flooding. The local HMP planning team identified the following strategies that could be used to reduce the threat of flooding in Princeton:

- Drainage and culvert upgrades at Hobbs Road, Ball Hill Road, Sterling Hill, and other sites to address regular localized flooding.
- Investigate Community Rating System (CRS) benefits and requirements and decide whether to participate
- Educate the public about strategies for preventing basement flooding, such as with rain gardens or other nature-based and small-scale mitigation strategies.
- Stormwater management and erosion control bylaw. Princeton does not have a stormwater management or erosion control bylaw. Princeton does have an Earth Removal Bylaw, adopted in May 2015, included as Chapter XX in the Town's General Bylaws. Princeton does not participate in the Central Mass Stormwater Coalition, but should look into.

4.4 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 event. Winter storms can result in flooding, storm surges, closed highways, blocked roads, downed power lines, and hypothermia among residents. A northeast coastal storm, known as a nor'easter, is typically a large counterclockwise wind circulation around a low-pressure center; nor'easters often result in heavy snow, high winds, and rain.

Location

The entire Town of Princeton is susceptible to severe snowstorms; this means that the location of occurrence of severe snowstorms in town is "large." Because these storms occur regionally, the entire town is equally vulnerable to them. Princeton's increased elevation makes it more susceptible to snow events, along with other towns north of Worcester such as Rutland and Paxton.

Extent

The Northeast Snowfall Impact Scale (NESIS) characterizes and ranks high-impact snowstorms in the northeast USA. These storms have large areas of 10-inch or greater snowfall accumulations. 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 storm's path. 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 classified into one of the five NESIS categories. The largest NESIS values are given to storms producing heavy snowfall over large areas which include major metropolitan centers.

Table 15: Northeast Snowfall Impact Scale Categories[53]

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

[53] National Centers for Environmental Information, "The Northeast Snowfall Impact Scale (NESIS)," Ncei.noaa.gov, National Oceanic and Atmospheric Association, accessed June 12, 2024, https://www.ncei.noaa.gov/access/monitoring/rsi/nesis.

Previous Occurrences

Based on data available from the National Oceanic and Atmospheric Administration, there have been 88 high-impact snowstorms since 1956 that have affected the northeast USA. Of these, approximately 35 storms resulted in at least 10 inches of snow fall in Princeton. These storms are listed in the table below:[54]

Table 16: High-Impact Snowstorms with Snow Falls in Princeton of at Least 10 Inches Since 1958

Start Date	NESIS Value	NESIS Category	NESIS Classification
1/28/2022	1.73	1	Notable
1/30/2021	4.93	3	Major
12/14/2020	3.21	2	Significant
3/03/2019	1.29	1	Notable
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
12/18/2009	3.99	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
2/2/1961	7.06	4	Crippling
1/18/1961	4.04	3	Major

[54] Ibid.

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

In addition, the National Centers for Environmental Information (NCEI) database notes the following instance of heavy snowfall in Worcester County:[55]

- 01/07/2024 – Heavy Snow: A strong storm moved up the east coast passing near the 70/40 benchmark brought heavy snow to southern New England beginning late Monday night and continuing on Sunday. The first round of heavy snow fell overnight followed by a lull in the snow and mixing with rain Sunday morning. Comma head snow then filled back into eastern MA and RI bringing moderate to heavy snow Sunday afternoon and evening. Snow amounts ranged from 2 to 18 inches.
- 11/15/2017 – Heavy Snow: An early-season nor'easter moved from the Mid-Atlantic coast to southeastern Massachusetts on the 15th and away from the region on the 16th. A quick thump of heavy snow occurred on the front end of the storm, with most accumulations over with by or shortly after midnight on the 16th. Snowfall amounts ranged from only a couple of inches in southeasternmost sections of MA to 8 to 10 inches in western and northern MA. Mainly rain occurred at Boston's Logan Airport. Strong east to northeast winds battered coastal areas ahead of the low pressure system. Based on numerous reports from CoCoRaHS, Co-Op, trained spotter, and amateur radio observers, snowfall ranged from 7 to 10 inches in northern Worcester County. Here are some sample amounts: Lunenburg had 8.5 inches, Westborough, Fitchburg, Clinton, and Boylston all had 9.0 inches; and the highest total was 10.0 inches in Princeton.
- 12/30/2019 – Winter Weather: A strong low pressure system over the Great Lakes drew in moisture across southern New England, where cold air remained in place at the higher elevations. This led to ice storm conditions on the 30th in a narrow region along the immediate east slopes of the Berkshires, where 0.5 to 0.75 inches of ice was observed. Lesser amounts occurred in northern Worcester County. There was also some light snow and sleet, mainly north of the Mass Pike. Weaker low pressure developed south of Long Island on the 31st, which prolonged light precipitation.
- Elevated instability during the afternoon of the 30th led to thunderstorms tracking across the Poconos, eastern NY, and into northern CT and western and central MA. One of these storms became severe, producing quarter-size hail in Southwick and Westfield, MA (Hampden County) - very unusual for the end of December. Approximately 0.10 to 0.25 of ice accretion occurred in northern Worcester County. At 750 AM in Princeton, a tree was down on wires on Bigelow Road.

[55] "Storm Events Database Search Results for Worcester County, Massachusetts," NCDC.NOAA.gov, National Oceanic and Atmospheric Administration National Centers for Environmental Information, accessed May 5, 2025 https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Heavy+Snow&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2020&endDate_mm=06&endDate_dd=30&endDate_yyyy=2024&county=WORCESTER%3A27&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=25%2CMASSACHUSETTS.

- 04/16/2021 – Heavy Snow: An extremely dynamical intensifying closed mid level low tracked across southern New England Thursday night into Friday. Rain changed to snow in the Worcester Hills and Berkshires. In lower elevations rain mixed with snow for a time but did not add up to much. Snowfall amounts generally ranged from 6 to 12 inches. Some of the higher amounts included 12 inches in Princeton, 9.3 inches in Rutland, and 8 inches in North Ashburnham. Some damage due to the weight of the heavy snow included a tree down in Templeton at 630 AM EDT, a tree down in Leicester at 638 AM EDT, a tree down in Warren at 825 AM EDT, a tree down in Rutland at 920 AM EDT, and a large branch down in Ashburnham at 1113 AM EDT.

The local hazard mitigation planning team noted that the 2008 ice storm remains the worst in memory for the town, but it is not uncommon for the town to receive multiple snowstorms with multiple feet of snow during the winter seasons.

Probability of Future Events

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

The 2023 ResilientMass Plan notes that, on average, Massachusetts experiences one to two nor'easters per year.[56] Between 2013 and 2022, there were 63 heavy snow days, 12 blizzard days, and two ice storm days in Massachusetts.

Impact

Princeton faces a "minor" impact, with less than 10% of total property in affected areas damaged, from snowstorms. The weight from multiple snowfall events can test the load ratings of building roofs and can potentially cause significant damage. Multiple freeze-thaw cycles can also create large amounts of ice and can lead to even heavier, even more dangerous roof loads.

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 also being at risk from severe winter storms and the associated flooding that can occur following heavy snow melt;
- Damage to telecommunications structures; and
- Reduced ability of emergency officials to respond promptly to medical emergencies and fires.
- Power interruptions result in a lack of water supply in all buildings in town because all of them are supplied by private or public wells that rely on electricity to provide water.

The local HMP planning team in Princeton noted icing concerns on roadways throughout town.

Exposure

Certain features within Princeton's infrastructure, society, and environment may face more

[56] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

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 of this plan. These features include:

- Elderly residents, who may have more difficulty clearing 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.

The local hazard mitigation planning team noted that the town's proximity to Mount Wachusett carries with is several specific exposures:

- The top of Mount Wachusett has critical communications infrastructure that has in the past been affected by severe snow events and could be affected by future events. This communications infrastructure is serviced by a single gravel road.
- Mount Wachusett itself is a popular ski destination, and it is not an uncommon occurrence for rescue personnel to be called for lost skiiers in inclement weather.
- Roadway infrastructure on the mountain is typically gravel road infrastructure maintained by the Department of Conservation and Recreation.

The local hazard mitigation planning team noted that size of Princeton itself makes Princeton more vulnerable to snow events, as during snowstorms response times can be severely delayed due to weather and typically life flight is unable to fly during these conditions. They also noted that town shelters are not currently adequate for extended sheltering during longer events.

Potential Climate Change Effects

According to the 2023 ResilientMass Plan, sea level rise, warming ocean temperatures, and changing atmospheric circulation patterns are likely to increase the frequency and severity of winter storms.[57] Warmer temperatures indicate that more precipitation will fall as rain rather than snow throughout the 21st century. The result of this will be fewer overall snowstorms; however, the snowstorms that do occur will likely be worse. Increased wintertime rain also creates a greater risk for wintery mix, sleet, and ice storms; in addition, it will cause hazardous roadway conditions, as temperature drops overnight will cause transportation infrastructure to ice over if mitigation measures are not put in place.

In summary, climate change is likely to increase the extent and probability of future snowstorm events in Princeton. This may have societal impacts; more frequent severe winter storms may change land use and development protocols, as more homes and community buildings may need to have greater sheltering infrastructure to prepare for heavy snowfall. The local HMP planning team in town noted that extreme snowfall events are high on their list of concerns, as the snow transforms more into a wintery mix of ice and snow as time goes on creating a greater concern

[57] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

for icing.

VULNERABILITY

Based on the above assessment, Princeton has a hazard index rating of "2 – high risk" from snowstorms and ice storms. Snowstorms, ice storms, nor'easters, and other forms of winter precipitation are a frequent occurrence in Massachusetts, and they are expected to only become more frequent over time. Additionally, the expected increase in "wintery-mix" precipitation may lead to increased roadway hazards, as standing water freezing in overnight temperatures creates hazardous road conditions for travelers and responders.

MITIGATION STRATEGIES

The Town of Princeton is currently able to effectively respond to severe snowstorms, ice storms, and nor'easters through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. Given that Princeton, as well as other towns in the region, experience snowstorms frequently, local and state officials as well as emergency response personnel amply prepare for major snow events. However, there are numerous opportunities to expand upon the town's existing capabilities to mitigate and respond to severe snowstorms, ice storms, and nor'easters. The local HMP planning team identified the following strategies that could be used to reduce the threat of snowstorms in Princeton:

- Establish a second, back-up power interconnection to ensure rapid reestablishment of power distribution following storm events
- Investigate and adopt National Weather Service's Storm Ready Program
- Update and implement a Town-wide snow plan and snow removal policy, which should include coordination and planning steps for snow removal

4.5 HURRICANES

Hurricanes begin as tropical storms that form over warm ocean waters in the Atlantic Ocean off the west coast of Africa or the Pacific Ocean. These storms form as heated, moist air that is drawn up into the atmosphere and begin circulating clockwise or counterclockwise, depending on which hemisphere they are in. Tropical storms become hurricanes when their sustained winds exceed 74 miles per hour. The primary damaging forces associated with these storms are high-level sustained winds and heavy precipitation. Hurricane winds can reach speeds of up to 200 miles per hour and can grow to 500 miles in diameter. The official hurricane season starts on June 1st. In New England, hurricanes generally occur in August, September, and the first half of October due to the time required for the waters south of Long Island to warm enough to sustain hurricane activity this far north. Hurricanes in the region can result in flooding and wind damage to structures and above-ground utilities.[58]

LOCATION

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

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, is 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 17: The Saffir-Simpson Scale (1)[59]

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

[58] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

[59] National Hurricane Center and Central Pacific Hurricane Center, "Saffir-Simpson Hurricane Wind Scale," National Oceanic and Atmospheric Association, accessed May 28, 2025, https://www.nhc.noaa.gov/aboutsshws.php

Previous Occurrences

Hurricanes which have affected the region near Princeton are shown in the following table:[60]

Table 18: Hurricanes Which Have Affected the Region Near Princeton

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	Extratropical Storm, made landfall south of MA but still had impacts in the state
Andrea	2013	Minor Storm
Elsa	2021	Tropical Storm
Fred	2021	Extratropical Storm
Henri	2021	Tropical Storm/Depression

Probability of Future Events

Princeton's inland location in Central Massachusetts reduces the risk of extremely high winds that are associated with hurricanes, although the town can still experience some high wind events. Based upon past occurrences, it is reasonable to say that there is a "low" probability (1% to 10% in any given year) of hurricanes in Princeton. However, 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 likely increase in town in the future.

[60] "Historical Hurricane Tracks," Coast.noaa.gov, National Oceanic and Atmospheric Administration, accessed May 28, 2025, https://coast.noaa.gov/hurricanes/#map=6.02/42.065/-71.688&search=eyJzZWFyY2hTdHJpbmciOiJNYXNzYWNodXNldHRzLCBVU0EiLCJzZWFyY2hUeXBlIjoiZ2VvY29kZWQiLCJvc21JRCI6IjYxMzE1IiwiY2F0ZWdvcmllcyI6WyJINSIsIkg0IiwiSDMiLCJIMiIsIkgxIiwiVFMiLCJURCIsIkVUll0sInllYXJzIjpbXSwibW9udGhzIjpbXSwiZW5zbyI6W10sInByZXNzdXJlIjp7InJhbmdlIjpbMCwxMDMwXSwiaW5jbHVkZVVua25vd25QcmVzc3VyZSI6dHJ1ZX0sImJ1ZmZlciI6NjAsImJ1ZmZlclVuaXQiOlsiTmF1dGljYWwgTWlsZXMiXSwic29ydFNlbGVjdGlvbiI6eyJ2YWx1ZSI6InllYXJzX25ld2VzdCIsImxhYmVsIjoiWWVhciAoTmV3ZXN0KSJ9LCJhcHBseVRvQU9JIjp0cnVlLCJpc1N0b3JtTGFiZWxzVmlzaWJsZSI6dHJ1ZX0=.

IMPACT

Descriptions of damage that could occur due to hurricanes of different storm categories of the Saffir-Simpson scale are shown below:

Table 19: The Saffir-Simpson Scale (2)

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 the 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 damage to Princeton from 1% and 0.2% hurricane events (storms that are 1% and 0.2% likely to happen each year, and roughly equivalent to Category 1 and Category 2 hurricanes, respectively). The damage 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 20: HAZUS Potential Damages to Princeton from 1% and .2% Annual Chance Hurricane Events

	1% storm (89 mph winds)	0.2% storm (102-105 mph winds)
Building Characteristics		
Estimated total number of buildings	1,282	
Estimated total building replacement value (2024 $)	$ 740,129,000.00	

Building Damages		
# of buildings sustaining minor damage	38	185
# of buildings sustaining moderate damage	2	20
# of buildings sustaining severe damage	0	1
# of buildings destroyed	0	1
Population Needs		
# of households displaced	0	3
# of people seeking public shelter	0	1
Debris		
Building debris generated (tons)	133	579
Tree debris generated (tons)	18,348	27,133
# of truckloads to clear building debris	5	23
Value of Damages		
Total property damage (buildings and content)	$ 5,889,120.00	$ 16,631,000.00
Total losses due to business interruption	$ 108,780.00	$ 586,050.00

Though there are no recorded instances of a hurricane equivalent to a 0.2% storm passing through Massachusetts, this model was included in this plan in order to present a reasonable "worst case scenario" that can help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as more intense and frequent storms become more common. For more information on the HAZUS-MH software, go to http://www.fema.gov/hazus-software.

Princeton faces a "minor" impact from hurricanes, with 10% or less of property in the affected area of town being damaged or destroyed in any given hurricane instance.

EXPOSURE

Certain features within Princeton's 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 are documented in the list of critical facilities and vulnerable populations in Section 3. These features include:

- The electrical grid, which is vulnerable to outages from trees falling across power lines. The Princeton Municipal Light Department proactively trims trees in their right of way in Princeton, and the local HMP planning team noted that that the town has not had too many calls for emergency tree removal in between the last plan and this one.
- Municipal buildings have been impacted by high winds in the past. Damage to these buildings could impact critical town functions and distract people from other essential emergency response and recovery activities; and

- 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 above also apply to hurricanes.

Potential Climate Change Effects

According to the 2023 ResilientMass Plan, there are two major ways that climate change influences hurricanes and tropical storms:[61]

- 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; and
- 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 Princeton.

Vulnerability

Based on the above analysis, Princeton has a hazard index rating of "4 – low risk" from hurricanes. Its location and elevation decrease the risk of hurricane-force winds and rains, though it does not remove them entirely. Historically, by the time a storm has arrived in Princeton, it has been typically downgraded to a tropical storm or tropical depression; however, climate change may increase the severity of these types of storms in town in the future. The risk to Princeton from high wind events is covered elsewhere in this plan and represents the bulk of the risk that hurricanes pose to the town.

Mitigation Strategies

The Town of Princeton is currently able to effectively respond to hurricanes through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities to expand upon the Town's existing capabilities to mitigate and respond to hurricanes. The local HMP planning team identified the following strategies that could be used to reduce the threat of hurricanes in Princeton:

- Generator upgrade – Highway Department. Replace generator with adequate size and capabilities to run all electrical needs and emergency management operations.
- Purchase a command vehicle that can function as a heavy rescue communications center with radios. These will help to coordinate communication with MEMA, Feds, DCR, Town, etc. in the event of an emergency.
- Adopt local bylaws that are built upon the State's Wetlands Protection Act and Regulations. These add 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. Princeton should consider adopting a local, town-wide wetland bylaw to further protect itself from possible damaging construction and development. Princeton should also examine enhanced development controls at other wetlands to sustain natural barriers to flooding.

[61] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

4.6 Severe Thunderstorms / Wind / Tornadoes

A thunderstorm is a storm with lightning and thunder produced by a cumulonimbus cloud; thunderstorms usually produce gusty winds as well as heavy rain and sometimes generate hail. Effective January 5, 2010, the National Weather Service (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 ever recorded was a 175-mph downburst in North Carolina. Downburst winds exceeding 100 mph have been measured in Massachusetts.[62]

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

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 paths that range from a few dozen yards to over a mile in width. The path of a tornado can be unpredictable because tornadoes can stall or change direction abruptly. 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. In Massachusetts, tornadoes have occurred most frequently in the Connecticut River Valley and in western Worcester County, with Princeton approximately 30 miles east of the zone of most frequent past occurrences.

Location

As per the 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan, the entire Town is at risk of high winds, severe thunderstorms, and tornadoes. This plan identifies Princeton and the communities surrounding it as having a moderate frequency of tornado occurrence within the Massachusetts context. However, the area affected by thunderstorms, wind, or tornadoes in town is "small," with less than 10 percent of the town generally affected.

Extent

An average thunderstorm is 15 miles across and lasts for 30 minutes; severe thunderstorms can be

[62] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

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, as previously discussed, is linked to a number of other hazards, including hurricanes and winter storms, in addition to thunderstorms and tornadoes. High winds can cause damage to structures and trees and can also increase the risk of wildfire.

Tornadoes are measured using the Enhanced Fujita Scale, which is shown below with the following categories and corresponding descriptions of damage:

Table 21: Enhanced Fujita Scale Levels and Descriptions of Damage[63]

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; damage 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.

Table 22: Extent Scale for Hail[64]

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

[63] National Weather Service, "The Enhanced Fujita Scale (EF Scale),"Weather.gov, National Oceanic and Atmospheric Administration, accessed May 15, 2025, https://www.weather.gov/oun/efscale.
[64] Storm Prediction Center, "Converting Traditional Hail Size Descriptions," Spc.noaa.gov, National Oceanic and Atmospheric Administration, accessed May 15, 2025, https://www.spc.noaa.gov/misc/tables/hailsize.htm.

Hail Size (in.)	Object Analog Reported
3.00	Tea cup
4.00	Grapefruit
4.50	Softball

Previous Occurrences

Because thunderstorms and wind affect Princeton regularly, there is not a comprehensive record available of all thunderstorm and wind events which have affected the Town. As per the Massachusetts State Hazard Mitigation and Climate Adaptation 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; Tornadoes with a rating of 3 or above and tornadoes resulting in a death or injury, or significant property damage, are listed below.

- In 1953, an F4 tornado struck Worcester. The event resulted in at least 90 fatalities and more than 1,200 injuries. There was extensive property damage. On the same date, an F3 tornado began in the Town of Sutton.
- In 1970, an F3 Tornado Touched down in Hardwick and traveled on a linear path to Harvard before tacking north/ northeast, passing through the town of Princeton. This tornado caused significant property damage in the affected towns.[65]
- In 1981 an F3 tornado struck Westminster, resulting in 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.

In the last 10 years, there has only been one small tornado that has affected Princeton that was reported as such:

- 06/23/2015 – Tornado: A strong cold front combined with a remnant of an elevated mixed layer (EML) and a significant amount of deep layer shear and instability to produce showers and thunderstorms across southern New England. Many of these thunderstorms became severe, producing strong to damaging winds, large hail, and even two EF0 tornadoes. A tornado touched down off of West Princeton Road near Wachusett Mountain. It damaged about a dozen trees and sheared off several tree tops. This damage was further supported by an eyewitness account of the tornado and rotation on the radar.

[65] EF3 tornado on Oct. 03, 1970 16:15 PM CDT | burlingtonfreepress.com

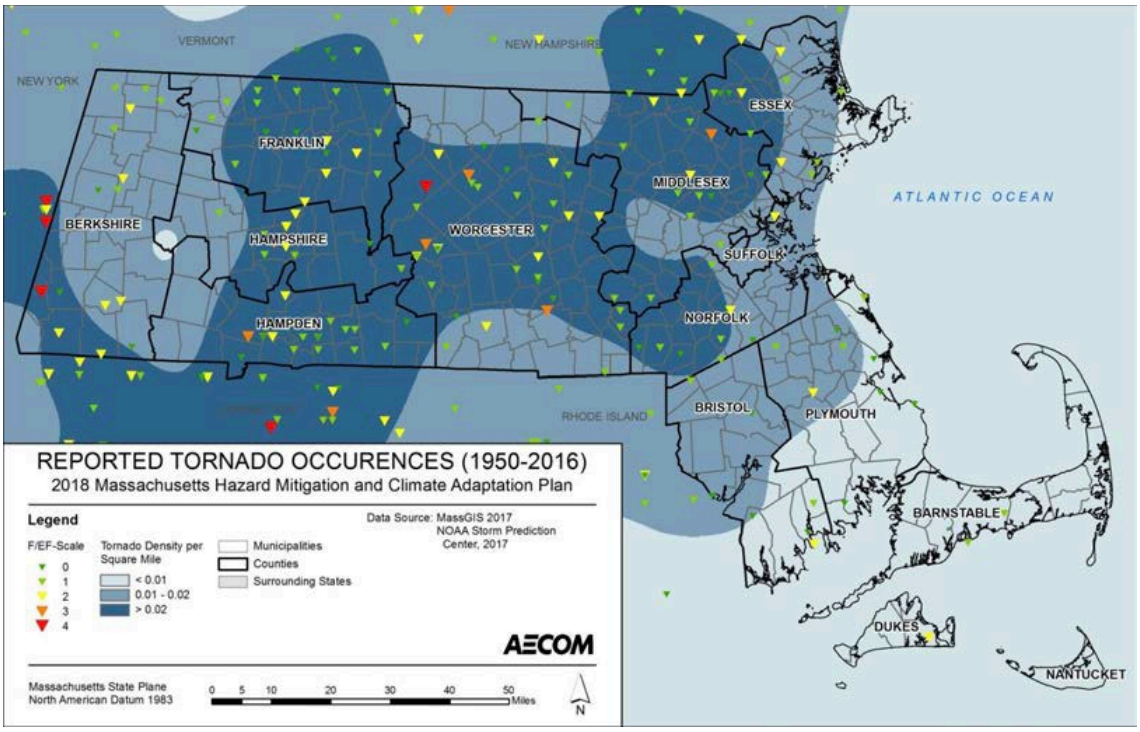

Figure 1: Density of Reported Tornados per Square Mile (1950-2016)[66]

Image 1: 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 the Landsat 5 satellite.

[66] "Massachusetts State Hazard Mitigation and Climate Adaptation Plan," Mass.gov, Massachusetts Executive Office of Energy and Environmental Affairs and Massachusetts Emergency Management Agency, September 2018, https://www.mass.gov/doc/state-hazard-mitigation-and-climate-adaptation-plan/download.

Thunderstorm occurrences are more frequent in Massachusetts than occurrences of tornados, and thunderstorms have the potential to produce tornadoes. Supercells are the type of storm that most commonly produces tornadoes; they are severe, long-lived thunderstorms. Approximately 20 percent of supercells produce tornadoes. In Princeton, there have been several severe thunderstorm/wind occurrences:[67]

- 05/16/2016 – High Wind: A major winter storm moved up the east coast, hugging the southern NJ coast then moving rapidly northeast across southern Rhode Island and interior southeast Massachusetts. The storm dropped 12 to nearly 20 inches of snow across much of western, central, and northeastern Massachusetts, with lesser amounts in the southeast, where a changeover to rain occurred in the late morning and early afternoon. Cape Cod only received 1 to 2 inches before changing to rain, with temperatures rising into the 40s. Snowfall rates of 3 inches per hour were observed in western MA. Damaging winds pounded Cape Cod and the Islands...with gusts to hurricane force. High winds also occurred along the coast, especially over Cape Ann. Lawrence, in Essex County, was the only ASOS site to officially reach blizzard conditions. Gusty winds to 30-50 mph were common in the interior. Thunder-snow also occurred in northeast MA during the height of the storm. The snow changed to rain over Cape Cod early in the morning, but didn't change in Boston until 2:45 PM local time, after most of the snow had occurred. Snow lingered in western and central sections into the late afternoon/early evening. At 11:19 AM EDT, a large tree and multiple utility poles were downed on Damon Pond Road in Rutland, per amateur radio. At 12:50 PM, power lines were down on Cedar Street in Leominster. At 1:11 PM, the Worcester Airport ASOS recorded a wind gust to 55 mph. At 1:34 PM, a trained spotter reported a wind gust to 61 mph in Milford. At 2:52 PM, trees and wires were down in Princeton. A large tree and wires were reported down on Fairview Avenue in Rutland at 2:57 PM. At 4:21 PM, a tree was down on wires on Charles Street in Leicester. At 5:34 PM, an amateur radio reported a tree down in Harvard on Still River Road. At 5:50 PM, a tree was down on Browning Pond Road in Spencer, near the Oakham line. At 9:20 PM, a very large pine tree was downed onto wires on Burncoat Street in Leicester.
- 10/26/2017 – Strong Wind: Coastal low pressure intensified as it lifted north through Maine. This brought strong northwest winds, primarily across eastern and central Massachusetts, during the evening of the 26th. Several large trees were brought down by this wind. A tree was down and blocking Wachusett Street in Princeton.
- 05/04/2018 – Strong Wind: A low pressure area over the Great Lakes the morning of May 4th moved to the Maritimes the morning of May 5th. As it moved, the low swung a cold front west to east through Massachusetts shortly before midnight. Winds behind the front became west to northwest and produced gusts near 50 mph overnight. The winds then

[67] "Storm Events Database Search Results for Worcester County, Massachusetts," NCDC.NOAA.gov, National Oceanic and Atmospheric Administration National Centers for Environmental Information, accessed May 5, 2025, https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Hail&eventType=%28Z%29+High+Wind&eventType=%28Z%29+Strong+Wind&eventType=%28C%29+Thunderstorm+Wind&eventType=%28C%29+Tornado&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2013&endDate_mm=11&endDate_dd=30&endDate_yyyy=2023&county=WORCESTER%3A27&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=25%2CMASSACHUSETTS.

diminished by sunrise on May 5th. At 9:44 PM EST on May 4th, the Automated Surface Observing System at Fitchburg Municipal Airport measured a wind gust to 49 mph. At 10:24 PM EST a tree was down on power lines and blocking West Princeton Road in Westminster. At 12:20 AM on May 5th, a tree was down on a house and cars on Onset Street in Worcester.

- 09/06/2018 – Thunderstorm Wind: A cold front moved into very warm humid air over Massachusetts on September 6th. This brought showers and strong thunderstorms to the region during the afternoon and evening. At 2:55 PM EST, wind brought a tree down on Princeton Road in Sterling.
- 10/27/2018 – Strong Wind: Low pressure from the Gulf of Mexico moved up the East Coast on October 27th and 28th, bringing strong winds to Central and Eastern Massachusetts and minor coastal flooding. A general one to two inches of rain was measured across the state. In Sterling at 12:31 PM EDT, a tree was down on Route 62 near the Princeton line and at 347 PM a tree was reported down across Route 140 at Route 62. In Hardwick at 2:35 PM EDT, a tree was down on Ruggles Hill Road, and another tree was down on Route 32. In Spencer at 3:26 PM EDT, a tree was down on power lines on North Brookfield Road.
- 07/23/2020 – Thunderstorm Wind: A short-wave trough approached the region aloft while a pre-frontal trough moved into the area at the surface. producing severe thunderstorms in the afternoon. Dewpoints were between 70 and 75, providing ample moisture. With only marginal shear, the storms were slow-moving and produced torrential downpours, which led to significant flooding, especially in urban areas of northeast Massachusetts. In Princeton, a tree was down on Mountain Road.
- 02/28/2024 – High Wind: A strong cold front crossed southern New England on Wednesday night the 28th bringing soaking rains and strong wind gusts to southern New England followed by sharply falling temperatures. This cold frontal passage included a fine line stronger storms. Winds generally gusted 45 to 55 mph. The strongest gusts were 59 mph at the Worcester Airport ASOS (KORH) at 2:18 AM EST on the 29th and a gust to 55 mph at the Fitchburg Airport ASOS (KFIT) at 1:57 AM EST on the 29th.

Though not recorded on the variety of previously cited sources, the local planning team noted that there have been several microbursts following a similar track, starting in Hubbardston and then moving into Princeton running over the center of town down Worcester Road, and into the valley towards Coal Kiln Road, the last one occurring in June of 2024. In regard to thunderstorms, Princeton has experienced severe thunder events and lightning strikes in town, including a lightning strike at their DPW which damaged their fuel pump's electronics on site, preventing its use during power outages.

Probability of Future Events

According to the 2023 ResilientMass Plan, Massachusetts averages two to five tornadoes per year.[68] Only two tornadoes in the state (which occurred in 1953 and 2011) received disaster

[68] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

declarations. Massachusetts has experienced 12 EF0 to EF1 tornadoes since 2018; six EF0 tornadoes occurred in the state in 2021, and these 2021 EF0 tornadoes caused under $50,000 in property damage. Because tornadoes are relatively rare in the Commonwealth, residents are less likely to be prepared for them in the Commonwealth than in other parts of the country. People who live in manufactured housing, such as mobile homes, are more at risk to tornadoes. Tornadoes can affect all sectors and populations, and their primary effect is damage from their high winds to structures and the environment. Any structure located in a tornado zone or path is at risk. Tornado activity may become more variable due to climate change, so predicting the likelihood of future tornado events in Princeton is difficult.

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

IMPACT

Overall, Princeton faces a "minor" impact from severe thunderstorms, with less than 10% of property in the affected area of town expected to be damaged in this type of hazard event. Princeton also faces a "limited" impact from severe winds and tornados, with between 10% and 25% of property in town expected to be damaged in these types of hazard events.

As indicated in Table 21 above, the following likely impacts on the physical environment can result from tornadoes of different levels:

- EF0 - Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damage to sign boards.
- EF1 - The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving automobiles pushed off the roads; attached garages may be destroyed.
- EF2 - Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
- EF3 - Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
- EF4 - Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

The potential for local catastrophic damage is a factor in any tornado, severe thunderstorm, or wind event. In Princeton, the town's exurban development has widely dispersed most of the housing throughout town, with the exception of the state lands around Mt Wachusett and its surrounding forests. Most buildings in town have not 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 52.1% of the Town's 1,409 total housing units were constructed in 1979 or earlier (according to 2022 American Community Survey 5-year estimates).[69]

Princeton's median home value is $496,400 (according to 2022 American Communities Survey 5-

[69] "DP04: Selected Housing Characteristics," Data.Census.gov, United States Census Bureau, accessed May 5, 2025, https://data.census.gov/table/ACSDP5Y2023.DP04?q=dp04+selected+housing+characteristics&g=060XX00US2502755395 .

year estimates).[70] Utilizing the total value of all property in town, $789,723,794.00,[71] and an estimated 10 percent of damage to 5 percent of all structures, the estimated amount of damage from a tornado in town is $3,948,618.97. The cost of repairing or replacing roads, bridges, utilities, and contents inside structures is not included in this estimate.

Exposure

Certain features within Princeton's 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 are documented in the list of critical facilities and vulnerable populations in Section 3. Vulnerable features to severe thunderstorms/wind/tornadoes overlap with the features vulnerable to hurricanes and flooding described in the sections of this plan focusing on these other hazards.

Potential Climate Change Effects

The 2023 ResilientMass Plan identifies that current climate models predict an increase in severe thunderstorms, which have the potential to produce tornadoes. However, it is unknown if tornado frequency will increase with climate change. Some studies suggest there will be a decrease in the number of tornado days, but an increase in the number of tornadoes per day.[72]

Without a clear understanding of how climate change will impact tornadoes, the Town is not able to determine exactly how this hazard will impact population patterns and land use needs for the Town of Princeton. However, if climate change does increase the likelihood of tornado occurrence, the town may have to incorporate additional emergency shelters into development and land use.

Vulnerability

Based on the above assessment, Princeton has a hazard index rating of "2 – high risk" from severe thunderstorms and winds, and a "3 – medium risk" hazard index rating from tornadoes. The relatively old age of the housing stock in Princeton makes the Town particularly vulnerable to tornadoes, despite their relative infrequency.

Mitigation Strategies

The Town of Princeton is currently able to effectively respond to severe thunderstorms, wind, and tornadoes through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities for the Town to expand upon its existing capabilities to mitigate and respond to severe thunderstorms, wind, and tornadoes. The local HMP planning team identified the following strategies that could be used to reduce the threat of severe thunderstorms, wind, and tornados in Princeton:

[70] Ibid.

[71] Data Analytics and Research Bureau, "Assessed Values by Class," Dlsgateway.dor.state.ma.us, Massachusetts Department of Revenue, May 5, 2025, https://dlsgateway.dor.state.ma.us/reports/rdPage.aspx?rdReport=PropertyTaxInformation.AssessedValuesbyClass.assessedvaluesbyclass&tblassessedvalues-PageNr=27&rdDataCache=400584956&rdShowModes=&rdSort=&rdNewPageNr=True1&rdRequestForwarding=Form

[72] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," page 5.1-56.

- Lightning rod protection at Public Safety Buildings required. Proper radio tower and equipment grounding to Motorola R-56 Standards also required. Two outdoor warning sirens at the Fire Stations have been struck by lightning in the past, and a member of the Fire Department was struck by lightning outside of the East Princeton Fire Station.
- Install Lighted windsock for Station 2 to assist with life flight landings.
- Plan for assisting mobility-impaired residents with evacuations when a hazard occurs. Identify where these residents live and the best methods of communication in order to safely evacuate them to shelters and evacuation routes. Help with providing emergency medical equipment, prescriptions, and other necessities as well.

4.7 Wildfires / Brush Fires

Wildfires are typically larger fires involving full-sized trees as well as meadows and scrublands. Brush fires are uncontrolled fires that occur in meadows and scrublands and that do not involve full-sized trees. Typical causes of wildfires and brush fires are lightning strikes, human carelessness, and arson. In Princeton, sparks from trains along railroad tracks have started many brushfires. 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."[73] When relative moisture drops, light fuels like grasses become drier and burn more easily.[74]

FEMA has classifications for three different types of wildfires:

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

Potential effects of wildfires include damage to structures and other human infrastructure as well as impacts on natural resources. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly, and people with respiratory and cardiovascular diseases.

Location

Approximately 74.4% of total land area in Worcester County is deciduous forest, evergreen forest, forested wetland, scrub/shrub land, scrub/shrub wetland, or grassland.[75] Much of this region of Massachusetts, including the Princeton area, has a higher risk of wildfires than for the state as a whole.[76] In Princeton, approximately 83% of the land is forested (48% of land is deciduous forest, 29% of land is evergreen forest, 6% of land is forested wetland, approximately 1% of land is scrub/shrub land, and 2% of land is grassland).[77] Princeton is developed in sparse exurban pattern, with much of its land in and around town being forested interspersed with single family detached homes. The substantial tree cover in town does present a risk for wildfires and brushfires with the total amount of the town that could be affected by a wildfire is categorized as "large," or greater than 50% percent of its total area.

Princeton is vulnerable to interface problems (fires spreading from unoccupied land to human development) because of its development patterns around state forest land, specifically Mount Wachusett, the Leominster State Forest, The Mass Audubon Wachusett Meadow, and other conservation areas. Human activity, which may involve cooking and camping fires as well as carelessly tossed cigarettes and other fire sources, can lead to problems for residents living near these areas. In addition, lightning strikes and faulty power infrastructure can lead to wildfires

[73] "Understanding Fire Danger," Nps.gov, United States National Park Service, August 17, 2023, https://www.nps.gov/articles/understanding-fire-danger.htm.
[74] Ibid.
[75] Massachusetts Bureau of Geographic Information, "MassGIS Data: 2016 Land Cover/Land Use," Mass.gov, Massachusetts Executive Office of Technology Services and Security, May 2019, https://www.mass.gov/info-details/massgis-data-2016-land-coverland-use.
[76] "Massachusetts State Hazard Mitigation and Climate Adaptation Plan," September 2018
[77] Massachusetts Bureau of Geographic Information, "MassGIS Data: 2016 Land Cover/Land Use"

developing in town.

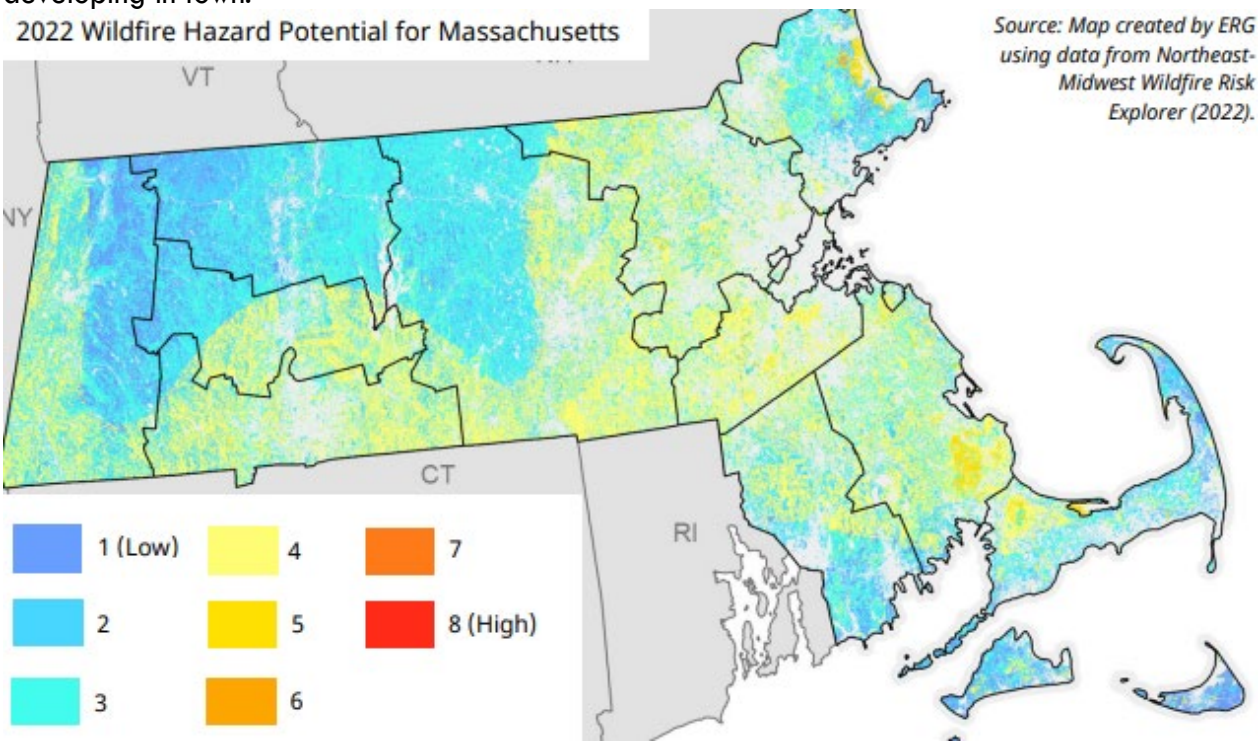

Figure 2: Wildfire Risk Areas for the Commonwealth of Massachusetts.[78]

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. Wildfires can last from several hours up to several weeks or months.

As previously discussed, approximately 85% of Princeton's total land area is deciduous forest, evergreen forest, forested wetland, scrub/shrub land, or grassland. These areas are at risk of fire and are concentrated in the northern and, with developed areas, rivers, and transportation corridors (such as Route's 140, 62 and 31) breaking up the forest. In drought conditions, a brushfire or wildfire would be a matter of concern in town.

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

Table 23: The National Fire Danger Rating System

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.

[78] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

Rating	Basic Description	Detailed Description
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.

Beyond the direct hazards that wildfires pose, potential wildfires both in the Princeton area and other fires as far away as Central/Western Canada pose the indirect hazard of air quality reduction from smoke particulates. Smoke particulates are measured, along with other particulates that affect air quality, by the EPA's Air Quality Index.[79] For each pollutant, an AQI value of 100 generally corresponds to an ambient air concentration that equals the level of the short-term national ambient air quality standard for the protection of public health. AQI values at or below 100 are generally thought of as satisfactory. When AQI values rise above 100, air quality is unhealthy; at first for certain sensitive groups of people, then for everyone as AQI values get higher. The EPA establishes an AQI for five major air pollutants regulated by the Clean Air Act. Each of these pollutants have a national air quality standard set by EPA to protect public health, and these pollutants are: ground-level ozone; particle pollution (also known as particulate matter, including PM2.5 and PM10); carbon monoxide; sulfur dioxide; and nitrogen dioxide.

The AQI is divided into six categories. Each category corresponds to a different level of health concern. Each category also has a specific color. The color makes it easy for people to quickly determine whether air quality is reaching unhealthy levels in their communities.

[79] "Air Quality Index (AQI) Basics," Airnow.gov, United States Environmental Protection Agency, accessed June 10, 2024, https://www.airnow.gov/aqi/aqi-basics/.

Table 24: AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Previous Occurrences

Princeton has an on-call paid professional fire department providing 24/7 coverage. In addition, Princeton is part of the Northern Worcester County Fire Department (Mutual Aid District 8) with 31other Towns. Princeton experienced 38 wildfires/brushfires between 2011-2020; however, each of these fires were quite small, and altogether they consumed 56.9 acres of brush/wildland.[80]

During a critical drought which occurred across most of Massachusetts in late 2024 and was ongoing at the time of the writing of this plan, at least 638 wildfires which in combination burned at least 3,413 acres occurred in the state.[81]

[80] "Wildfire Data," Cmrpc-my.sharepoint.com, Massachusetts Fire Incident Reporting System, accessed April 12, 2025, https://cmrpc-my.sharepoint.com/:x:/r/personal/wtalbot_cmrpc_org/_layouts/15/Doc.aspx?sourcedoc=%7B1F0B29EB-3A47-4669-B4E6-FA4FC08AD498%7D&file=Wildfire%20Data.xlsx&action=default&mobileredirect=true.

[81] Massachusetts Emergency Management Agency, "Massachusetts Emergency Management Agency Situational Awareness Statement # 24: Statewide Wildfire Operations," (issue brief), Boston, Massachusetts, November 21, 2024.

Probability of Future Events

The 2023 ResilientMass Plan notes that climate-change driven changes in the intensity and frequency of precipitation and thunderstorms, prolonged drought conditions, and rising temperatures are expected to increase the frequency and severity of wildfires.[82] In drought conditions, forest types that are not typically prone to wildfires will become more likely to burn. Globally, wildfires are projected to increase worldwide by 14% by 2030, 30% by 2050, and 50% by 2100.

Changes in weather patterns driven by climate change can intensify fires which in turn heighten the effects of climate change. By mid-century, mean summer temperatures in the Nashua River Basin are projected to increase by between 3.6° F and 8.1° F due to climate change.[83] Rising temperatures coupled with variable precipitation could exacerbate summer drought and could encourage more high-elevation wildfires; These wildfires release stores of carbon that contribute to the buildup of greenhouse gases and therefore further exacerbate climate change.

Climate change is also predicted to bring increased wind damage from major storms and bring new types of pests, including invasive species, 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.

The Princeton HMP Planning 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 in town and the increase in invasive species within the Town of Princeton (which is elaborated on in greater details in Section 4.12), the planning team determined the probability of future damaging wildfire events to be "high" (50% to 70% probability in the next year). This is in no small part due to the fact that there has not been a wildfire of significance in the past 15 years.

Impact

Of the concerns noted by the local hazard mitigation planning team, wildfires stood out as one of the greatest hazards the town was facing: The town has so far been spared destructive wildfires, which conversely creates a greater danger from wildfire as the fuel loads continue to accumulate. For this reason, the town faces a "critical" impact from wildfires, with damage to over 25% of property in the affected area of town likely to occur in the case of a wildfire hazard event.

Both wildfires and brush fires can consume homes, other buildings, and/or agricultural resources. Wildfires and brush fires impact:

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

[82] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"
[83] ResilientMass Maps and Data Center, "Climate Change Projections Dashboard," Resilientma-mapcenter-mass-eoeea.hub.arcgis.com, ResilientMass, accessed April 12, 2025, https://resilientma-mapcenter-mass-eoeea.hub.arcgis.com/#ClimateDashboard.

- The overall destruction of property, loss of life, and/or injuries.

Utilizing the total value of all property, $789,723,794.00,[84] and an estimated 25 percent of damage to 10 percent of all structures, the estimated amount of damage from a wildfire in town is $19,743,094.85. The cost of repairing or replacing roads, bridges, utilities, and contents inside structures is not included in this estimate. This also does not include the loss of the communications facilities on top of Mount Wachusett, nor the economic losses caused by the loss of the eco-tourist trade around the mountain and surrounding forests.

The Wildland Urban Interface (WUI) is defined as the area where houses meet or intermingle with undeveloped wildland vegetation; the WUI represents a large percentage of the land use within Worcester County as a whole.[85]

Exposure

Certain features within Princeton's infrastructure, society, and environment may face more exposure to wildfires and brush fires, or be disproportionately impacted by them, relative to the rest of the community. Some of these features are documented in the list of critical facilities and vulnerable populations in Section 3. These features include:

- People who are sensitive to smoke, including children, the elderly, and individuals with health conditions. Air pollution from wildfires is a public health concern, as it leads to smoke inhalation which can be severe. Smoke can exacerbate respiratory conditions like asthma and can carry toxic chemicals and particulate matter. In 2021, wildfire smoke from western states and Canada extended across the continental US and forced the Massachusetts Department of Environmental Protection to issue an air quality alert;[86]
- First responders, especially the town's firefighters;
- Critical communications infrastructure located on Mount Wachusett that acts as a telecommunications relay for the entire eastern seaboard;

As previously described in the 2021 example above, wildfires do not have to take place within town to affect the Town; in March through July of 2023, historic wildfires in Canada sent smoke across a broad swath of New England, peaking in June of that year. In Worcester County, these fires reduced air quality throughout the months of May and June. The AQI for Worcester County peaked at 148 – Unhealthy for Sensitive Groups for fine particulate matter (PM2.5) – on June 6th 2023.[87]

Potential Climate Change Effects

Climate change effects will impact future wildfires, as is noted in the "Probability of Future Events" section above. According to the 2023 ResilientMass Plan, precipitation changes, prolonged drought, rising temperatures, and increased frequency of lightning are expected to contribute to

[84] Data Analytics and Research Bureau, "Assessed Values by Class"
[85] Volker C. Radeloff et al., "The 1990-2020 wildland-urban interface of the conterminous United States - geospatial data," FS.USDA.gov, Forest Service Research Data Archive, 2023, https://www.fs.usda.gov/rds/archive/products/RDS-2015-0012-4/_metadata_RDS-2015-0012-4.html.
[86] Kat J. McAlpine (2021, July 27). "Wildfire Smoke in New England Is 'Pretty Severe from Public Health Perspective'," BU.edu, The Brink: Pioneering Research from Boston University, July 27, 2021, https://www.bu.edu/articles/2021/wildfire-smoke-in-new-england/.
[87] "Pre-Generated Data Files," Aqs.epa.gov, United States Environmental Protection Agency, October 26, 2023, https://aqs.epa.gov/aqsweb/airdata/download_files.html.

increased frequency and severity of wildfire.[88] As droughts become more frequent and severe, forest types that do not usually burn and are not fire adapted will be more likely to burn. Wildfires are projected to increase worldwide by 14% by 2030, 30% by 2050, and 50% by 2100.

Seasonal drought exacerbated by climate change may also make it more difficult to ensure a reliable water source for firefighting.

In summary, climate change will increase the frequency and extent of wildfires in Princeton. This increase in wildfires may lead to changes in land use, such as the Town no longer being able to develop near dense forest. Additionally, when wildfires and brush fires worsen significantly, residents may desire to move away from dense forest, shifting populations from more rural areas to other cities or downtown communities. The future air quality risks to Princeton from wildfires are hard to predict with any certainty and represent a threat to the broader region; town officials could consider including air purifying equipment as a needed aspect of shelter planning in the future.

Vulnerability

Based on the above assessment, Princeton has a hazard risk index of "1 – Highest risk" from wildfires, due to the above mentioned assessment. If the threat of wildfires to Princeton and its surrounds is not addressed it is not a question of if, but when a wildfire will pose a significant threat to the town.

Mitigation Strategies

The Town of Princeton is currently able to effectively respond to wildfires and brush fires through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities for the Town to expand upon its existing capabilities to mitigate and respond to wildfires and brush fires. The local HMP planning team identified the following strategies which could reduce the threat of wildfires and brush fires in Princeton:

- Cistern storage and capacity upgrade. Worcester Road Cistern in most immediate need, but other cistern locations for wildland and interface firefighting operations will need to be identified and planned for future wildfire protection planning documents.
- Pursue funding for a municipal public safety facility to house Fire, EMS and Police.
- Dredge fire ponds which are too shallow and dry out during the summer months. This would also help with stormwater collection and help prevent flooding in the area of the ponds.
- Fire defensible space education system; school newsletters and public/community forums.
- Write and implement a wildfire management plan for Wachusett Mountain and Leominster State Forest. There were concerns of wildfires and fuel load during the Fall 2024 drought. The Town has begun the process of seeking funds for this plan.

[88] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

4.8 EARTHQUAKES

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

LOCATION

Because of the regional nature of the hazard, the entire Town of Princeton is susceptible to earthquakes. This makes the location of occurrence for this hazard "large."

EXTENT

Earthquake magnitude and intensity are two measures of the overall extent of earthquakes in a given area. Magnitude is defined as the energy produced by an earthquake, and intensity is defined as an earthquake's level of effect on the Earth's physical environment, nature, people, and structures.

The magnitude of an earthquake can be measured using the Richter Scale, which measures the energy of an earthquake by determining the size of the greatest vibrations recorded on a seismogram. On this scale, one step up in magnitude (from 5.0 to 6.0, for example) indicates an increase in energy of an earthquake of 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.[89]

Table 25: 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.

[89] "How Do We Measure Earthquake Magnitude? Michigan Technological University," MTU.edu, Michigan Tech, accessed June 10, 2024, 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; I denotes a weak earthquake and XII denotes an earthquake that causes almost complete destruction.

Table 26: Modified Mercalli Intensity Scale for and Effects[90]

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

[90] Earthquake Hazards Program, "The Modified Mercalli Intensity Scale," USGS.gov, United States Geologic Survey, accessed May 28, 2025, https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale?qt-science_center_objects=0#qt-science_center_objects.

Previous Occurrences

The last recorded earthquake to cause major damage in New England occurred in 1755,[91] though seismologists state that another serious earthquake occurrence in the region in the future 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.[92] Earthquakes occur without warning and may be followed by aftershocks. Figure 3 below shows the locations of earthquakes that have occurred across the New England region and beyond from January 1975 through October 2017.

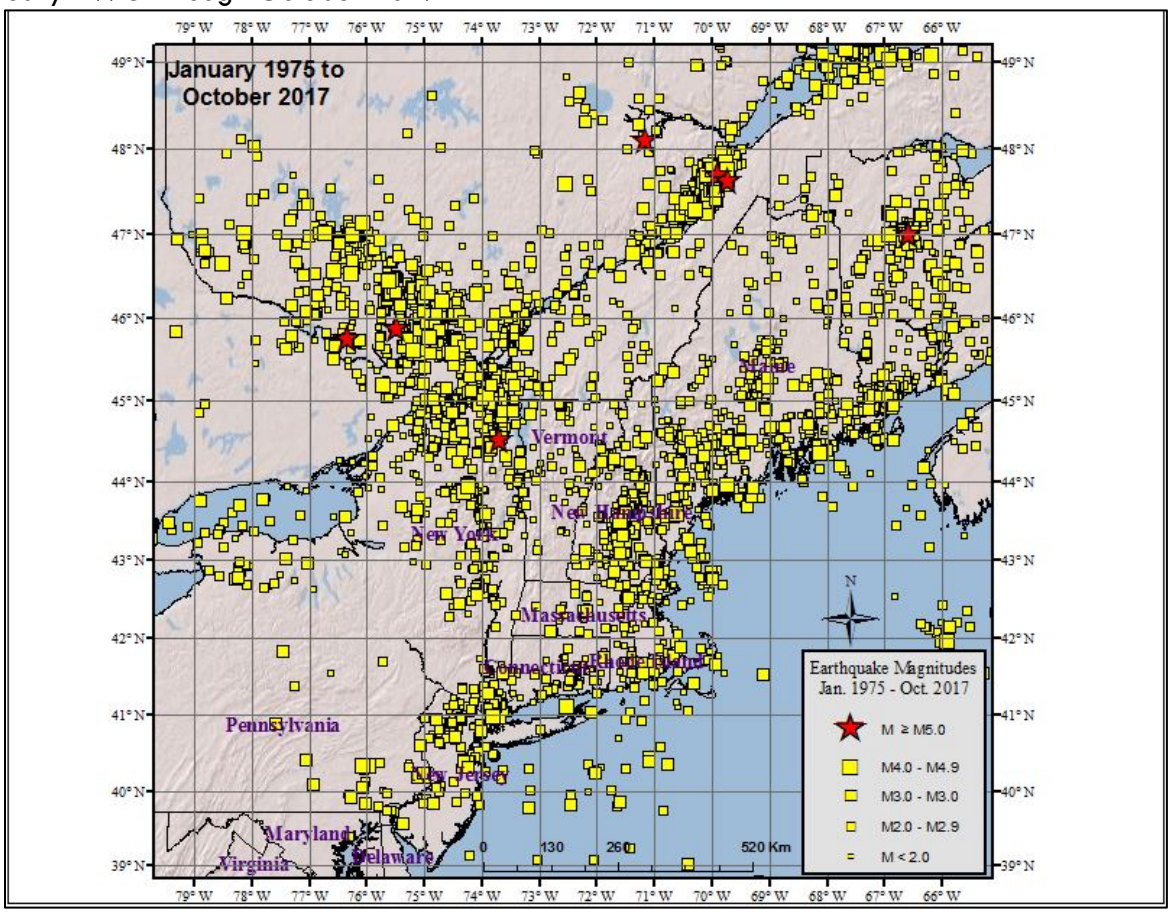

Figure 3: Map of Earthquakes of the Northeastern US and Southeastern Canada 1975 to 2017.[93]

The local hazard mitigation planning team reports that no earthquakes have recently been felt in Princeton. To determine whether earthquakes have occurred recently near Princeton, earthquake data over the past six years for all Massachusetts cities and towns gathered by the Weston Observatory at Boston College was reviewed.

[91] Northeast States Emergency Consortium and John E. Ebel, PhD. Boston College, Weston Observatory, "Massachusetts Earthquakes," NESEC.org, Northeast States Emergency Consortium, accessed May 28, 2025, http://nesec.org/massachusetts-earthquakes/.

[92] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

[93] "New York Earthquakes," NESEC.org, Northeast States Emergency Consortium, accessed May 28, 2025, https://nesec.org/new-york-earthquakes/.

The Weston Observatory utilizes two scales to track the magnitude of earthquakes. One of these scales is the Nuttli magnitude (Mn) for North America east of the Rocky Mountains. Weston Observatory also utilizes the Coda Duration magnitude (Mc) scale, which is based on the duration of shaking at a particular station. The Coda Duration magnitude can quickly estimate the magnitude of an earthquake before its exact location is known.

The following earthquakes with a magnitude of over 2.0 on either the Nuttli magnitude or Coda Duration magnitude scales have been recorded at the Weston Observatory since 2018:

- 12/21/2018 – 3 km WSW of Gardner, 2.1/2.1 [Mn*/Mc**]
- 8/21/2019 – 2 km SSE of Wareham, 1.7/2.4
- 12/3/2019 – 4 km SSE of Plymouth, 1.6/2.2
- 11/8/2020 – 11 km SW of New Bedford, 3.8/3.4
- 11/22/2020 – 12 km WSW of New Bedford, 1.7/2.6
- 07/25/2021 – 5.0km W OF PEABODY 1.4/2.5 [Mn*/Mc**]
- 01/01/2022 – 13.0km N OF ROCKPORT 2.3/3.0
- 03/04/2022 – 5.0km WSW OF ORANGE 2.2/2.7
- 11/10/2022 – 12.0km NW OF NANTUCKET 2.6/3.0
- 11/13/2023 – 208.0km E OF CHATHAM 2.8/3.3
- 12/26/2023 – 52.0km ENE OF ROCKPORT 2.2/2.8
- 03/11/2024 – 6.0KM E OF LAWRENCE 1.1/2.1

  *Mn is the Nuttli Magnitude (see below)

  **Mc is the Coda Duration Magnitude (see below)

Each of these earthquakes are minor. Additionally, earthquakes with a magnitude of about 2.0 or less are usually called "microearthquakes" and are generally only recorded locally.

On August 23, 2011, an earthquake measuring 5.8 on the Richter scale centered in Virginia was felt in much of the northeast, but this earthquake was not felt in Princeton according to the local HMP planning team.[94]

Probability of Future Events

The 2023 ResilientMass Plan notes that "The probability of a magnitude 5.0 or greater earthquake centered in New England in a 10-year period is about 10–15%."[95] Additionally, this plan notes that while Massachusetts is not near any tectonic plate boundaries, it is still susceptible to earthquakes on the North American Plate. Earthquakes elsewhere could also have secondary effects on the state and the region, such as potentially disrupting supply chains.

Based upon existing records, there is "very low" frequency (less than 1 percent probability in any given year) of damaging earthquakes in Princeton.

[94] Northeast States Emergency Consortium and John E. Ebel, PhD. Boston College, Weston Observatory, "Massachusetts Earthquakes," NESEC.org.

[95] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," page 5.1-42.

IMPACT

Massachusetts introduced earthquake design requirements into its state building code in 1975 and improved its state building code for seismic resilience in the 1980s. However, these specifications apply only to new buildings or to extensively modified existing buildings. Buildings, bridges, water supply lines, and electrical power lines and facilities built before the 1980s may not be 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 52.1% of the Town's 1,409 total housing units, according to 2022 American Community Survey 5-year estimates, were constructed in 1979 or earlier.[96] Seismic standards in Massachusetts were upgraded with the 1997 revision of the state building code. Despite its fairly old housing stock, Princeton faces a "minor" impact from earthquakes, with damage to less than 10% of property in town likely to occur in the event of an earthquake due to the extreme rarity of damaging events.

HAZUS-MH (multiple-hazards) is a computer program developed by FEMA which estimates losses due to a variety of natural hazards. The HAZUS earthquake module allows users to define an earthquake magnitude and model the potential damage caused by that earthquake as if its epicenter is 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 earthquake occurred in the region in 1963.

Table 27: HAZUS Potential Damages from a Magnitude 5.0 Earthquake with an Epicenter in Princeton

	Magnitude 5.0
Building Characteristics	
Estimated total number of buildings	5,155
Estimated total building replacement value (2024 $)	$ 3,604,000,000.00
Building Damages	
# of buildings sustaining slight damage	395
# of buildings sustaining moderate damage	187
# of buildings sustaining extensive damage	34
# of buildings completely damaged	6
Population Needs	
# of households displaced	5
# of people seeking public shelter	2
Debris	
Building debris generated (tons)	5,000
# of truckloads to clear debris (@ 25 tons/truck)	200

[96] "DP04: Selected Housing Characteristics," Data.Census.gov

Value of Damages (dollars)	
Total property damage	$68,867,700.00
Total losses due to business interruption	$6,684,900.00

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

Exposure

Certain features within Princeton's 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 are documented in the list of critical facilities and vulnerable populations in Section 3. These features include:

- Older buildings constructed prior to the first edition of the Massachusetts State Building Code.

Potential Climate Change Effects

The 2023 ResilientMass Plan identifies no climate change effects that pertain to earthquake hazards.[97]

Vulnerability

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

Mitigation Strategies

The Town of Princeton is currently able to effectively respond to earthquakes through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities for the Town to expand its existing capabilities to mitigate and respond to earthquakes. The local HMP planning team identified the following strategies that could be used to reduce the impact of earthquakes in Princeton:

- Retrofit municipal facilities to improve / strengthen resiliency to natural hazards (including earthquakes) and increase energy efficiency.
- Pre- and post-earthquake safety measure education to residents.
- Inventory unreinforced masonry and brick buildings in town may be vulnerable to earthquakes. Conduct a study which identifies ways that these buildings can meet the Massachusetts State Building Code's seismic standards.

[97] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

4.9 Dam Failure

Dams and their associated impoundments provide many benefits, such as water supply, recreation, hydroelectric power generation, and flood control, to communities. However, dams also pose a risk to lives and property in cases in which they fail. 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 overtop and erode the material components of the dam. Other dam failures are caused by foundation defects, inadequate maintenance, internal erosion caused by seepage, and other specific causes.[98] Dam failures may be influenced by storm floodwaters, but most dam failures are caused by structural, mechanical, or hydraulic failures.[99] Dam breaches can lead to catastrophic consequences; they cause water to rush in a torrent downstream, flooding an area engineers refer to as an "inundation area." The number of casualties and the amount of property damage resulting from a dam failure 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 are more vulnerable to failing because of structural problems caused by their age and/or lack of proper maintenance, as well as due to structural damage caused by an earthquake or flooding. The Massachusetts Department of Conservation and Recreation (DCR) 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).[100] Dams that are in excess of 6 feet in height (regardless of storage capacity) and that have more than 15 acre-feet of storage capacity (regardless of height) are under DCR regulation. 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 eight dams in Princeton. Of these dams, two are ranked as Significant Hazard and two are ranked as Low Hazard. The local HMP planning team identified concerns with the Bickford Pond Dam (MA01021) in Hubbardston that is owned by the City of Fitchburg. Bickford Pond Dam is a High Hazard dam that would affect the Town of Princeton because it would cause issues in the western part of town near Old Colony Road (Route 62). Dams within and/or owned by Princeton are listed below and are mapped in Appendix A:

[98] Association of State Dam Safety Officials. (n.d.). Dam Failures and Incidents. Association of State Dam Safety Officials, accessed May 28, 2025, from https://damsafety.org/dam-failures

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

[100] "Section 44: Definitions applicable to Secs. 44 to 48B," MAlegislature.gov, The 193rd General Court of the Commonwealth of Massachusetts, accessed May 28, 2025, https://malegislature.gov/Laws/GeneralLaws/PartIII/TitleIV/Chapter253/Section44; "302 CMR 10.00: Dam safety," Mass.gov, The Commonwealth of Massachusetts, Massachusetts Court System, February 10, 2017, https://www.mass.gov/regulations/302-CMR-1000-dam-safety#:~:text=302%20CMR%2010.00%20provides%20regulatory%20guidelines%20for%20the,public%20review%20of%20the%20performance%20of%20a%20dam.

Table 28: Dams Within and/or Owned by Princeton

National ID	Dam Name	Owner	Regulatory Authority	Hazard Code	Notes
MA0252	Echo Lake Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	Significant Hazard	This dam has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.
MA0318	Paradise Pond Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	Significant Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA0286	Tenny's Pond Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	Low Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is extremely close to the 1% flood zone.
MA0286	Tenny's Pond Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	Low Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone and is close to a locally identified flooding hazard. This dam is being rebuilt; the design process for this rebuilding is currently underway.
MA0177	Guest Pond Dam	Private	Non-Jurisdictional – Other	N/A	There are concerns that this dam may fail.
MA0177	Speckman Pond Dam	Private	Non-Jurisdictional – Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA0233	Pool Dam	Public – Town of Princeton	Office of Dam Safety	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.

National ID	Dam Name	Owner	Regulatory Authority	Hazard Code	Notes
MA0286	Glockner's Pond Dam	Public – Town of Princeton	Office of Dam Safety	N/A	This dam has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.
MA01021	Bickford Pond Dam (Hubbardston)	City of Fitchburg	Office of Dam Safety	High	The local Planning team identified this dam as being of concern to the town should it fail.

Inundation areas for these dams within Princeton cover less than 10% of the town, or a "small" portion of its area.

Extent

As stated in the introduction to this dam failure section, dam or levee breaches often lead to catastrophic consequences; water released by a breach 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 which a dam failure causes 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:

1. 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.
2. 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.
3. 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 Princeton. The local team noted a partial failure of the Echo Lake Dam that has since been remediated.

Probability of Future Events

The probability of future dam failure events in Princeton is "very low," with a less than 1% chance of a dam in town failing in any given year.

Impact

The town faces a "limited impact" from the failure of dams, with 10% to 25% of property in the affected area of town likely to see damage in the case of a dam failure event.

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 likely be geographically limited to portions of the dam's inundation zone. The geographic areas included in dam inundation zones may change with future improvements to dam breach modeling software which are being developed and are currently in early trial stages, such as the DSS-WISE™ (Decision Support System for Water Infrastructural Security) program.[101]

Exposure

Certain features within Princeton's infrastructure, society, and environment may face more exposure to dam failures, 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. These features include:

- Structures located within the inundation areas of Significant and High Hazard Dams;
- Downstream waterway infrastructure; and
- Poorly maintained or inspected dam infrastructure held in public or private hands.

Potential Climate Change Effects

Intensified and more frequent flooding caused by climate change can increase dam failure risk. Flooding can cause dam failure through overtopping; Overtopping occurs when floodwaters flowing into a dammed body of water exceed the spillway capacity of the dam and cause water to flow over the top of the dam. If the water flowing over the dam erodes the dam, then a dam failure can occur. Therefore, the risk of dam failure may be indirectly impacted by climate change through intensified flooding.

Vulnerability

Based on a mostly qualitative assessment, Princeton has a hazard index rating of "4 – low risk" from dam failure. There are dams that could affect some of the more low lying areas of town, however most of the town is built at a higher elevation.

Mitigation Strategies

The Town of Princeton is currently able to effectively respond to dam failure through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities for the Town to expand its existing capabilities to mitigate and respond to dam failures. The local HMP planning team identified the following strategies that could be used to reduce the threat of dam failure in Princeton:

- Coordinate with dam owners to ensure that dam EAPs are updated regularly and that issues with maintenance are addressed.
- Pass Community Preservation Act Adoption within the town to establish funding source for land conservation and acquisition in Princeton

[101] "About DSS-WISE™ Web," Dsswiseweb.ncche.olemiss.edu, University of Mississippi, accessed June 10, 2024, https://dsswiseweb.ncche.olemiss.edu/userpages/about.php.

4.10 DROUGHT

Drought is a normal and recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. Drought is a lack of precipitation over an extended period of time which results in a prolonged water shortage for some activity, group, or environmental sector. The direct impacts of droughts include reduced crop yields; reduced rangeland and forest productivity; increased fire hazards; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat. Drought 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 within Princeton of this hazard is "large."

EXTENT

The National Drought Mitigation Center records information on historical drought occurrences. Unfortunately, drought data are only available at the state and county levels and not at the local level. The National Drought Mitigation Center categorizes drought severity on a D0-D4 scale as is shown below.

Table 29: National Drought Mitigation Center D0-D4 Scale[102]

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

PREVIOUS OCCURRENCES

In Massachusetts, five statewide extreme droughts have occurred since 1930. These historic major droughts range in severity and in length, lasting from three to nine years. During many of these droughts, water supply systems around the state were found to be inadequate; At the times of these droughts, water was piped into urban areas, and water-supply systems were modified to permit withdrawals at lower water levels. Princeton area has been spared the most severe impacts in each of these droughts according to the information for Massachusetts included in the

[102] "Drought Classification," Droughtmonitor.unl.edu, National Drought Mitigation Center, University of Nebraska-Lincoln, accessed May 28, 2025, https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx.

USGS Water Supply Paper #2375.[103]

The following table shows peak drought severity data in Massachusetts from the National Drought Mitigation Center for each year since 2000:

Table 30: Peak Drought Severity Data in Massachusetts Per Year Since 2000[104]

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
2022	D3 conditions in 70% of the state
2023	D1 conditions in 0.4% of the state
2024 (through late November)	D3 conditions in 47% of the state

The following table shows peak drought severity data in Worcester County from the National

[103] Richard W. Paulson et al., "National Water Summary 1988-89 – Hydrologic Events and Floods and Droughts," *United States Geological Survey Numbered Series Water Supply Paper,* no. 2375 (1991), https://doi.org/10.3133/wsp2375, page 333.

[104] "Statistics by Threshold," Droughtmonitor.unl.edu, National Drought Mitigation Center, University of Nebraska-Lincoln, accessed May 28, 2025, https://droughtmonitor.unl.edu/DmData/DataDownload/StatisticsbyThreshold.aspx.

Drought Mitigation Center for each year since 2018:

Table 31: Peak Drought Severity Data in Worcester County Per Year Since 2018[105]

Year	Maximum Severity
2018	D1 conditions in 33% of Worcester County
2019	D0 conditions in 100% of Worcester County
2020	D3 conditions in 14% of Worcester County
2021	D1 conditions in 51% of Worcester County
2022	D3 conditions in 53% of Worcester County
2023	D0 conditions in 74% of Worcester County
2024 (through late November)	D3 conditions in 51% of Worcester County

In Princeton, there have been no recorded drought events with substantial impacts in recent decades.

At the time of the writing of this plan, the Town of Princeton and large portions of Massachusetts were recently in critical drought conditions; since August 2024, all regions of the state except for the Cape and Islands have seen a rainfall deficit of 8 to 11 inches.[106]

Probability of Future Events

In Princeton, as in the rest of the state, the probability of extreme and exceptional droughts is "low" (a 1% to 10% chance in the next year). Based on past events and current criteria outlined in the Massachusetts Drought Management Plan, Central Massachusetts may be slightly more vulnerable than parts of eastern Massachusetts to severe drought conditions.[107] However, many factors such as water supply sources, population, economic factors (i.e., if an area has an agriculture-based economy), and infrastructure may affect the severity and length of a drought event in different parts of the state.

The long-term risk of drought, including extreme and exceptional drought, may increase in Princeton due to climate change influences. Specifically, climate change may cause an increase in consecutive dry days over time.

Impact

The specific impacts of historical droughts in Massachusetts are categorized by the National Drought Mitigation Center in Table 32 below:

[105] Ibid.
[106] "Drought Management in Massachusetts," Mass.gov, Massachusetts Executive Office of Energy and Environmental Affairs Drought Management Task Force, December 9, 2024, https://www.mass.gov/guides/drought-management-in-massachusetts.
[107] "Massachusetts Drought Management Plan," Mass.gov, Massachusetts Executive Office of Energy and Environmental Affairs and Massachusetts Emergency Management Agency, December 2023, https://www.mass.gov/doc/massachusetts-drought-management-plan/download.

Table 32: Historic Impacts of Drought in Massachusetts[108]

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
	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 2023 ResilientMass plan notes that while drought is a naturally occurring climate phenomenon, its impacts can be exacerbated by human behavior.[109] The volume and rate of groundwater withdrawn from underground aquifers can impact the amount of water that flows through surface water bodies; therefore, high rates of groundwater withdraw can negatively impact aquatic ecosystems. Additionally, more impervious surface coverage, and some forms of stormwater infrastructure, can prevent the natural infiltration of precipitation into groundwater and can therefore exacerbate drought.[110]

The town is almost entirely on private well water, with all residents' water coming from private wells. Subsequently, a drought of significant magnitude as to lower the water table would effect residents greatly.

[108] "State Impacts," Droughtmonitor.unl.edu, National Drought Mitigation Center, University of Nebraska-Lincoln, accessed June 10, 2024, https://droughtmonitor.unl.edu/DmData/StateImpacts.aspx.
[109] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"
[110] Ibid.

Exposure

Certain features within Princeton's infrastructure, society, and environment may face more exposure to drought, 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. These features include:

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

The cost of re-drilling private wells due to drought impacts could also negatively affect residents in town. Other factors like PFAS contamination of water sources could compound drought-related water supply challenges. The local planning team did note that PFAS contaminated wells are a concern in town, including at a town cistern that had to be capped and no longer used.
The Town of Princeton is uniquely exposed to risk from drought due to the town not having a water system. This included private residents (all of whom are on well water) and the town's fire hydrants, which draft either from cisterns or fire ponds in the community. Additionally, due to the sparse development and the geography of the town, fire hydrants and draft sites are few and far between, necessitating the use of water tenders in harder to reach areas. While the threat of wildfire is documented earlier in this plan, it bears mentioning again as drought exacerbates the fire risk. The local planning team noted that the town does not have many water sources to draft from in the event of a fire and a significant drought could reduce that even further.

Potential Climate Change Effects

According to the 2023 ResilientMass Plan, there are two major ways that climate change influences drought frequency and severity.[111]

- 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 becoming less frequent yet more extreme when it does occur.
- Rising temperatures and changes in precipitation patterns will reduce snowpack and hasten snowmelt and therefore can exacerbate drought. The process of reduced snowmelt can result in less snowmelt recharge of groundwater, less snowmelt feeding stream flows, and less snowmelt available as an agricultural water source.

In summary, climate change is likely to increase the frequency and extent of drought in Massachusetts. Drought that is worsened by climate change can have numerous community-wide implications in Princeton. Due to the impacts of drought on crop yield, land use designated for farming could be altered or reduced. In addition, drought is predicted to worsen significantly in other parts of the country, particularly in the southwestern United States, and it is possible that this could result in people from other parts of the country moving to the northeast, including to Princeton.

Vulnerability

Based on the above assessment, Princeton has a hazard index rating of "2 – high risk" from

[111] Ibid.

drought.

MITIGATION STRATEGIES

The Town of Princeton is currently able to effectively respond to drought through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities for the Town to expand its existing capabilities to mitigate and respond to drought. The local HMP planning team identified the following strategies that could be used to reduce the threat of drought in Princeton:

- Build a water use dashboard for the Town and Fire Dept. websites, spearheaded by the Princeton Environmental Action Committee (EAC). The Fall 2024 drought led to low water levels across the region. Enhance the provision of information to residents and businesses on conserving water through reduction in use, low-impact landscaping, and other low-cost measures; in part, an impetus for this strategy is to conserve water for firefighting.
- Conduct enhanced enforcement of water usage restrictions (in part to conserve water for firefighting).

4.11 Extreme Temperatures

The 2023 ResilientMass Plan states that there are no universal definitions of "extreme heat," "extreme cold," or "extreme temperatures"; these terms are relative terms whose meaning depends on the normal average temperatures and climatic highs and lows in a region.[112] Extreme heat in Massachusetts is typically defined as a period of three or more consecutive days with temperatures above 90 °F.[113] Extreme heat may also refer to any prolonged period of especially hot weather (which is called a heat wave) which may also be accompanied by high humidity. Extreme cold, like extreme heat, is a dangerous situation that can result in health emergencies for susceptible people. People without shelter, who are stranded, or who live in homes that are poorly insulated or are without heat and/or air conditioning are especially at risk to extreme temperatures.

For Massachusetts, extreme temperatures can be defined as those that are far outside the normal ranges. Normal temperatures within the period ranging from 1991-2020 for the area near Princeton are:

Table 33: Normal Temperatures in the Period Between 1991-2020 in the Area Near Princeton[114]

	July (Hottest Month)	January (Coldest Month)
Average High (°F)	79.8°	32.3°
Average Low (°F)	61.7°	17.1°

The National Weather Service's (NWS's) specific criteria for issuing extreme heat and extreme cold watches, warnings, and advisories are described in the Extent section below.

Location

Princeton's elevation extremes do create some variance in temperatures, with the overall average trending colder as the town's elevation on average is 915 ft above sea level, with the elevations of the following points all exceeding that average:

- 1,175 feet (on the Town Common)
- 1,093 feet (Savage Hill)
- 1,312 feet (Brown Hill)
- 1,468 feet (Pine Hill)
- 1,559 feet (Little Wachusett)
- 2,006 feet (Wachusett Mountain)

Subsequently, the town more typically experiences extreme cold events rather than extreme heat events.

[112] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"
[113] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," pages 5.2-1-5.2-2.
[114] These temperature estimates are based on data recorded at a weather station at Worcester Regional Airport. "U.S. Climate Normals Quick Access," Ncei.noaa.gov, National Oceanic and Atmospheric Administration National Centers for Environmental Information, accessed September 25, 2024, https://www.ncei.noaa.gov/access/us-climate-normals/.

EXTENT

The NWS uses the heat index scale to categorize extremely hot temperatures. This scale combines relative humidity with actual air temperature to determine the risk to humans. 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 issues an Excessive Heat Warning when the daytime heat index is forecasted to reach 105°F for 2 or more hours. The NWS defines a Heat Wave as 3 or more days of greater than or equal to 90°F temperatures. The following chart indicates the relationship between heat index and relative humidity:

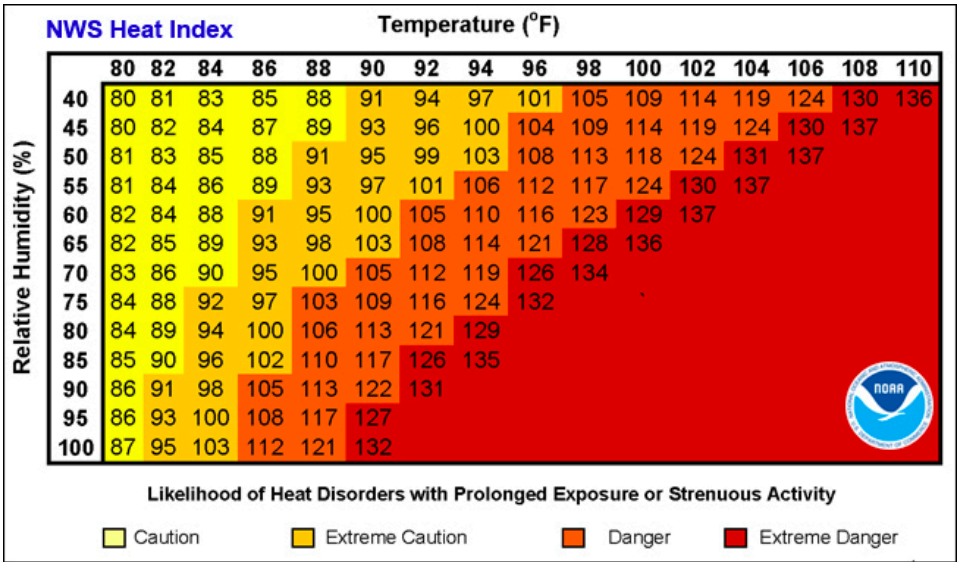

Figure 4: Heat Index[115]

Extreme heat causes more fatalities in the United States that all other weather-related natural hazards combined.[116] Extreme heat can be the underlying cause of death or can worsen other medical conditions like heart disease, hypertension, alcohol poisoning, and drug overdoses.[117] The heat-related mortality rate is higher among males and people aged 65 years and older.[118]

Table 34: Heat Effects on the Body lists the effects of extreme heat on 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 in the region to dangerous levels / temperatures above 100°F.

[115] National Weather Service, "What is the heat index?," Weather.gov, National Oceanic and Atmospheric Administration, accessed September 16, 2024, https://www.weather.gov/ama/heatindex.
[116] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,"
[117] Ambarish Vaidyanathan et al., "Heat-Related Deaths—United States, 2004–2018," *Morbidity and Mortality Weekly Report* 69, no. 24 (2020): 729-734. https://doi.org/10.15585/mmwr.mm6924a1.
[118] Ibid.

Table 34: Heat Effects on the Body[119]

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.[120] Prolonged heat can cause power use to spike and in turn can overload the electrical grid, causing outages.[121] Extreme heat and cold can both negatively impact transportation infrastructure; railroad tracks are a particular concern because metal rails can kink in high temperatures.[122]

The 2023 ResilientMass Plan notes that the extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature Index. The wind chill temperature is the temperature that people and animals feel when outside; it is based on the rate of heat loss from exposed skin due to the effects of wind and cold.[123] In Massachusetts, the National Weather Service (NWS) Norton Forecast Office issues a wind chill warning when the Wind Chill Temperature Index, based on sustained wind, is –25°F or lower for at least three hours. The NWS Wind Chill Chart below shows three shaded areas of combinations of wind and temperature conditions in which there is frostbite danger; each shaded area shows how long a person can be exposed before frostbite develops.

[119] National Weather Service, "What is the heat index?," Weather.gov, National Oceanic and Atmospheric Administration, accessed May 28, 2025, https://www.weather.gov/ama/heatindex.
[120] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,"
[121] Ibid.
[122] Ibid.
[123] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," pages 5.2-1-5.2-3.

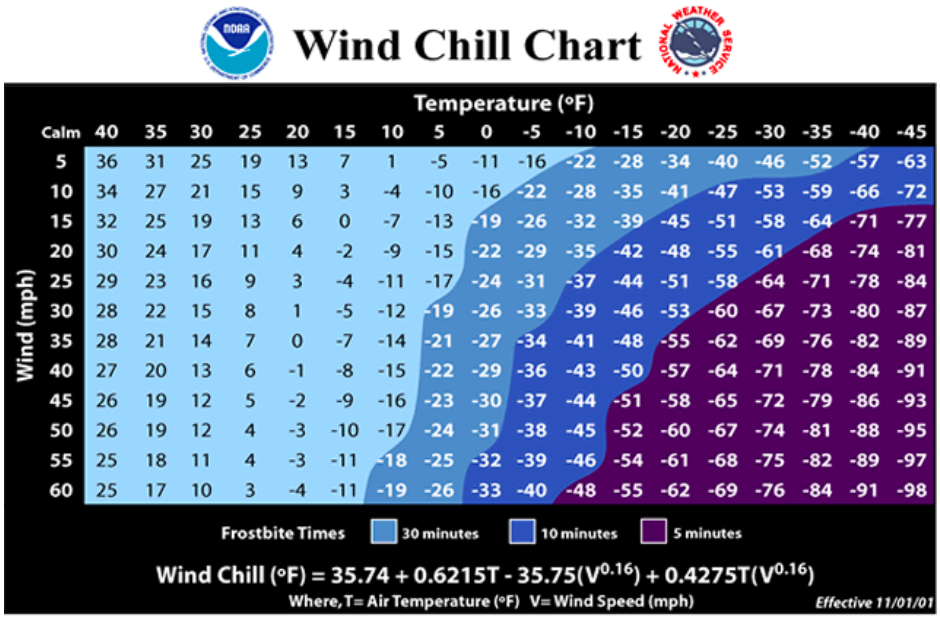

Figure 5: NWS Wind Chill Temperature (WCT) index.[124]

Cold temperatures are often combined with winter storms. People may experience the loss of heat and power in their homes and workplaces due to storm damage, which could further subject them to the cold.[125] Carbon monoxide poisoning is another risk during cold weather, especially when households lack adequate power or heat.[126]

Previous Occurrences

There is not a comprehensive data source that lists instances when the National Weather Service has issued extreme heat or cold warnings or advisories in Worcester County.

According to the 2023 Resilient Mass Plan, there have been 118 warm weather events (heat and excessive heat events) in the state between 1995 and 2022.[127] 2010–2022 had seven of the 10 warmest summers on record in the state.

2012 and 2013 were notably hot summers in Massachusetts[128] In July 2013, a long period of hot and humid weather occurred throughout New England. One fatality occurred on July 6, when a postal worker collapsed as the heat index reached 100°F.[129]

The hottest two summers on record in the Commonwealth were 2020 and 2022.[130] August 2022 was the hottest August ever recorded in the Commonwealth, with temperatures more than 6°F greater than the 20th century average. In August 2022, Boston experienced at least 17 days above 90 degrees, including two six-day heat waves.

[124] National Weather Service, "Understanding Wind Chill," Weather.gov, National Oceanic and Atmospheric Administration, accessed May 28, 2025, https://www.weather.gov/safety/cold-wind-chill-chart.
[125] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," pages 5.2-1-5.2-3.
[126] Ibid.
[127] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," pages 5.2-7-5.2-8.
[128] Ibid.
[129] Ibid.
[130] Ibid.

Statewide, there were 33 extreme cold weather events between 1994 and 2018. The NOAA Storm Events Database lists the following Extreme Cold / Wind Chill Events as having occurred in Worcester County since the last Princeton HMP was developed in 2016:[131]

- 01/06/2018: Strong west winds trailed the January 4 winter storm. These winds drew bitterly cold arctic air over Massachusetts. The combination of strong wind and low temperatures created a dangerous wind chill, with readings reaching 25 degrees below zero or colder in a couple of locations during the early mornings of January 6 and 7.
- 01/21/2019: Strong west to northwest winds trailing the January 20th storm drew cold air across Southern New England on January 21st and caused wind chill values of 25 below zero or colder in Central and Western Massachusetts. The wind diminished during the afternoon and evening of January 21st allowing wind chill values to become less extreme, in the teens below zero.

Inland portions of Massachusetts are more subject to extreme temperatures because they lack the moderating effect of the Atlantic Ocean. However, densely developed cities are more likely to be impacted by heat waves than smaller towns like Princeton.

Probability of Future Events

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

Impact

The impact of extreme heat or cold in Princeton is considered to be "minor," with no property damage and a limited effect on humans anticipated in the case of extreme temperature events.

Exposure

Certain features within Princeton's 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. These features include:

- Children and elderly residents, who are more vulnerable to the effects of extremely hot or cold conditions;
- Low-income residents who are unable to afford adequate cooling or heating;
- Renters who may have few home improvement options for mitigating extreme heat and cold;
- People who work outdoors such as construction or farm workers;

[131] "Storm Events Database Search Results for Worcester County, Massachusetts," NCDC.NOAA.gov, National Oceanic and Atmospheric Administration National Centers for Environmental Information, accessed September 17, 2024, https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Extreme+Cold%2FWind+Chill&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2018&endDate_mm=12&endDate_dd=31&endDate_yyyy=2024&county=WORCESTER%3A27&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=25%2CMASSACHUSETTS.

- The utility grid, which could be vulnerable to outages due to surges in power use during extreme temperatures. Power outages during extremely hot or cold days could cause further problems for people who rely on air conditioners or electric heaters; and
- Certain forms of agriculture which may be negatively affected by extreme temperatures, especially extreme heat.

The local planning team noted that the town's shelter infrastructure is currently insufficient for sheltering needs during extreme temperature events. May residents have wood stoves and generators for power outages, so the exposure would primarily be felt by the more vulnerable populations in town. The current town shelter, the Thomas Prince School, has a generator but lacks air conditioning and other shelter supply essentials.

Potential Climate Change Effects

According to the 2023 ResilientMass Plan, climate change is already causing more high heat days and fewer extreme cold events in Massachusetts and beyond.[132] Climate change is also shifting the average temperature in Massachusetts higher, leading to longer warm seasons as well as shifts to growing seasons, habitat and vegetation ecosystems, and migratory patterns. Rising temperatures will also cause warming seas, a degradation in air quality, impacts on people's health, and an increased demand for energy and government services. Secondary climate change effects of extreme temperatures include increased severity of wildfires, droughts, and flooding as well as encroachment by invasive species. According to the 2023 ResilientMass Plan:[133]

- By 2050, average annual temperatures are expected to increase by between 5.9° and 7.9°F. This is a drastically shortened timeline from the 2018 state hazard mitigation plan, where increases of this magnitude were not expected until the end of the century.
- By 2100, annual average temperatures are expected to increase by between 10.0° and 12.9°F compared to the 1971-2000 baseline.

According to the 2022 Massachusetts Climate Change assessment, by 2030, the summer mean temperature could increase by 3.6°F from the period between 1950 and 2013, worsening stress on electric transmission and utility distribution infrastructure.[134]

In summary, climate change is likely to increase the frequency and duration of extreme heat events in Massachusetts. Changes to average annual temperatures will also impact Princeton. Seasonal temperatures will shift, with spring and summer temperatures extending through more of the year.[135] Winters may also be milder than historical norms.[136] Changes to average temperatures could impact the agricultural industry and the natural environment. Farmers may need to shift their practices to account for new climate conditions, and certain specific plants and animals may need to migrate to new ranges to find suitable habitat.[137]

To respond to climate change-induced changes in temperatures, Princeton residents and businesses may have to alter work patterns during extreme heat days and events to reduce workplace injuries in vulnerable jobs such as construction trades and agricultural labor. The Town may have to plan to

[132] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"
[133] Ibid.
[134] "2022 Massachusetts Climate Change Assessment," page RS30.
[135] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"
[136] Ibid.
[137] Ibid.

offer more cooling stations for residents, particularly vulnerable populations such as the elderly and low-income residents. Princeton may also have to account for an increase in people moving to town and/or visiting town to seek refuge from extreme heat in other parts of the country.[138]

VULNERABILITY

Princeton's vulnerability to extreme heat and cold is considered to be "3 – moderate risk." While much of the town's population is resilient to extreme temperature events (and indeed the town's elevation makes it generally cooler than surrounding towns) the towns current shelters are inadequate to handle a serious influx of people needing shelter from extreme temperatures.

MITIGATION STRATEGIES

The Town of Princeton has identified the following opportunities to expand upon its existing capabilities to mitigate and respond to extreme temperatures. The local HMP planning team identified the following strategies that could be used to reduce the threat of extreme temperatures in Princeton:

- Incorporate low-impact development (LID) measures to reduce heat island impacts in town and deal with stormwater mitigation issues. For example, the town could install rain gardens and natural mitigation measure to reduce impacts from flooding and/or establish an tree and shrub planting program to address Heat Island Effect.
- Install air filters, cooling / central air conditioning, and/or dehumidification at emergency shelter locations to ensure the continued viability of shelters.

[138] Ibid.

4.12 Invasive Species

An invasive species, as defined by the Invasive Species Advisory Committee (ISAC) of the U.S. Department of the Interior, is "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health."[139] Invasive species are not the same as native pest species, such as beavers and deer. The State of Massachusetts, being heavily forested with relatively new growth forests, as well as having a great deal of its water sourced from open reservoirs, is vulnerable to the threat of both land and aquatic invasive species. Invasive species can damage and disrupt existing ecosystems by outcompeting the native flora and fauna: many invasive aquatic species harm water quality, and many land-borne invasive species increase the risk of wildfires. The effects of invasives are species-dependent, and a challenge for invasive species management is that many municipalities are affected by some invasive species but not others.

Location

Several invasive species affect broad regions of Massachusetts. The Emerald Ash Borer (*Agrilus planipennis*) has been detected in every city and town within the Central Region.[140] However, invasives and their effects can also be very species-dependent and localized, so invasive species hazards can also bear a resemblance to other more localized hazards such as localized flooding. Princeton's suburban development along with is geography lends itself towards being more vulnerable to invasives. Princeton is characterized by its mountainous terrain and uninterrupted forests interspersed with streams, and vulnerable to intrusion from both land based and aquatic invasives. More than 50% of the Town is vulnerable to invasives, so this hazard has a "large" geographic coverage in town.

Extent

It is difficult for local officials to understand the extent of the impact that invasive species have on their communities. Factors that lead to a dearth of knowledge about the extent of impacts of invasive species include: the unpredictable nature of invasives, the lack of verified data clearinghouses about invasive species, and the lack of resources and capacity for local conservation officials to track invasives. Often, it is not until the damage caused by invasives is apparent that local officials discover the true extent of the hazard. Still, there are some resources available to the local hazard mitigation planning team. This plan utilizes the Massachusetts Department of Agriculture's Invasive Pest Dashboard;[141] the Center for Invasive Species and Ecosystem Health's Early Detection and Distribution Mapping System (EDDMapS) hosted by the University of Georgia;[142] and the Forest Ecosystem Monitoring Cooperative's Northeastern Forest Health

[139] Definitions Subcommittee of the Invasive Species Advisory Committee (ISAC). "Invasive Species Definition Clarification and Guidance," Doi.gov, United States Department of the Interior, April 27, 2006, https://www.doi.gov/sites/doi.gov/files/uploads/isac_definitions_white_paper_rev.pdf.

[140] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," page 5.1-48.

[141] "MDAR Invasive Pest Dashboard," Experience.arcgis.com, Massachusetts Department of Agricultural Resources, accessed May 14, 2025, https://experience.arcgis.com/experience/a25afa4466a54313b21dd45abc34b62d/page/Page-2/?views=Town-by-Town.

[142] "My EDDMapS," EDDMapS.org, Center for Invasive Species and Ecosystem Health, accessed May 14, 2025, https://www.eddmaps.org/tools/query/index.cfm?observationDateStart=06/03/2017&observationDateEnd=06/03/2024&eradicationstatus=1,2&country=926&state=92625000&fipscode=92625027.

Atlas.[143]

In Worcester County from 2017 to 2024, according to EDDMaps analysis of verified invasive species reporting, there have been 378 records of locations with invasive species; In the county, 353 distinct sightings of invasive species ranging from plants to insects have been left unchecked, 2 invasive species are being treated, and a total of 47 acres are considered to be infested with invasive species.[144]

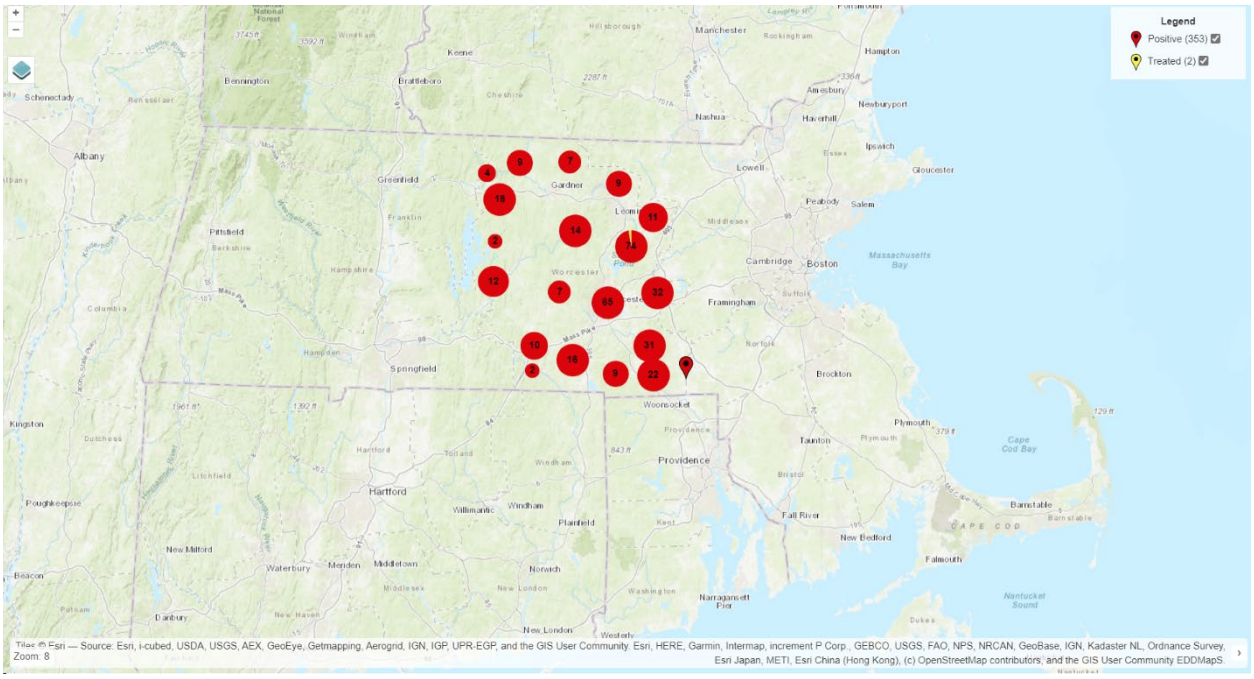

Figure 6: EDDMapS Analysis of Worcester County Invasives 2017-2024

The Massachusetts Department of Agriculture's Invasive Pests Dashboard notes that the Emerald Ash Borer was detected in Princeton in 2020 and Beech Leaf Disease was detected in town in 2023, which was corroborated by the local planning team Also, as of the time of writing of this plan, the entire state of Massachusetts is under a U.S. Department of Agriculture quarantine to restrict the spread of the Box Tree Moth. While not yet detected in town, Mile-a-Minute Vine has been detected in the nearby towns of Sterling and Holden.[145] The local planning team noted that phragmites incursion in wetland areas is becoming a problem.

A lack of reporting on invasives may mean that the extent of invasives in Princeton is far greater than these databases report.

Previous Occurrences

According to the Northeast Forest Health Atlas, in the past 20 years of reporting, Massachusetts

[143] "Northeastern Forest Health Atlas," UVM.edu, Forest Ecosystem Monitoring Cooperative, accessed June 10, 2024, https://www.uvm.edu/femc/forest-health-atlas.

[144]"My EDDMapS," EDDMapS.org.

[145] "MDAR Invasive Pest Dashboard: Emerald Ash Borer (*Agrilus planipennis*)," Experience.arcgis.com, Massachusetts Department of Agricultural Resources, June 10, 2024, https://experience.arcgis.com/experience/a25afa4466a54313b21dd45abc34b62d/page/Page-2/?views=Emerald-Ash-Borer#data_s=id%3AdataSource_3-17f4202b73c-layer-3%3A87.

has experienced tree damage (including defoliation and mortality events) to 43,127,411 acres of forests from a variety of invasive pests; alarmingly, the greatest proportion of this damage has occurred in the past 3 years.[146]

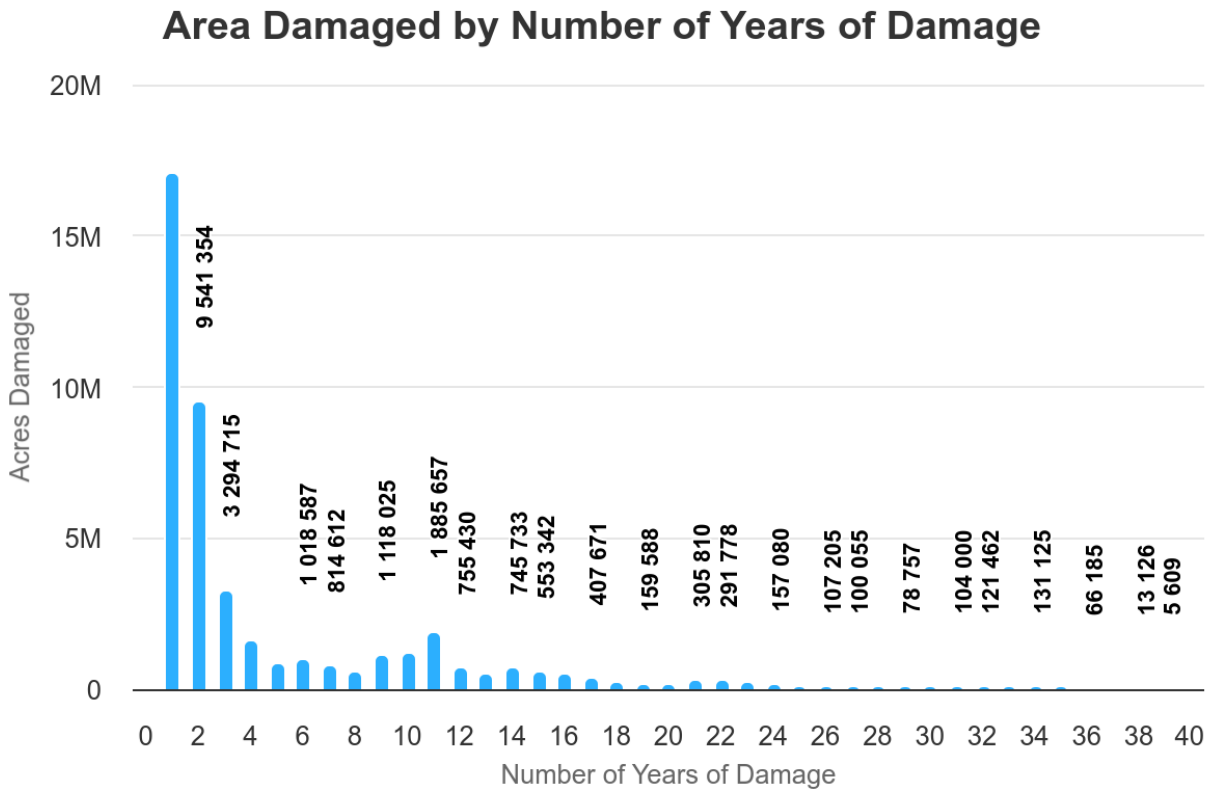

Figure 7: Area Damaged by Spongy Moth, Forest Tent Caterpillar, and Winter Moth from 1979 to 2019

In Worcester County, the vast majority of these invasive pest tree damage events occurred in the southern part of the county. Significant damage events have also occurred in the west and southwest of the county (near the border with Hampshire and Hamden Counties). In addition, localized defoliation events have occurred around the Town of Barre, the Tatnuck Neighborhood of Worcester, and other communities. Tree mortality correlated with invasive species has been concentrated in the southern half of Worcester County.[147] In 2008, an outbreak of Asian long-horned beetles in Worcester destroyed nearly 30,000 trees.[148]

Princeton has experienced invasives-related defoliation events from 1998 through 2020, with significant mortality events occurring in 2018, 2019, and 2020. Based on trends identified in the Atlas, there is no reason to assume that invasive forest species hazards have lessened in more recent years.

Probability of Future Events

The 2023 ResilientMass Plan notes that increased globalization of trade has created new paths for

[146] "Northeastern Forest Health Atlas - Defoliation: Years of Damage," UVM.edu, Forest Ecosystem Monitoring Cooperative, accessed June 10, 2024, https://www.uvm.edu/femc/forest-health-atlas?premade=All_Defo.
[147] Ibid.
[148] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

invasive species to spread. Climate change is also an aggravating factor in the spread of invasives, as natural ecosystems become strained by increased temperatures and shifting precipitation patterns; Climate change therefore creates more opportunities for invasives to disrupt an already fragile ecology. Based on the previously identified occurrences and trends, the probability of invasive species occurrences in Princeton is very high, with a 70% to 100% probability of occurrence in the next year.

Impact

Specific impacts of invasive species in Princeton may vary, depending on the type of invasive, the habitat that it is supplanting within the native ecosystem, and other factors. Invasive species' direct impact on the natural ecology has many notable secondary impacts. The 2023 ResilientMass plan identifies that invasive species can introduce new diseases to a region[149] (such as the 2005 Chikungunya Epidemic, spread in part by a viral mutation that allowed for the virus to be more commonly present in the *Aedes albopictus* mosquito, an invasive subspecies).[150] Invasives are also one of the costliest natural hazards in terms of control efforts, costing the United States and estimated $21 billion per year.[151] Given what information is known about the extent of invasive species within Princeton, the local HMP planning team estimates a "critical" impact on the town from invasive species, with between 25% and 50% of property in the areas affected by this hazard.

Exposure

Certain features within Princeton's infrastructure, society, and environment may face more exposure to invasive species, 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. These features include:

- People with compromised immune systems or preexisting health conditions, children under the age of five, and people over 65 years old who might be particularly vulnerable to new diseases or aggravated health problems caused by invasives;
- Roadways, as Japanese Knotweed, an invasive known to cause streambank destabilization, can contribute to flood damages and can affect sightlines along roadways, potentially causing roadway hazards;
- Local government, as invasive species may pose a management cost burden that exceeds local financial capacity, especially for departments tasked with their management and for departments tasked with the maintenance of facilities that are impacted by invasives;
- The local ecology, as invasive species can also change the local ecology to make it more fire prone, either by damaging the native plants or by being prone to fire themselves.

Potential Climate Change Effects

According to the 2023 ResilientMass Plan, climate change is predicted to increase the spread of

[149] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"
[150] Konstantin A. Tsetsarkin et al., "A single mutation in chikungunya virus affects vector specificity and epidemic potential," *PLOS Pathogens* 3, no. 12 (December 7, 2007): e201, https://doi.org/10.1371/journal.ppat.0030201.
[151] Kerry Sheridan, "Invasive species cost the US $21 billion per year, study finds," WUSF.org, WUSF Public Media, January 4, 2022, https://www.wusf.org/local-state/2022-01-04/invasive-species-cost-the-us-21-billion-per-year-study-finds.

invasive species and expand their range.[152] Already fragile ecosystems, if left unmanaged, will suffer the worst effects of invasive species; native flora and fauna species could be supplanted by invasive species that outperform or outright damage them. The vast majority of invasive species introductions are caused by human activity, either accidental or intentional.

Both changes in precipitation patterns and temperature may increase the chance of a successful invasion of ecosystems by non-native species.

1. Precipitation
    a. Elevated atmospheric CO2 concentrations could reduce the ability of ecosystems to recover from climate shocks; this can create an opportunity for invasive species, which can often rapidly establish themselves following a disturbance, to successfully propagate.
2. Temperature
    a. Climate-driven temperature changes exacerbate the impacts of invasive species by altering ecosystem conditions in ways that enhance their ability to reproduce, spread, and in some cases outcompete native species.
    b. As warmer temperatures place stress on native cold-weather species in the region, invasive species accustomed to higher temperatures are able to more easily fill native species' niches and therefore expand their habitat ranges northward.

Secondary hazard impacts from invasive species include increased temperatures, damage to agricultural crops, and increased wildfire risk; as described in previous sections, all of these hazard impacts have associated potential societal implications through population shifts and changes in land use and development.

VULNERABILITY

Based on the above assessment, Princeton has a hazard index rating of "3 – medium risk" from invasive species.

MITIGATION STRATEGIES

The Town of Princeton is currently able to effectively respond to invasive species through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, there are numerous opportunities for the Town to expand upon its existing capabilities to mitigate and respond to invasive species. The local HMP planning team identified the following strategies that could be used to reduce the threat of invasive species in Princeton:

- Increase public outreach and education around forest health impacts
- Write and implement a town-wide mosquito control plan based on natural solutions such as bat boxes and dragonfly gardens
- Write and implement a pest and landscape management plan to address invasive species and pest-borne illnesses.

[152] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

4.13 Other Hazards

In addition to the hazards identified in previous sections, the Princeton Hazard Mitigation Planning Team reviewed the other hazards listed in the Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP). Hazards from the SHMCAP deemed irrelevant to Princeton due to the town's location are coastal hazards, atmospheric hazards, ice jams, coastal erosion, sea level rise, and tsunamis. Coastal hazards, coastal erosion, sea level rise, and tsunamis are recognized to affect coastal jurisdictions in Massachusetts and other New England states but have been deemed irrelevant to Princeton due to the Town being around 50 miles from the nearest coastline.

Landslides

One other hazard discussed in the SHMCAP that can affect Princeton is landslides. Landslides occur in all U.S. states and territories. During 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 and thawing, and/or
- Steepening of slopes caused by natural erosion or human modification.

Debris and mud flows (landslides) 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 Princeton. The town, while notably hilly with a significant number of high-grade areas, is sparsely developed, with those high-grade areas typically being forested and at a reduced risk of landslide. Roadways in town are not generally built close to river channels; this reduces the risk from stormwater-induced bank erosion. Should a landslide occur in town in the future, the type and degree of impact would be highly localized. Vulnerabilities in town to landslides could include damage to structures, damage to transportation and other infrastructure, and localized road closures, though CMRPC's data review and the local HMP planning team both noted no specific concerns. Injuries and casualties, although possible, would be unlikely given the low extent and impact of landslides in Princeton. The local planning team noted that the town's primary concerns from landslides occur with new construction when this protective vegetation is removed. Otherwise, the planning team did not consider landslides to be a high enough concern to the town due to there being no historical record of them ever occurring in Princeton.

Landslides are therefore considered low frequency events that may occur once in 50 to 100 years (with a 1% to 2% chance of occurring per year) in Princeton.

Changes in Groundwater

Another hazard of concern that affects Princeton is changes in groundwater. This hazard was identified primarily through the community survey for this plan; common concerns among town

residents who responded to the survey included basement flooding from water as well as concerns regarding wells drying up in the future. While the 2023 ResilientMass Plan notes changes in groundwater as a specific hazard, our plan identifies it as being a secondary effect of drought and flooding.[153] While Princeton is more vulnerable to changes in groundwater that other towns in the region due to being entirely on private wells, the details of the Town's specific vulnerabilities to changes in groundwater are included in both the drought and flooding sections of this plan.

According to the 2023 ResilientMass Plan, climate change is predicted to affect groundwater availability; Sea level rise, extreme temperature events, changes in precipitation patterns, and the increased frequency and duration of drought conditions will all reduce the amount of available groundwater to the Town.[154]

[153] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," pages 5.1-34-5.1-35.
[154] Ibid.

5.0 EXISTING PROTECTION

Sections 5.0 and 5.1 help meet the following FEMA local mitigation plan requirements:

- *A4. "Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information?" (Requirement 44 CFR § 201.6(b)(3));*
- *B2. "Does the plan include a summary of the jurisdiction's vulnerability and the impacts on the community from the identified hazards? Does this summary also address NFIP-insured structures that have been repetitively damaged by floods?" (Requirement 44 CFR § 201.6(c)(2)(ii));*
- *C1. "Does the plan document each participant's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?" (Requirement 44 CFR § 201.6(c)(3)); and*
- *C2. "Does the plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate?" (Requirement 44 CFR § 201.6(c)(3)(ii))*

The Town of Princeton currently makes use of most of the available locally controlled tools, including zoning regulations, planning, and physical improvements, to help mitigate the consequences of natural hazards. The town does not participate in the federal StormReady certification or in the Federal Firewise Community certification. However, the town plans to research the utility of public awareness and education programs because of this planning process. The town currently utilizes CodeRed for emergency notifications.

Princeton has most of the no-cost or low-cost hazard mitigation capabilities in place. These include land use, zoning, and subdivision regulations as well as an array of specific policies and regulations that include hazard mitigation best practices, such as limitations on development in floodplains, tree maintenance, and other practices. Princeton also has appropriate staff dedicated to hazard mitigation-related work for a community of its size, including a Town Administrator, Fire Chief, Police Chief, as well as a Highway Department, Building Department, and a Tree Warden. Princeton has several plans relevant to hazard mitigation in place, including the Housing Production Plan (2023), Municipal Vulnerability Preparedness Plan (2021), Comprehensive Emergency Management Plan (2022), the Open Space and Recreation Plan (2020), and the Environmental Action Plan (2020). The town is currently updating the Master Plan. Not only do Princeton have these capabilities in place, but they are also deployed for hazard mitigation as is appropriate. The town also has committed volunteers who serve on boards, commissions, and committees as well as in other volunteer positions. The town collaborates closely with surrounding communities through its Local Emergency Planning Committee (LEPC) and has opted into fire protection and DPW mutual aid agreements through MEMA. Princeton is also an active member community of the Central Massachusetts Regional Planning Commission (CMRPC) and can take advantage of no-cost local planning assistance provided by the professional planning staff at CMRPC as needed.

The table below describes existing hazard mitigation protections in Princeton. It includes a brief description of each activity, a subjective evaluation of each activity's effectiveness, and a description of any recommendations for improvement for each activity.

5.1 Existing Protection Matrix

Table 35: Existing Protection Matrix

Existing Measure	Description	Action	Effectiveness & Recommendations
Stormwater Management Policy and Regulations	The town's Planning Board and Conservation Commission review projects for consistency with MA DEP standards. This helps ensure adequate on-site retention and recharge.	Princeton does not have a Stormwater Management and Erosion Control Bylaw, but the town does have an Earth Removal Bylaw, adopted in May 2015, included in the Town General Bylaw. Some stormwater considerations are included within the Zoning Bylaw. The town is presently developing a Special Flood Hazard District Bylaw and is considering a shared driveways bylaw that will incorporate stormwater management into the regulations. Princeton does not participate in the Central Mass Stormwater Coalition.	Somewhat Effective It is recommended that Princeton review and adopt the best practices for stormwater management, and/or adopt a Stormwater Management Policy or Bylaw, and/or join the Central Mass. Stormwater Coalition.

Existing Measure	Description	Action	Effectiveness & Recommendations
Open Space and Recreation Plan (OSRP)	Open Pace and Recreation Plan (2020) This local plan identifies significant natural resources to ensure their protection. Following Massachusetts Department of Conservation and Recreation (DCR) guidance for the development of OSRPs, this document does not focus on specific hazards. Open Space Plans can provide many tools. The Town must commit to making land acquisitions and regulatory changes which are included in this plan's action items. It also must give increased attention to preserving undeveloped flood-prone areas and associated lands.	Princeton's Open Space and Recreation Plan was recently updated in 2020, was approved by the Massachusetts Division of Conservation Services in 2022 and is valid through January 2028. It included recommendations to include hazard mitigation considerations in the Town's future actions.	Effective / Very effective Princeton should work to implement the strategies outlined in this plan as they related to hazard mitigation, expanding the town's overall resiliency to natural hazards

Existing Measure	Description	Action	Effectiveness & Recommendations
Master Plan	The master plan serves as a policy guide as well as the town's future vision of itself. It compiles a comprehensive analysis of all aspects of community development and is designed to be a resource for the town over the next 10 to 20-year time period.	The Princeton Master Plan was adopted in 2007. The Phase 1 update was completed in 2022; the town is in the process of completing the plan update. The town has a very active Master Plan Implementation Committee. Developers of new developments in town must provide a statement stating that each new development is in compliance with the Princeton Master Plan.	Very Effective In the future, the town should review the implementation of the Master Plan on a biannual basis instead of every four years. The town should continue to consider hazard mitigation concerns in master plan implementation.
Municipal Vulnerability Preparedness (MVP) Plan	This plan is a guide for climate resiliency implementation projects in town. It includes a vulnerability assessment and an action-oriented resiliency plan. This plan makes the town eligible for MVP Action Grant funding.	Princeton's Municipal Vulnerability Preparedness Plan was adopted in 2021. The town is in the initial phases of the MVP 2.0 Process which will update and review the town's resilience priorities and provide funding for a seed project in town. The town has already utilized this plan to seek funding for a community wildfire protection plan during the course of the writing of this plan.	Effective The town should incorporate its MVP Plan recommendations into its broader planning goals and objectives and continue to seek MVP Action Grant funding.

Existing Measure	Description	Action	Effectiveness & Recommendations
Princeton Environmental Action Plan	This plan provides a roadmap for the town of Princeton to perform environmental actions to increase the town's climate resilience.	The town adopted its Environmental Action Plan in 2020 as prepared by the town's Environmental Action Committee. This committee oversees a broad swath of municipal efforts around climate resiliency, including energy and transportation, waste materials management, natural systems and natural resources management, and land use. From this plan, the town was able to successfully seek a Green Communities Designation from the State of Massachusetts.	Effective This plan's recommendations and strategies should continue to be referenced, updated, and implemented by the town.
Light and Power Department Vegetation Management Plan	This plan details the town's tree trimming efforts to prevent future damages from ice storms and severe weather	PMLD's Vegetation management was Approved by the State Forester and augments the town's tree trimming program with additional setbacks around PMLD power infrastructure.	Effective PMLD should continue to partner with the town for local tree trimming measures as well as the removal of dead and dying trees and should enhance this partnership.

Existing Measure	Description	Action	Effectiveness & Recommendations
Local Conservation Commission Protecting Wetlands (Mass. Assoc. of Conservation Commissions, 2006 Data)	The Local Conservation Commission acts upon the state's Wetlands Protection Act and Regulations. This commission enacts regulatory oversight provisions for development within the jurisdictional buffer zone, increasing attention to alteration of wetlands and the opportunity to preserve capacity and quality.	Princeton has an active conservation commission but does not have a town-wide wetland bylaw in place. Some wetlands protections are included in the zoning bylaw.	Effective Although the Princeton Conservation Commission is upholding the state wetland regulations, Princeton should consider adopting a local, town-wide wetland bylaw to further protect itself from possible damaging construction and development. Princeton should also examine enhanced development controls at other wetlands to sustain natural barriers to flooding.
Drainage System Maintenance and Repair Program	This program keeps municipal drainage facilities (storm drains, culverts, etc.) in good order.	Princeton performs street sweeping and catch basin cleaning from April to November.	Effective Princeton should examine a public education program for residents on storm drain clearance and other best practices.
Tree Trimming Program	This program consists of the routine maintenance of trees and reduces the likelihood of vegetative debris problems during and after storm events.	Princeton conducts roadside mowing from April – November to remove juvenile trees. Tree trimming (take-downs and clearing dead branches) takes place as needed. The town has an annual tree trimming plan it follows	Effective Princeton should continue to partner with its utility for local tree trimming measures as well as the removal of dead and dying trees and should enhance this partnership.

Existing Measure	Description	Action	Effectiveness & Recommendations
Culvert Maintenance and Replacement Program	This program consists of regular maintenance of existing culverts and (in some cases) beaver controls as well as replacing and expanding culverts where needed to allow for adequate stormwater flow.	The town has historically maintained and replaced problem culverts when needed and as funding allows. Princeton will continue to seek grant funding for larger projects. Princeton is currently strengthening and systematizing its efforts to reduce the risk posed by problem culverts, seeking grant funding from various state and federal sources to address deficiencies	Effective Current efforts in town are limited by available resources. Culvert failures are repaired and replaced as warranted. A townwide culvert inventory completed in 2019 provides the location, size, and condition of the culverts in town. Princeton should enlarge infrastructure from culverts to drainage systems and continue to seek grant funding sources for larger projects.
Public Safety Answering Point (PSAP) Communications Participation with the Town of Holden	The town entered the Wachusett Regional Agreement with the Town of Holden to participate in a regional PSAP in 2013, located in Holden.	Police and Fire communications have set up on Mount Wachusett and are utilizing the communications infrastructure there for emergency services	Somewhat Effective Police communications have experienced significant issues with functionality on a fairly consistent basis, necessitating frequent trips to the site for repairs. Princeton has identified dead spots with police and fire communications. The current police repeater is located in a disadvantageous location on site and should be moved to a shared repeater with DCR/Fire. Princeton should consider moving to digital simulcast to reduce the effect of communication dead zones. Princeton has identified interoperability issues with HWY, Police, PLMD due to differences in transmitting on

			different frequencies, Princeton should consider switching to multiband radios town wide and across departments to address this interoperability deficiency.

6.0 Status of Mitigation Measures From 2016 Plan

Section 6.0 helps meet the following FEMA local mitigation plan requirements:

- *E2. "Was the plan revised to reflect changes in priorities and progress in local mitigation efforts?" (Requirement 44 CFR § 201.6(d)(3))*

During this hazard mitigation plan update process, the local HMP team in Princeton provided updates on the status of mitigation measures from the Town's 2016 Hazard Mitigation Plan. Certain measures were incomplete as of 2026 and were deemed as still being relevant; these relevant measures were re-incorporated in the 2026 Hazard Mitigation Plan action strategy if they are anticipated to be effective. The changes in the Town's priorities from the 2016 plan to this plan are noted in the **bolded** passages from the "2025 Notes" column in the table below. These changes in community priorities have resulted from reassessments of specific hazards-related challenges described in the 2016 plan.

Table 36: Status of Mitigation Measures from 2016 Plan

Structure & Infrastructure Strategies			
2016 Task	**2026 Status**	**2026 Notes**	**Include in 2026 Plan?**
Drainage and culvert upgrades at Hobbs Road. Regular flooding. Take advantage of the flooding in this area for Critical Infrastructure #18: Hobbs Road water hole; 2 PVC and steel hydrant.	In Progress	The state is working on this project. It was funded through a Small Bridge Grant. Construction is projected to begin in Summer 2025. The town has made temporary repairs in the meantime and also seeks to incorporate nature-based solutions.	YES
Drainage and culvert upgrades at Ball Hill Road, 5 sites. Regular flooding.	In Progress	The engineering design for Ball Hill Rd. was funded through the state Rural Development Fund in FY2025. The town will apply for construction funding in FY2026. The state may help with the other sites; each project side would take approximately 2 years.	YES
Drainage and road upgrades at Sterling Hill Road. Regular flooding, and street washes into roadway.	No movement on this action yet	Currently, there are no plans for repairs due to other infrastructure priorities. It is a possibility in 5 years. Sterling Hill is on the shelter route. Funding could come from the local operating budget or Chapter 90 funds. The town would like to include this item for future consideration.	YES

2016 Task	2026 Status	2026 Notes	Include in 2026 Plan?
Rebuild road at Calamint Hill. Steep road in poor condition has potential to wash out in heavy rains.	Completed	Full reconstruction (paving and drainage) work completed. Funding mostly came from Chapter 90 funds.	NO
Generator upgrade – Fire Station 2, Town EOC. Replace generator with adequate size and capabilities to run all electrical needs and emergency management operations.	Completed	The town completed these upgrades.	NO
Generator upgrade – Highway Department. Replace generator with adequate size and capabilities to run all electrical needs and emergency management operations.	In progress	The town noted this as a high priority. The building currently has a fuel pump supply system, and there is no generator for the fuel system. The rest of the generator is complete. This could be funded through ARPA, HMPG, BRIC, FMA, and various state funds.	YES
Water Hole storage and capacity upgrade. Worcester Road water hole in most immediate need, also most expensive to fix, at $18K.	In Progress	The town is working with engineers to survey existing water holes and create blueprints on water holes, as well as nearby septic infrastructure. Construction costs to replace the existing cistern and replace it with an underground tank downtown are likely in the $250-$300K range. The town wishes to pursue this strategy and adapt it to the new plan.	YES

2016 Task	2026 Status	2026 Notes	Include in 2026 Plan?
Water Hole storage and capacity upgrade. Identify locations and prioritize remaining water holes besides Worcester Road.	In Progress	This strategy will be rolled into an updated strategy as indicated above	NO
Light & Power Department Vegetation Management Plan Implementation. Plan approved by State Forester. Plan calls for five cycles; one every year. Plan covers whole town, clearing 10' back, then 20'. Town experienced prolonged power outages after 2008 ice storm.	In progress	Plan is currently operating on 4 cycles due to the past ice storm. This item is moved to existing protection measures.	NO
East Princeton Fire Station roof leak. Building doubles as EOC. Roof leaks and has other issues.	Complete	There was a total roof replacement in approximately 2018-2019. Princeton is currently looking into a new public safety complex.	NO
Upgrade Fire Stations to include bunking, cooking, which requires vehicle exhaust extrication. Town has not been able to obtain 250K Federal Fire Act Grant but continues to write it every year.	In progress	The vehicle exhaust project is complete. The remaining fire station upgrades are not complete, though the town has final design and bid docs for a new building. The town is still seeking funding for the project.	YES
Lightning rod protection at Public Safety Buildings required. Proper radio tower and equipment grounding to Motorola R-56 Standards also required. Two outdoor warning sirens at the Fire Stations have been struck by lightning in the past, and a member of the Fire Department was struck by lightning outside of the East Princeton Fire Station.	In progress	Design of the new lightning rods is complete at the downtown complex, but not at Station 2, as the town does not use the tower there.	YES

Preparedness, Coordination & Response Action Strategies			
2016 Task	**2026 Status**	**2026 Notes**	**Include in 2026 Plan?**
Investigate and adopt National Weather Service's Storm Ready Program	No movement on this action yet	The town has had other financial priorities and building capacity challenges. The town would like to implement an automated system compared to the current system.	YES
Work with the Department of Conservation and Recreation to maintain adequate fire roads to provide access to Leominster State Forest and Wachusett Mountain	Ongoing	DCR does the best they can; they post advisories for users in some spots. The town would like to establish regular contact with DCR about this.	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	Ongoing	This is moved to Existing Protection Measures. The town continues to participate.	NO
Investigate Community Rating System (CRS) benefits and requirements and decide whether to participate	Ongoing	The town is still considering the CRS.	YES
Road information coordination and planning for snow removal	Ongoing	The town is currently working on a snow plan and snow removal policy. There is a draft policy for large snowfalls and ice storms.	YES

2016 Task	2026 Status	2026 Notes	Include in 2026 Plan?
Evacuation Plan updates	In progress	CMRPC is building support for a regional evacuation plan for all communities in the CMRPC region, specifically to update plans and coordinate mass evacuations for (rare) events such as wildfires, landslides, etc.	YES

Education & Awareness Strategies			
2016 Task	**2026 Status**	**2026 Notes**	**Include in 2026 Plan?**
Generator usage education program. First responders had to educate residents during last ice storm.	No movement on this action yet	The town has not taken action on this item yet. The town would like to add safety information to the town website, as this can be very dangerous.	YES
Fire defensible space education system; school newsletters and public/community forums.	Ongoing	The town receives grants annually to host programs/community forums in the schools and for elderly populations. This item has been moved to Existing Protection Measures.	NO
Pre- and post-earthquake safety measures education for residents.	No movement on this action yet	Other hazards have taken higher priority in town, especially in light of the Fall 2024 drought and heightened wildfire risk. Therefore, the town seeks to wrap earthquake education into an all-hazards education and outreach program.	NO

Local Plan & Regulation Strategies			
2016 Task	**2026 Status**	**2026 Notes**	**Include in 2026 Plan?**
Local bylaws building upon the State's Wetlands Protection Act and Regulations. These add 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. Princeton should consider adopting local, town-wide wetland bylaws to further protect itself from possible damaging construction and development. Princeton should also examine enhanced development controls at other wetlands to sustain natural barriers to flooding.	Ongoing	This action has been ongoing. Though there are currently no new buildings constructed in floodplains, the town is still trying to update local bylaws.	YES
Stormwater management and erosion control bylaw. Princeton does not have a stormwater management or erosion control bylaw. Princeton does have an Earth Removal Bylaw, adopted in May 2015 included as Chapter XX in the Town's General Bylaws. Princeton does not participate in the Central Mass. Stormwater Coalition but should look into it.	In Progress	Princeton is in the process of developing these bylaws as well as a special flood hazard area bylaw and would like this plan to support that effort. Princeton will be keeping this strategy in the report.	YES
Princeton does not have a Floodplain Zoning District but should adopt one to hold all development and construction in floodplains accountable to state building code requirements.	In Progress	The town recently updated its site plan review requirements so that underground utilities are now required for new subdivisions and retrofits. Princeton is currently developing this bylaw and wish for it to be supported in this planning document.	YES

7.0 Mitigation Strategy

The Princeton 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 Priority and Impact

Section 7.1 helps meet the following FEMA local mitigation plan requirements:

- C5. "Does the plan contain an action plan that describes how the actions identified will be prioritized (including a cost-benefit review), implemented, and administered by each jurisdiction?" (Requirement 44 CFR § 201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

Real world considerations were brought into the analysis to inform the priority ranking process for the different mitigation strategies. 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. Each strategy was ranked as being high, medium, or low priority.

- High priority strategies 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 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 have relatively low mitigation impacts that do not necessarily justify their costs and may have difficulty being funded, being completed in a timely fashion, being administered effectively, and garnering local support.

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 political and/or public support which is shown through public feedback, prioritization in previous regional and local plans, initiatives that were locally initiated or adopted, and/or prioritization in the Municipal Vulnerability Preparedness Program Community Resilience Building workshop process.

Administrative burden – Strategies that are realistically within the administrative capacity of the Town and its available support network (CMRPC, local non-profit organizations, regional collaborative associations etc.) are prioritized. Grant application requirements, grant administrative requirements (including audit requirements), procurement, and staff time to oversee projects are all considered when figuring out the administrative burden of a strategy.

Impact – The HMP Core 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), and the geographic extent of each strategy's benefits (other factors being equal, a larger area equals higher impact).

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

7.2 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 cost estimate 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.). Strategies that already have secured funding are noted. Detailed and current cost estimates for strategies were generally not available, so costs are summarized within the following ranges:

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

7.3 Expected Timeline

Section 7.3 helps meet the following FEMA local mitigation plan requirements:

- *C5. "Does the plan contain an action plan that describes how the actions identified will be prioritized (including a cost-benefit review), implemented, and administered by each jurisdiction?" (Requirement 44 CFR § 201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))*

Each strategy is provided with an estimated length of time it will take for implementation. For strategies for which funding has been secured, a specific future timeline is provided for when completion is expected. However, most strategies 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. Each strategy has a timeframe of either a specified period of less than 5 years, a 5+ year timeframe, or an ongoing timeframe.

7.4 Strategy Types

Mitigation strategies included in this plan are subdivided into the following four broad categories which can help facilitate local implementation discussions, especially regarding budget considerations and staff roles/responsibilities:

Structure and Infrastructure Projects relate to constructing "brick & mortar" infrastructure and building improvements in order to eliminate or reduce hazard threats or in order to mitigate the impacts of hazards. Examples of this type of project 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. They integrate disaster prevention/mitigation and preparedness into every relevant aspect of town operations, including the operations of the Police Department, Fire Department, EMD, EMS, DPW, Planning Board, Conservation Commission and Selectboard; they also help the Town coordinate with neighboring communities where appropriate. Recommendations in this category often help standardize generally practiced activities.

Education and Awareness Programs help raise awareness of overall or hazard-specific risk and generate support for individual or community-wide efforts to reduce risk. Education and awareness seek to affect broad patterns of behavior. 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 propose updates to or formally update or establish local bylaws, ordinances and other regulations to protect vulnerable resources and prevent future natural hazard impacts on these resources. Local plans can also review the effectiveness of past mitigation projects, programs, procedures, and policies so that strategies for making them more effective in the future can be formed. An example of a project which fits under this category is incorporating mitigation planning into master plans, open space plans, capital improvement plans, facility plans, and other town plans.

Planning and regulatory activity tends to provide extraordinary benefits to towns 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 the benefits of planning. 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, the row for each strategy also identifies what hazard(s) the strategy is intended to address. Each row also identifies the lead organizations who serve as the primary points of contact for coordinating efforts associated with the corresponding strategy and identify potential funding sources for implementing the strategy.

7.5 Strategy Goals

Section 7.5 helps meet the following FEMA local mitigation plan requirements:

- *C3. "Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?" (Requirement 44 CFR § 201.6(c)(3)(i))*

For each of the strategy types included above, there is an associated mitigation goal. The goals are as follows:

Structure and Infrastructure Projects – Harden and adapt the Town's current infrastructure to withstand hazards in the near-term and the long-term, incorporating nature-based strategies whenever feasible and desirable to build a more resilient municipality.

Preparedness, Coordination and Response Actions – Improve the Town's emergency and municipal service capabilities to effectively respond to and recover from natural disasters, as well as to build and establish relationships with stakeholders to ensure the continuation of essential services in the event of a disaster.

Education and Awareness Programs – Educate and inform the public about the threats of natural hazards and climate change; provide the resources for individual and community preparedness and foster a whole community response to natural hazards and climate change.

Local Plans and Regulations – Adopt and approve plans and legislation that prioritize climate resiliency and hazard mitigation; incorporate principles of resiliency within local and regional planning and legislative actions.

7.6 Town of Princeton 2026 Hazard Mitigation Strategies

Section 7.6 helps meet the following FEMA local mitigation plan requirements:

- *C3. "Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?" (Requirement 44 CFR § 201.6(c)(3)(i));*
- *C4. "Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?" (Requirement 44 CFR § 201.6(c)(3)(ii));*
- *C5. "Does the plan contain an action plan that describes how the actions identified will be prioritized (including a cost-benefit review), implemented, and administered by each jurisdiction?" (Requirement 44 CFR § 201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii)); and*
- *D2. "Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a five-year cycle)?" (Requirement 44 CFR § 201.6(c)(4)(i))*

The Town has decided to prioritize the following mitigation strategies. The columns of the table below reflect the criteria described above. In the "Who (Agencies Involved)" column, the lead agencies for each strategy are **bolded**.

OVERALL GOAL: The overall goal of these mitigation strategies is to facilitate activity within the Town of Princeton that reduces the loss of people's lives, property in town, and environmental resources in town, as well as the risk of these losses in the case of natural hazard occurrences. Please view section 8.4, Potential Federal and State Funding sources, for more information on the funding sources listed below. The Executive Summary (p. 8) lists the most high-priority strategies.

Table 37: Town of Princeton 2026 Hazard Mitigation Strategies

Structure & Infrastructure Strategies							
Actions	**Hazards Addressed**	**Agencies Involved**	**Potential Funding Sources**	**Priority**	**Impact**	**Estimated Cost**	**Expected Timeline**
Drainage and culvert upgrades at Hobbs Road. Regular flooding. Take advantage of the flooding in this area for Critical Infrastructure #18: Hobbs Road water hole; 2 PVC and steel hydrant.	FL, SS, ST, HU	Highway Department	Local, Federal Grants (HMGP/PDM), State Grants (Various)	Medium	Medium	Low	3-5 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Drainage and culvert upgrades at Ball Hill Road, 5 sites. Regular flooding.	FL, SS, ST, HU	Highway	Local, Federal Grants (HMGP/PDM), State Grants (Various)	Medium	Medium	Low	3-5 years
Drainage and road upgrades at Sterling Hill. Regular flooding, and street washes into roadway.	FL, SS, ST, HU	Highway	Local, Federal Grants (HMGP/PDM), State Grants (Various)	Medium	Medium	Low	3-5 years
Cistern storage and capacity upgrade. Worcester Road Cistern is in most immediate need, but other cistern locations for wildland and interface firefighting operations will need to be identified and planned for in future wildfire protection planning documents	DR, WF	Fire Department, SB, DEP	Local, Federal Grants (HMGP/PDM), State Grants (Various)	High	High	Low	3-5 years
Pursue funding for a municipal public safety complex to house Fire, EMS and Police.	All	Local Emergency Management	Local, Federal Grants (HMGP/PDM), State Grants (Various)	High	High	High	Greater than 5 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Pursue funding for a municipal public safety facility to house Fire, EMS and Police.	All	Local Emergency Management	Local, Federal Grants (HMGP/PDM), State Grants (Various)	High	High	High	Greater than 5 years
Lightning rod protection at Public Safety Buildings and other town facilities required. Proper radio tower and equipment grounding to Motorola R-56 Standards are also required. Two outdoor warning sirens at the Fire Stations have been struck by lightning in the past, and a member of the Fire Department was struck by lightning outside of the East Princeton Fire Station. A lightning strike also made a Highway Department fuel pump inoperable.	All	Local Emergency Management	Local, Federal Grants (HMGP/PDM), State Grants (Various)	High	High	High	3-5 years
Create town-wide microgrid(s) by installing the following: solar canopy system(s) on municipal and/or school parking lots, brownfields, capped landfills, and closed fuel facilities, rooftop solar array(s) for municipal, public hospital, and/or public school building rooftops, and a battery storage substation which connects to the grid. These microgrids can increase the town's resiliency to storm events.	SS, ST, HU, WF	Regional School District, Municipal Government, MLP	Local (Town Meeting), State (MVP), Federal (BRIC)	Medium	High	High	1-2 Years
Incorporate low-impact development (LID) measures to reduce heat island impacts in town and deal with stormwater mitigation issues. For example, install rain gardens and natural mitigation measures to reduce impacts from flooding and/or establish an tree and shrub planting program to address Heat Island Effect.	FL, XT	Environmental Action Committee, CC	Local (Town Meeting), State (DEP funding, MVP Action Grant, DOER grants), Federal (FMA Grants)	Medium	High	Medium	1-2 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Retrofit municipal facilities to improve / strengthen resiliency to natural hazards and increase energy efficiency.	All	Environmental Action Committee, CC	Local (Town Meeting), State (DEP funding, MVP Action Grant, DOER grants, Green Communities)	High	Medium	High	3-5 years
Install traffic lights at major intersections to aid in mass evacuations. Princeton's main roads are evacuation routes for the Town as well as from the Boston area. The lack of traffic lights could cause confusion and traffic backup in the event of an evacuation.	All	Highway, Mass DOT, SB	State (Complete Streets), Federal (DOT Grants)	Medium	High	High	3-5 years
Install Lighted windsock for Station 2 to assist with life flight landings.	All	Fire, DPW	Local (Town Warrant)	Medium	Medium	Medium	1 year
Dredge fire ponds which are too shallow and dry out during the summer months. This would also help with stormwater collection and help prevent flooding in the area of the ponds.	WF, FL, ST	Fire, DPW	Federal (FEMA Assistance to Firefighters Grant, other FEMA Grants), State (EEA grants), Local (Town Warrent)	Medium	Medium	High	2-3 years
Establish power interconnections to ensure rapid reestablishment of power distribution following storm events.	ALL	PMLD	State (DOER Grants), Local (PMLD Operating Budget)	High	High	High	1-2 Years

Preparedness, Coordination & Response Action Strategies							
Actions	**Hazards Addressed**	**Agencies Involved**	**Potential Funding Sources**	**Priority**	**Impact**	**Estimated Cost**	**Expected Timeline**
Investigate and adopt National Weather Service's Storm Ready Program	All	Local Emergency Management	Local (General Operating Budget)	High	High	Medium	1 Year
Work with the Massachusetts Department of Conservation & Recreation to maintain adequate fire roads to provide access to Leominster State Forest and Wachusett Mountain	WF	Fire Department, Conservation Commission, DCR	Local (Trails Grant), State (MVP Action), Federal Grants (CWDG Program Through US Forest Service)	High	Medium	Low	1-2 Years then ongoing
Participate in the National Flood Insurance Program (NFIP) to become eligible for the Community Rating System (CRS).	FL, SS, ST, HU	Highway, Local Emergency Management, Planning	Local (General Operating Budget)	Low	Low	Low	1 year
Participation in a regional evacuation plan spearheaded by CMRPC, who looks to plan and coordinate the region's communities for rare events like landslides and wildfires	All	Local Emergency Management, Highway, CMRPC, MassDOT	Local, Federal Grants (Homeland Security Grant funding through EOPSS and CRHSAC)	High	High	Low	1-2 years
Update and implement a town-wide snow plan and snow removal policy, which should include coordination and planning steps for snow removal	SS	Highway, MassDOT, Mass State Police, Blackstone REPC	Local, Federal Grants (HMGP/PDM), State Grants (Various), Private Contracts	High	High	Low	1 year

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Install a heavy rescue communications center - command unit. Purchase a command vehicle with radios. These will help to coordinate communication with MEMA, Feds, DCR, Town, etc. in the event of an emergency.	All	Local Emergency Management, Fire, Police, CMRPC, MassDOT;	Local, Federal Grants (Homeland Security Grant funding through EOPSS and CRHSAC)	High	High	Medium	1-2 years
Install air filters, cooling / central air conditioning, and/or dehumidification at emergency shelter locations to ensure the continued viability of shelters.	All	Local Emergency Management, SB	Local, Federal Grants (HMGP/PDM), State Grants (Various), Private Contracts	High	Medium	Medium	1-2 years
Repair and establish Policies for use of town wide tornado warning sirens.	All	Fire Department, Local Emergency Management	Local (Town Meeting), State (MVP), Federal (Assistance to Firefighters Grants)	High	High	Low	1-2 Years
Coordinate with dam owners to ensure that dam EAPs are updated regularly and that issues with maintenance are addressed.	DF	Local Emergency Management	Local (Town Meeting), Federal Grants (HMGP/PDM), State Grants (MVP), Private Contracts	Medium	Medium	Low	1-2 Years

Education & Awareness Strategies							
Actions	**Hazards Addressed**	**Agencies Involved**	**Potential Funding Sources**	**Priority**	**Impact**	**Estimated Cost**	**Expected Timeline**
Generator usage education program. First responders had to educate residents during the last ice storm.	All	MLP	Local	High	Medium	Low	1-2 years
Fire defensible space education system; school newsletters and public/community forums.	WF	Fire & Police Departments	Local	Medium	Medium	Low	1-2 years
Pre- and post-earthquake safety measure education to residents.	EQ	Local Emergency Management	Local, State Grants (Various)	Low	Low	Low	1-2 years
Develop and implement a climate education awareness campaign, led by the Princeton Environmental Action Committee (EAC). Educate residents on the effects of climate change and how to prepare for hazards.	All	EAC	Local, State Grants (Various)	High	High	Low	1-2 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Build a water use dashboard for the Princton town and Princeton Fire Dept. websites, spearheaded by the Princeton Environmental Action Committee (EAC). The Fall 2024 drought led to low water levels across the region. Enhance the provision of information to residents and businesses on conserving water through reduction in use, low-impact landscaping, and other low-cost measures; in part, an impetus for this strategy is to conserve water for firefighting.	DR	EAC	Local, State Grants (Various)	High	High	Low	1-2 years
Educate the public about strategies for preventing basement flooding, such as with rain gardens or other nature-based and small-scale mitigation strategies.	FL	EAC	Local, State Grants (Various)	High	High	Low	1-2 years
Increase public outreach and education around forest health impacts	WF, IS	EAC	Local, State Grants (Various)	High	High	Low	1-2 years

Local Plan & Regulation Strategies							
Actions	**Hazards Addressed**	**Agencies Involved**	**Potential Funding Sources**	**Priority**	**Impact**	**Estimated Cost**	**Expected Timeline**
Local bylaws building upon the state's Wetlands Protection Act and Regulations. These add 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. Princeton should consider adopting a local, town-wide wetland bylaw to further protect itself from possible damaging construction and development. Princeton should also examine enhanced development controls at other wetlands to sustain natural barriers to flooding.	SS, ST, HU, FL	CC	Local, State Grants (Various)	Medium	Medium	Low	1-2 years
Stormwater management and erosion control bylaw. Princeton does not have a stormwater management or erosion control bylaw. Princeton does have an Earth Removal Bylaw, adopted in May 2015, included as Section XX in the Town General Bylaws. Princeton does not participate in the Central Mass Stormwater Coalition but should look into participating.	SS, ST, HU, FL	CC, Highway	Local, State Grants (Various)	Medium	Medium	Low	3-5 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Local bylaws concerning limitations or prohibition of building in 100-year floodplains (an area with a 1% chance of flooding in a given year). Princeton does not currently have a bylaw that limits or prohibits development in the 1% floodplain. Implementing a 100-year floodplain bylaw would enable the town to participate in the National Flood Insurance Program (NFIP), and subsequently the Community Rating System (CRS). Princeton can choose to implement either this action item or the item below (Floodplain Zoning District).	SS, ST, HU, FL	CC, Highway	Local, State Grants (various)	Medium	Medium	Low	1-2 years
Princeton does not have a Floodplain Zoning District but should adopt one to hold all development and construction in floodplains accountable to state building code requirements. Princeton can choose to implement either this action item or the item above (100-year floodplain).	SS, ST, HU, FL	CC, Highway, Building Department	Local, State Grants (Various)	Medium	Medium	Low	3-5 years
Write and implement a town-wide mosquito control plan based off natural solutions such as bat boxes and dragonfly gardens	IS	EAC	Local, State Grants (Various)	Medium	Medium	Low	1-2 years
Plan for assisting mobility-impaired residents with evacuations when a hazard occurs. Identify where these residents live and the best methods of communication in order to safely evacuate them to shelters and evacuation routes. Help with providing emergency medical equipment, prescriptions, and other necessities as well.	All	Local Emergency Management, Council on Aging	Local, State Grants (Various)	Medium	Medium	Low	1-2 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Write and implement a debris management plan. A previous ice storm resulted in branches, leaves, etc. blocking critical evacuation routes.	All	Emergency Management	Local, State Grants (Various)	Medium	Medium	Low	1-2 years
Write and implement a pest and landscape management plan to address invasive species and pest-borne illnesses.	IS	EAC, CC	Local, State Grants (Various)	Medium	Medium	Low	1-2 years
Write and implement a wildfire management plan for Wachusett Mountain and Leominster State Forest. There were concerns about wildfires and fuel load during the Fall 2024 drought. The town has begun the process of seeking funds for this plan.	DR, WF	Princeton Fire Department, DCR, Westminster Fire Department	State (MVP Action Grant)	High	High	Low	1-2 years
Explore land acquisition partnerships for conservation purposes.	FL	SB, CC, EAC	Local, State Grants (Various)	Low	Low	Low	1-2 years
Monitor implementation of the town's Hazard Mitigation Plan. On an annual basis and/or as hazards occur, review the mitigation strategies in the plan and assess implementation progress by holding a meeting of the Hazard Mitigation Planning Team.	ALL	Local Emergency Management	Local, State (DLTA, LPA)	High	High	Low	1-2 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Conduct enhanced enforcement of water usage restrictions (in part to conserve water for firefighting).	DR, WF	Fire, Local Emergency Management, SB	Local, State (DLTA, LPA)	High	High	Low	1-2 years
Participate in a region-wide Threat and Hazard Identification and Risk Assessment. Conduct region-wide capabilities gaps assessment in conjunction with the THIRA.	All	Fire, Local Emergency Management, SB	Local, State (DLTA, LPA)	Medium	High	Low	1-2 years
Participate in a region-wide risk analysis for all hazards to include in future updates to this HMP and other related plans. Address data deficiencies and improve analysis, when available, by partnering with federal, state, local, and other subject matter experts.	All	Fire, Local Emergency Management, SB	Local, State (DLTA, LPA)	Medium	High	Low	1-2 years
Develop an integrated Invasive Species Management and Emergency Response Plan for invasive pest and plant species as well as water invasives, including federally regulated species, that pose a significant risk to the Town.	IS	EAC, SB	Local, State (DLTA, LPA)	Medium	High	Low	1-2 years
Develop a Continuity of Government Plan for the town to ensure municipal government can provide the steps and processes needed to maintain critical services during and after an emergency in order to maintain minimum essential functions.	All	Fire, Local Emergency Management, SB	Local, State (DLTA, LPA)	Medium	High	Low	1-2 years

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Expected Timeline
Inventory unreinforced masonry and brick buildings in town which may be vulnerable to earthquakes. Conduct a study which identifies ways that these buildings can meet the Massachusetts State Building Code's seismic standards.	EQ	Highway, Local Emergency Management, SB	Local, State (DLTA, LPA)	Low	Medium	Low	1-2 years
Consider beaver removal strategies. Complete a beaver management plan.	FL, DF	**Highway**, CC	State (EEA grants), Local (general operating budget, town appropriations)	Low	Low	Low / Medium	3 years
Pass Community Preservation Act Adoption within the town to establish funding source for land conservation and acquisition in Princeton.	All	CC, SB	Local (General Operating Budget)	Medium	High	Low	1-2 Years

'Hazards Addressed' abbreviations:

DF	Dam Failure	DR	Drought
EQ	Earthquakes	FL	Flooding
HU	Hurricanes	IS	Invasive Species
OT	Other	SS	Severe Snowstorms / Ice Storms / Nor'easters
ST	Severe Thunderstorms / Wind / Tornadoes	WF	Wildfire / Brushfire
XT	Extreme Temperatures		

'Agencies Involved' abbreviations:

CMRPC	Central Mass. Regional Planning Commission	CC	Conservation Commission
SB	Selectboard	EMD	Emergency Management Director
PB	Planning Board	PSC	Public Safety Committee
ZBA	Zoning Board of Appeals	MLP	Municipal Light and Power
MassDOT	Massachusetts Department of Transportation	DCR	Massachusetts Department of Conservation and Recreation

8.0 Plan Adoption, Implementation, and Maintenance

8.1 Plan Adoption

A public meeting was held on Wednesday June 11th, 2025 as part of the Selectboard's meeting in order to detail the Princeton Hazard Mitigation Plan update process to that date and to solicit comments and feedback from the public and the Selectboard on the draft plan which was then being developed. The draft plan was provided to the Town for distribution and was posted on the Town's website for four weeks starting on June 12th, 2025 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 adopted by vote of the Princeton Selectboard and certified on April 1st, 2026.

8.2 Plan Implementation

Section 8.2 helps meet the following FEMA local mitigation plan requirements:

- *A4. "Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information?" (Requirement 44 CFR § 201.6(b)(3)); and*
- *E2. "Was the plan revised to reflect changes in priorities and progress in local mitigation efforts?" (Requirement 44 CFR § 201.6(d)(3)).*

The Town of Princeton has taken steps to implement findings from its 2016 Hazard Mitigation Plan into the following plans: the 2024 Ecotourism Economic Development Plan, the 2023 Housing Production Plan, the 2021 Municipal Vulnerability Preparedness Plan, the 2020 Open Space and Recreation Plan, the 2022 Comprehensive Emergency Management Plan, and the 2020 Environmental Action Plan. Findings from the 2026 Hazard Mitigation Plan update may be integrated into future iterations of all these plans as well as into zoning updates for the town, plans completed as part of the implementation of the town's Master Plan, and other planning mechanisms and documents.

The implementation of this 2026 plan update began upon its formal adoption by the Selectboard and approval by MEMA and FEMA. Town departments and boards responsible for ensuring the development of policies, ordinance revisions, and programs as described in Sections 6 and 7 of this plan will be notified of their responsibilities immediately following this plan's approval. The local Hazard Mitigation Team in town will oversee the implementation of this plan.

Incorporation with Other Planning Documents

Findings from the 2016 Princeton Hazard Mitigation Plan were incorporated into other planning mechanisms and policies in town besides this plan update, including the 2024 Ecotourism Economic Development Plan, the 2023 Housing Production Plan, the 2021 Municipal Vulnerability Preparedness Plan, the 2020 Open Space and Recreation Plan, the 2022 Comprehensive Emergency Management Plan, and the 2020 Environmental Action Plan. Existing plans, studies, reports, and municipal documents completed by and/or relating to the Town were also incorporated throughout this planning process. The following key documents were reviewed as part of the planning process, and information from these documents was incorporated into this plan update:

- ***Princeton's Comprehensive Emergency Management Plan*** (particularly the critical infrastructure section) – The critical infrastructure section of this plan 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 United States Department of Homeland Security via the Commonwealth of Massachusetts and the Central Region Homeland Security Advisory Council, this regional evacuation plan prepared by CMRPC helped identify evacuation routes and emergency shelters. This plan will soon be updated by CMRPC.
- ***Princeton Open Space and Recreation Plan*** – This plan was used to identify the natural context within which mitigation planning takes place; it proved useful for this planning process insofar as it identified water bodies, rivers, streams, infrastructure components (i.e., water and sewer, or the lack thereof), and population trends. This information was incorporated into this plan to ensure that the Town's mitigation efforts would be sensitive to the surrounding environment.[155]
- ***Princeton Zoning Bylaw*** – The Princeton Zoning Bylaw was used in this planning process to identify the actions that the town is already taking (such as creating wetlands and driveway bylaws, as well as researching floodplain bylaws) that reduce the potential impacts of a natural hazard and to make sure that this plan's mitigation strategies do not duplicate existing successful efforts.[156]
- ***Princeton Master Plan*** – At the time of this plan, the town is updating the Master Plan to identify the main priorities for the town so that the Hazard Mitigation Plan's strategies can align with these priorities.[157]
- ***Princeton Municipal Vulnerability Preparedness Plan –*** Recommendations from this plan deemed important to hazard mitigation by the planning team in town were incorporated into the Hazard Mitigation Plan's mitigation strategies.[158]
- ***ResilientMass State Hazard Mitigation and Climate Adaptation Plan*** - This plan was used to ensure that the town's HMP data and priorities are consistent with the State's data and priorities.[159]
- ***2022 Massachusetts Climate Change Assessment*** - This plan was used to ensure that the town's HMP data and priorities, especially in the hazards section of the plan, are consistent with the State's data and priorities.[160]

Additionally, this plan incorporated information from the 1981 FIRM maps for Princeton and the 2023 Worcester County Flood Insurance Study.

After both FEMA and the Princeton Selectboard approve this plan, a link to the plan will be

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[155] Town of Princeton Open Space Committee et al., "Town of Princeton Open Space and Recreation Plan – 2020," Town.princeton.ma.us, The Town of Princeton, accessed May 28, 2025, https://www.town.princeton.ma.us/sites/g/files/vyhlif4891/f/uploads/open_space_plan_2020_final.pdf

[156] "Town of Princeton, MA Town Bylaws (General and Zoning)," Town.princeton.ma.us, The Town of Princeton, accessed May 28, 2025, https://www.town.princeton.ma.us/town-clerk/files/full-text-zoning-bylaws

[157] "Town of Princeton Master Plan Steering Committee," Town.princeton.ma.us, The Town of Princeton, accessed May 28, 2025, https://www.town.princeton.ma.us/master-plan-steering-committee

[158] "Princeton MVP Summary of Findings," Town.princeton.ma.us, The Town of Princeton, April 2021, https://www.town.princeton.ma.us/environmental-action-committee/files/princeton-mvp-summary-findings-report-2021

[159] "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

[160] "2022 Massachusetts Climate Change Assessment"

shared to all town staff, boards, and committees; along with this link, the town staff, boards, and committees will review the plan periodically and work to incorporate its contents, especially the action plan, into other town planning processes and/or documents. In addition, during annual monitoring meetings for the Hazard Mitigation Plan implementation process, the local 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 to work on these plans and/or documents of the Hazard Mitigation Plan and will encourage them to incorporate information and strategies from 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. Information from the Hazard Mitigation Plan will also be incorporated into updates of the town's Comprehensive Emergency Management Plan.

8.3 Plan Monitoring and Evaluation

Section 8.3 helps meet the following FEMA local mitigation plan requirements:

- *D1. "Is there discussion of how each community will continue public participation in the plan maintenance process?" (Requirement 44 CFR § 201.6(c)(4)(iii));*
- *D2. "Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a five-year cycle)?" (Requirement 44 CFR § 201.6(c)(4)(i)); and*
- *D3. "Does the plan describe a process by which each community will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?" (Requirement 44 CFR § 201.6(c)(4)(ii))*

The town will review and update the Hazard Mitigation Plan every five years through forming a HMP planning team and working with a contractor to complete the update. The town's Emergency Management Director will also call meetings of all parties responsible to review, track, and monitor the progress of the Hazard Mitigation Plan on a yearly basis and/or as is needed based on the occurrence of hazard events. Any substantial revisions made to the plan will be made open for public comment and/or will be presented at a Selectboard meeting which is open to the public. Parties identified as responsible for specific mitigation actions will be asked to submit their reports relating to these actions in advance of town hazard mitigation planning meetings.

Town hazard mitigation planning meetings will involve evaluation, assessment, tracking, and monitoring of the most recent HMP plan update. Responsible parties will review the plan's effectiveness at achieving its goals and stated purpose at these meetings. The following questions will serve as the criteria that are 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 relating to the impact of previous hazard events or the probability of future hazard occurrences? If so, this information should be incorporated into the plan.
- How will progressing climate change impact the risk of each natural hazard? What impacts do hotter, wetter, and more variable weather have on each natural hazard?

Existing Mitigation Strategies

- Are the current strategies effectively mitigating the effects of any recent hazard events?

- Has there been any damage to property caused by natural hazards since the plan was last reviewed?
- How could the existing mitigation strategies be improved to reduce the impacts of recent occurrences of hazards? If there are improvements which should be made, 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 level of impact in town of hazards that have occurred since these strategies were completed?
- Should the criteria for prioritizing the mitigation strategies in the plan 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 and/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?

Plan tracking and monitoring will be accomplished by a group of town stakeholders led by the town's Emergency Management Director who have similar to if not the same credentials as the local HMP planning team for this plan update. When this team meets, they will review the mitigation strategies table from this plan update, will update it with any progress on the strategies which has been made since the plan update was adopted, and will discuss priorities for mitigation strategies which have not yet been implemented. Following these meetings, it is anticipated that the HMP planning team in town 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 most recent plan update. The town also has the option to work with a contractor to help facilitate the tracking and monitoring of the plan.

Public participation will be a critical component of the Hazard Mitigation Plan maintenance process. Any substantial revisions to the plan will be made open for public comment and/or will be presented on at a Selectboard meeting which is open to the public. Plan implementation will be approved through standard capital planning, Princeton Town Meeting, and/or other publicly accessible local approval processes. 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 sources for federal funding of hazard mitigation projects and activities in Massachusetts:

Table 38: Federal Hazard Mitigation Funding Sources

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
Hazard Mitigation Grant Program (HMGP)	Post-disaster cost-share grants	Post disaster program	MEMA	75% FEMA / 25% non- federal
Building Resilient Infrastructure and Communities (BRIC)	National, competitive cost-share grant program for projects & planning	Annual, pre-disaster mitigation program	MEMA	75% FEMA / 25% non- federal
Flood Mitigation Assistance (FMA) Program	Cost share grants for pre-disaster planning & projects	Annual pre-disaster grant program	MEMA	75% FEMA / 25% non- federal
Public Assistance	Post-disaster aid to state & local governments	Post Disaster	MEMA	FEMA, plus a non-federal share
Small Business Administration (SBA) Mitigation Loans	Pre- & Post- disaster loans to qualified applicants	Ongoing	MEMA	Small Business Administration
Emergency Management Performance Grant (EMPG)	Pre- & post-disaster management and implementation grants	Annual	MEMA	50% FEMA / 50% non-federal match
Homeland Security Grant Program (HSGP)	Funding to prevent, respond to, and recover from acts of terrorism	Annual	MEMA	FEMA

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Hazard Mitigation Grant Program Post-Fire (HMGP-PF)	Cost-share post-wildfire disaster mitigation measures	Annual, within six months after a Fire Management Assistance Grant declaration	FEMA	75% FEMA / 25% non-federal
Assistance to Firefighters Grants (AFG)	Training & equipment for wildfire-related hazards	Annual	FEMA	FEMA
Fire Prevention & Safety Grant Program (AFG) (FP&S)	Cost-share funding to support projects that protect people from fire-related hazards	Annual	FEMA	95% FEMA / 5% non-federal
Fire Management Assistance Grants (FMAG)	Cost-share funding to mitigate & manage major disasters caused by fire	Any time (pre- & post disaster)	FEMA	75% FEMA / 25% non-federal
National Dam Safety Program (State Assistance Grant Program) (NDSP)	Funding to improve dam safety & state dam safety programs	Annual	FEMA	FEMA, Bipartisan Infrastructure Law
Rehabilitation of High Hazard Potential Dam Program (State Dam Safety Divisions) (HHPD)	Cost-share funding to plan and rehabilitate high hazard potential dams	Annual	FEMA	65% FEMA / 35% non-federal
National Earthquake Hazards Reduction Program's State Assistance Program (NEHRP)	Cost-share funding for pre-earthquake risk management	Annual	FEMA	75% FEMA / 25% non-federal
Emergency Food and Shelter Program (EFSP)	Grant funding for supplemental food & shelter for those experiencing / at risk of experiencing homelessness	Annual	FEMA	FEMA

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Public Health Crisis Response Cooperative Agreement (PHCRCA)	Funding to support surge needs of existing public health programs responding to public health emergencies	Annual for approved by unfunded (ABU) roster	CDC	Varies
Army Corp of Engineers Planning Assistance	Water supply, conservation, wetlands, & dam safety funding	Any time (pre & post disaster)	U.S. Army Corps of Engineers	50% Federal / 50% non-federal
Forest Service Community Wildfire Defense Grant (USDA-FSCWDG)	Grant funding to plan for and reduce wildfire risk	Annual	USDA-FS	75% USDA / 25% non-federal
Emergency Watershed Protection Program (EWP)	Technical assistance and funding for helping communities mitigate natural disaster risks which affect watersheds	Ongoing	USDA-NRCS	75% USDA / 25% non-federal (90% USDA / 10% non-federal in limited resource areas)
Agricultural Management Assistance (Drought Mitigation Funding Program) (AMA)	Technical assistance for agricultural producers to manage financial risks	Ongoing	USDA-NRCS	75% USDA / 25% non-federal
USDA Community Facilities Direct Loan & Grant Program (Rural Development) (CFDLGP)	Funding for improving essential community facilities	Annual	USDA-RD	Varies
National Culvert Removal, Replacement, & Restoration Grant (NCRRRG)	Competitive grant funding to replace, remove, and repair culverts or weirs	Annual	US DOT	Varies
Bridge Investment Program (BIP)	Competitive grant program for improving the conditions of existing bridges	Annual	US DOT	80% FHWA / 20% other

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT)	Discretionary program which includes Competitive Resilience Improvement Grants and planning grants	Annual	US DOT	Varies (generally, up to 80% federal share)

This FEMA web page describes several funding opportunities: FEMA Grants | FEMA.gov. The programs listed in the above table are described in more detail below.

NATIONAL FLOOD INSURANCE PROGRAM (NFIP) AND COMMUNITY RATING SYSTEM (CRS) (PART OF THE NFIP)

The National Flood Insurance Program (NFIP) provides insurance to communities required to manage and adopt mitigation practices for high flood-risk areas. The Community Rating System (CRS) incentivizes communities to incorporate flood management practices and mitigation strategies through discounted flood insurance rates; Incentives are available on a voluntary and participatory basis to encourage communities to meet the minimum requirements of the NFIP. In encouraging communities to meet NFIP's minimum requirements, CRS can extend the availability of funding to homeowners, businesses, and renters for whom flood insurance may not be accessible. CRS allocates insurance discount rates according to a community's demonstrated efforts to implement the program's three goals:

- Reduce flood damage to insurable properties;
- Strengthen and support NFIP; and
- Incentivize proactive floodplain management.

Communities can earn CRS points based on their implementation of various flood mitigation initiatives, including but not limited to: (1) restricting development on flood prone areas, (2) extending public risk communication with flood warning systems, and (3) enhancing infrastructural resilience to flood damage. Please refer to | The National Flood Insurance Program (floodsmart.gov) and Community Rating System | FEMA.gov for more information.

HAZARD MITIGATION ASSISTANCE (HMA)

The Hazard Mitigation Assistance (HMA) grant programs provide funding opportunities for pre- and post-disaster mitigation. While the statutory origins of these programs differ, all share the common goal of reducing the risk of loss of life and property from 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)

The Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available under this program to implement projects in accordance with state, tribal, and local priorities. Please refer to Hazard Mitigation Assistance Grants | FEMA.gov for additional information.

HMGP funds may be used to fund projects that will reduce or eliminate the losses from future disasters. Projects completed under this program 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 a 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 eligible HMGP projects include, but are not limited to:

- Acquisition of real property from willing sellers and demolition or relocation of buildings to convert this property to open space use;
- Retrofitting structures and facilities to minimize damages from high winds, earthquakes, flooding, wildfires, 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; and
- Post-disaster building code related activities that support building code officials during the reconstruction process.

Hazard Mitigation Grant Program Post-Fire (HMGP-PF)

The Hazard Mitigation Grant Program Post-Fire (HMGP-PF) is a program aimed at providing financial funding to localities to reduce risk of damage from future fires after a given area has experienced a fire. Funds are determined through benefit-cost analysis software. For more information, please refer to: Hazard Mitigation Grant Program Post Fire | FEMA.gov.

Building Resilient Infrastructure and Communities (BRIC)

The Building Resilient Infrastructure and Communities (BRIC) 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 projects that demonstrate innovative approaches to partnerships, such as shared funding mechanisms, and/or project design. For example, an innovative BRIC 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 has replaced the Pre-Disaster Mitigation (PDM) grant program. More information on the BRIC program can be found here: Building Resilient Infrastructure and Communities | FEMA.gov.

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: Building Resilient Infrastructure and Communities (BRIC) & Flood Mitigation Assistance (FMA) Grant Programs | Mass.gov.

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: Flood Mitigation Assistance Grant Program

| FEMA.gov.

The following 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 program.
- **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 the elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties (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: Building Resilient Infrastructure and Communities (BRIC) & Flood Mitigation Assistance (FMA) Grant Programs | Mass.gov.

DISASTER ASSISTANCE

Disaster Assistance is money or direct assistance to individuals, families, and businesses 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

Assistance from FEMA in the event of a disaster declaration is grouped into the following 3 categories:

A. Housing Needs

- **Temporary Housing** (a place to live for a limited period of time): Money is made 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 is made available 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 a disaster, including:
    - Disaster-related medical and dental costs;
    - Disaster-related funeral and burial costs;
    - Clothing;
    - Household items (room furnishings, appliances);
    - Tools (specialized tools or protective clothing and equipment) required for people's jobs;
    - Necessary educational materials (computers, schoolbooks, supplies);
    - Fuels for primary heat source (heating oil, gas);
    - Clean-up items (wet/dry vacuums, dehumidifiers);
    - Expenses relating to disaster-damaged vehicles;
    - 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; and
    - Other expenses that are authorized by law.

C. Additional Services

- Crisis Counseling
- Disaster Unemployment Assistance
- Legal Services
- Special Tax Considerations

For additional information, please refer to: Get Assistance After a Disaster | FEMA.gov.

DISASTER LOANS AVAILABLE FROM THE U.S. 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 the following 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: Loans which provide economic relief to small businesses and nonprofit organizations that have suffered damage to their home or personal property.

- Military reservist loans: 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: Disaster assistance | U.S. Small Business Administration (sba.gov).

DISASTER ASSISTANCE FROM OTHER ORGANIZATIONS AND ENTITIES

Home | 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 go to DisasterAssistance.gov to register for receiving assistance 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 up 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 federal, state, tribal, regional, and local levels.

EMERGENCY MANAGEMENT PERFORMANCE GRANT (EMPG)

The Emergency Management Performance Grant (EMPG) provides resources for state, local, tribal, and territorial emergency response organizations required for the National Preparedness System. EMPG supports efforts in building and strengthening capabilities in areas related to protection, mitigation, prevention, response and recovery. In fiscal year 2024, this grant had a total available funding of $319.55 million. Please find more information about this grant program at the link here: Emergency Management Performance Grant | FEMA.gov.

HOMELAND SECURITY GRANT PROGRAM (HSGP)

The Homeland Security Grant Program (HSGP) provides a suite of grant opportunities in support of efforts in the mitigation of, prevention of, protection from, and recovery from terrorist and other threats at the state, local, tribal, and territorial levels. As of the 2024 fiscal year, the program, including its three separate grants, had $1.008 billion in funding. The three grants available under this program are:

- The State Homeland Security Program (SHSP);
- The Urban Area Security Initiative (UASI); and
- Operation Stonegarden (OPSG).

Please find more about this program at the link here: Homeland Security Grant Program | FEMA.gov.

ASSISTANCE TO FIREFIGHTERS GRANTS (AFG) AND FIRE PREVENTION & SAFETY GRANT PROGRAM (FP&S)

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. More about these programs can be found at these links: Assistance to Firefighters Grants Program | FEMA.gov, Fire Prevention and Safety (FP&S) | FEMA.gov.

FIRE MANAGEMENT ASSISTANCE GRANTS (F-MAG)

The Fire Management Assistance Grants (F-MAG) Program supports firefighting efforts in cases of fire-related disasters impacting public and private forests as well as grasslands at the state, local and tribal levels. For more information on this program, please refer to: Fire Management Assistance Grants | FEMA.gov.

NATIONAL DAM SAFETY PROGRAM (STATE ASSISTANCE GRANT PROGRAM) (NDSP)

The National Dam Safety Program (NDSP) provides financial assistance to strengthen the individual dam safety programs of states and territories. In the 2024 fiscal year, this program distributed $24.2 million among 49 states and Puerto Rico. For more information on this program, please refer to: Grant Assistance to States | FEMA.gov.

REHABILITATION OF HIGH HAZARD POTENTIAL DAM PROGRAM (STATE DAM SAFTEY DIVISIONS) (HHPD)

The Rehabilitation of High Hazard Potential Dams Program (HHPD) provides technical, planning, design, and construction assistance in the form of grants for the rehabilitation of high hazard potential dams in eligible states and territories. For more information, please refer to: Rehabilitation Of High Hazard Potential Dam (HHPD) Grant Program | FEMA.gov.

NATIONAL EARTHQUAKE HAZARDS REDUCTION PROGRAM'S STATE ASSISTANCE PROGRAM (NEHRP)

The National Earthquake Hazards Reduction Program's State Assistance Program (NEHRP) provides funding to localities for the reduction of risk associated with earthquakes. This is done through two grants:

- Individual State Earthquake Assistance (ISEA) and
- Multi-State National Earthquake Assistance (MSNEA).

More information about this program can be found at this link: National Earthquake Hazards Reduction Program's State Assistance Program | FEMA.gov.

EMERGENCY FOOD AND SHELTER PROGRAM (EFSP)

The Emergency Food and Shelter Program (EFSP) assists and expands upon the work of local nonprofit and governmental social service organizations to provide shelter, food, and other services to people experiencing or at risk of hunger and/or homelessness. For more information, please refer to: Emergency Food and Shelter Program | FEMA.gov.

PUBLIC HEALTH CRISIS RESPONSE COOPERATIVE AGREEMENT (PHCRCA)

The Center for Disease Control and Prevention's Public Health Crisis Response Cooperative Agreement (PHCRCA) allows for opportunities for state, local, and tribal government to receive funding in response to public health emergencies. For more information, please refer to: The Centers for Disease Control and Prevention's Public Health Crisis Response Cooperative Agreement Program Awards (hhs.gov).

ARMY CORP OF ENGINEER PLANNING ASSISTANCE

Under the authority provided by Section 22 of the Water Resources Development Act of 1974 (PL 93-251), as amended, the U.S. Army Corps of Engineers can provide states, local governments, other non-federal entities, as well as eligible Native American Indian tribes, assistance in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources. Typical studies funded under this program are only at the planning level of detail; they do not include detailed engineering designs intended for project construction. The program can encompass many types of planning studies which address water resources issues. Types of studies conducted in recent years under the program include the following: water supply/demand, water conservation, water quality, environmental/conservation, wetlands evaluation/restoration, dam safety/failure, flood damage reduction, coastal zone protection, and harbor planning. For more information, please refer to: Planning Assistance to States, U.S. Army Corps of Engineers, New England District.

FOREST SERVICE COMMUNITY WILDFIRE DEFENSE GRANT (USDA-FSCWDG)

The Forest Service Community Wildfire Defense Grant Program (USDA-FSCWG) provides funding and assistance to at-risk local communities and tribes to reduce wildfire risk. Funding and assistance under this program are primarily used to revise and develop community wildfire protection plans and to assist in implementing new projects described in said plans. For more information on this program, please refer to: Community Wildfire Defense Grant Program | US Forest Service (usda.gov).

EMERGENCY WATERSHED PROTECTION PROGRAM (EWP)

The Emergency Watershed Protection Program (EWP) provides technical and financial assistance to localities in response to imminent life- and property-threatening natural disasters which negatively impact local watersheds. For more information about this program, please refer to: Emergency Watershed Protection | Natural Resources Conservation Service (usda.gov).

AGRICULTURAL MANAGEMENT ASSISTANCE (DROUGHT MITIGATION FUNDING PROGRAM) (AMA)

Agricultural Management Assistance (AMA) is a program to help farmers build on and diversify their agricultural practices. The program is available in 16 states that have had historically low rates of participation in the Federal Crop Insurance Program. AMA covers up to 75% of funds needed to install conservation practices on farms, with a cap of $50,000 per individual participant in a given fiscal year. For more information, please refer to: Agricultural Management Assistance | Natural Resources Conservation Service (usda.gov).

USDA COMMUNITY FACILITIES DIRECT LOAN & GRANT PROGRAM

The UDSA Community Facilities Direct Loan & Grant program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings. Rural areas including cities, villages, and townships and towns, including Federally Recognized Tribal Lands, with no more than 20,000 residents according to the latest U.S. Census Data are eligible for this program. Program funds can be used to purchase, construct, and / or

improve essential community facilities, purchase equipment, and pay related project expenses. For more information on this program, please refer to: Community Facilities Direct Loan & Grant Program | Rural Development (usda.gov).

NATIONAL CULVERT REMOVAL, REPLACEMENT, & RESTORATION GRANT (NCRRRG)

The National Culvert Removal, Replacement, and Restoration Grant Program (NCRRRG) (Culvert Aquatic Organism Passage (AOP) Program) assists eligible tribes, states and local governments in issues related to culverts and weirs to improve and/or restore passage for anadromous fish in freshwater waterways. Anadromous fish are those that spawn in freshwater but live most of their lives in saltwater. More information about this program can be found at this link: Aquatic Organism Passage - Culvert Hydraulics - Hydraulics - Bridges & Structures - Federal Highway Administration (dot.gov).

BRIDGE INVESTMENT PROGRAM (BIP)

The Bridge Investment Program (BIP) provides the opportunity for governments at all levels to receive funding to repair and restore aging bridge infrastructure. BIP grant applications have a maximum grant award of 80% of the total eligible bridge project costs. For more information regarding this program, please refer to: BIP - Funding Programs - Management and Preservation - Bridges & Structures - Federal Highway Administration (dot.gov).

PROMOTING RESILIENT OPERATIONS FOR TRANSFORMATIVE, EFFICIENT, AND COST-SAVING TRANSPORTATION PROGRAM (PROTECT)

The Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (Protect) Program is a program established by the Bipartisan Infrastructure Law (BIL) which funds resilience-building activities for surface transportation, such as plans (including evacuation plans) and infrastructure improvements, which increase reliance to natural hazards and climate change. For more information regarding this program, please refer to: Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT) | US Department of Transportation and Bipartisan Infrastructure Law - Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Formula Program Fact Sheet | Federal Highway Administration (dot.gov).

8.4.2 State Funding Sources

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

Table 39: State Hazard Mitigation Funding Sources

Program	Type of Assistance	Availability	Managing Agency	Funding Source
604b Water Quality Management Planning Grant Program	Grants focused on nonpoint source pollution assessment and watershed planning	Annual	Mass DEP	State funding (match not required but recommended)
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	Mass DEP	State funding
Water Quality Monitoring Grant Program	Reimbursement funding for monitoring and/or data collection efforts that support water quality assessments	Annual	Mass DEP	State funding
Statewide Water Management Act Grant	Reimbursement grant funding for projects to help public water suppliers plan and manage water use	Annual	Mass DEP	Reimbursement grant
Massachusetts Gap Energy Grant Program (Gap III)	Program providing grant assistance (up to $200,000 per community) for implementing energy efficiency and clean energy generation projects at water and wastewater plants	Annual (likely)	Mass DEP	State funding
State Revolving Fund	Low-interest loans	Annual	Mass DEP	Municipal funding with state loan

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Municipal Vulnerability Preparedness (MVP) Action Grants	Competitive climate adaptation grants	Annual	EEA	75% EEA / 25% non-state match
Planning Assistance Grants (EEA PAG)	Competitive grants that support efforts to plan, regulate (zone), and act to conserve and develop land consistent with the Massachusetts Sustainable Development Principles	Annual	EEA	75% EEA / 25% non-state match
Dam and Seawall Repair or Removal Program	Competitive grants for dam and seawall repair and removal, as well as construction loans	Annual	EEA	State funding
Massachusetts Land & Water Conservation Fund Grant Program (LWCF)	Federal grant program to help improve access to and protection for public lands and waters	Annual	DCS	Federal program that funds up to 50% of total costs for acquisition, development, and renovation
Local Acquisitions for Natural Diversity (LAND)	Financial assistance to municipalities for the acquisition of conservation land	Annual	DCS	Reimbursement grant, the reimbursement rate varies per town
Drinking Water Supply Protection Grant (DWSP)	Competitive grants for protection of drinking water supplies	Annual	DCS	State funding
Land and Recreation Grants and Loans	Varies, though primarily grant funding for conservation and recreation projects	Varies, generally annually	DCS	Varies

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Land Conservation Assistance Grant Program	Financial assistance for permanently protecting land	Annual (Likely)	DCS	90% state reimbursement / 10% other
Forest Legacy Grant Program (USDA-FS) (FLGP)	Grant funding to protect environmentally important forestland from conversion	Annual	DCR	75% USDA FS / 25% non-federal
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	DER	State funding
Division of Ecological Restoration Priority Project Program	State competitive grant program that funds projects that restore and protect the state's rivers, wetlands, and watersheds (priority projects may differ each year)	Annual	DER	State funding
Mass Wildlife Habitat Management Grant Program (MWHMGP)	Reimbursement grant funding to assist municipalities in enhancing wildlife habitat and increasing recreational opportunities on protected lands	Annual	DFW	USDA NRCS
Agricultural Climate Resiliency and Efficiencies Program (ACRE)	Competitive reimbursement grant funding that supports practices that mitigate the agricultural sector's vulnerability to climate change	Annually through Climate Smart Agriculture Program (CSAP)	MDAR	MDAR

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Agricultural Preservation Restriction Program (APR)	Financial assistance in exchange for permanent deed restriction to protect lands' agricultural viability	Any time for owners of at least 5 acres of farmland	MDAR	MDAR
Hazard Mitigation Grant Program (State) (HMGP)	Sub-grant programs for the Hazard Mitigation Grant Program	Annual	MEMA	State funding
Community Development Block Grants (CDBG)	Competitive community development grants	Annual	EOHLC	US Department of Housing and Urban Development
Emergency Solutions Grant (ESG)	Competitive grant funding designed to support services that assist those experiencing / at risk of experiencing homelessness	Annual	EOHLC	MA EOHLC
Mass Works	Competitive infrastructure grants	Annual	EOED	State funding
Community Preservation Act (CPA)	Establishes a local community preservation fund through tax surcharge to support a variety of project related to conservation and housing	Ongoing	Department of Revenue (DOR)	Statewide Community Preservation Trust Fund / Local Community Preservation Fund
Special appropriations and legislative earmarks	Varies	Infrequent, after natural disasters or legislature vote	Massachusetts General Legislature	State funding
District Local Technical Assistance (DLTA)	Funding to support planning and technical assistance for housing, economic growth, and regional projects	Varies, generally annually	Massachusetts General Legislature, CMRPC	State funding

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Local Planning Assistance (LPA)	Planning and technical assistance	Annual	CMRPC	Planning assistance hours
Support and Incentive Grant	Reimbursement grant funding designed to assist in providing enhanced 911 service	Annual	MA EOPSS	MA EOPSS
Municipal Small Bridge Program	Competitive grants for small bridge replacement, preservation, and rehabilitation projects	Annual	MassDOT	State funding
Chapter 90 Program (Transportation Capital Improvement Projects) (Chpt. 90)	Reimbursable grants to support capital improvements on local public ways	Ongoing	MassDOT	State funding
State Transportation Improvement Program (STIP)	Competitive funding opportunity for transportation projects along federal-aid roadways	Annually updated five-year programming document	MassDOT	MassDOT
Complete Streets (CS)	Reimbursement grant funding to provide safe and accessible options for all travel modes	Annually available to municipalities that adopt a Complete Streets Policy	MassDOT	State funding
Drought Resiliency and Water Efficiency Grant Program	Funding for reducing indoor and outdoor water use, improving water loss control, and increasing drought management and planning in public water systems across the state	Annual	EEA	State funding

The Community Grant Funder web page includes the municipal grant programs listed above, as well as other funding opportunities: Community Grant Finder | Mass.gov. The programs listed in the above table are described in more detail below.

604B WATER QUALITY MANAGEMENT PLANNING GRANT PROGRAM

The 604B Water Quality Management Planning Grant Program provides funding opportunities to regional planning agencies, councils of governments, conservation districts, counties, cities and towns, federally and state recognized tribes, and other substate public planning agencies and interstate agencies to determine and correct water quality issues in Massachusetts. For more information on this program, please refer to: Grants & Financial Assistance: Watersheds & Water Quality | Mass.gov.

SECTION 319 NONPOINT SOURCE COMPETITIVE GRANTS PROGRAM

Section 319 of the Clean Water Act provides funding opportunities for the prevention, control, and abatement of nonpoint source (NPS) pollution. These grants are available to eligible Massachusetts public or private organizations, including: state and federally recognized tribes, regional planning agencies, councils of governments, counties, conservation districts, cities and towns, other substate public planning agencies, and interstate agencies. To be eligible for this program, these entities' projects must: include measures that address the prevention, control, and abatement of NPS pollution, target major sources of NPS pollution within a watershed, contain an appropriate method for evaluating the project results, and address activities in the current Massachusetts NPS Management Program Plan. For more information on this program, please refer to: Grants & Financial Assistance: Watersheds & Water Quality | Mass.gov.

WATER QUALITY MONITORING GRANT PROGRAM

The Water Quality Monitoring Grant Program provides funding opportunities to eligible entities and organizations to increase the amount of data on water quality in Massachusetts. For more information, please refer to: Grants & Financial Assistance: Watersheds & Water Quality | Mass.gov.

STATEWIDE WATER MANAGEMENT ACT GRANT

The Statewide Water Management Act Grant provides grant funding for projects which improve the ecological conditions of specific watersheds and projects aimed at reducing water demand. Specifically, projects funded under this program must: improve or increase instream flow, keep wastewater local, relate to stormwater management, reduce impervious cover and/or improve water quality, relate to water supply operational improvements, improve habitat, reduce wastewater inflow and infiltration, and/or be another type of project which can be demonstrated to mitigate the impacts of water withdrawals. This program awards approximately 10 grants a year and has a reimbursement rate of 80%. Grants are awarded to eligible public water suppliers and municipalities with Water Management Act permits. For more information, please refer to: Water Management Act Grant Programs for Public Water Suppliers | Mass.gov.

MASSACHUSETTS GAP ENERGY GRANT PROGRAM (GAP III)

Through a partnership between the Massachusetts Department of Energy Resources (DOER) and the Massachusetts Clean Energy Center (MassCEC), the Massachusetts Gap Energy Grant Program (Gap III) provides funding to fill the last financial "gap" needed for clean energy projects spearheaded by a variety of organizations to promote clean and efficient energy projects. In 2022, the GAP III program awarded a total of $8.1 million in grants. For more information about this program, please refer to: Massachusetts' Gap Energy Grant Program | Mass.gov.

PLANNING ASSISTANCE GRANTS (EEA PAG)

Executive Office of Energy and Environmental Affairs Planning Assistance Grant (EEA PAG) program grants are available to municipalities and regional planning agencies acting on their behalf to financially support efforts to conserve and develop land consistent with the Massachusetts Sustainable Development Principles. Top priorities of the program include: zoning for sustainable housing production, mitigation of climate change through zoning and other regulatory actions, and zoning that results in permanent land conservation. For more information about these grants, please refer to: Planning Assistance Grants | Mass.gov.

STATE REVOLVING FUND

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

MUNICIPAL VULNERABILITY PREPAREDNESS ACTION GRANT PROGRAM

The Municipal Vulnerability Preparedness (MVP) Action Grant program offers financial resources to municipalities that are seeking to advance priority climate adaptation actions to address impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate change-related events. Towns are eligible for this competitive grant program after successfully completing an MVP planning grant. A variety of project types are eligible for funding under this program, but projects must address local vulnerabilities to climate change and incorporate MVP Core Principles. Grant application information can be found here: MVP Action Grant | Mass.gov. The MVP Core Principles can be found here: https://www.mass.gov/doc/mvp-core-principles/download.

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 under the Dam and Seawall Repair or Removal Program. For additional information, please refer to Dam and Seawall Repair or Removal Program Grants and Funds | Mass.gov.

LAND & WATER CONSERVATION FUND GRANT PROGRAM (LWCF)

The Land & Water Conservation Fund Grant Program (LCWF) provides up to 50% of total project funding to eligible municipalities, tribes, and state agencies for park, trail and conservation area related projects. For more information, please refer to: Massachusetts Land and Water Conservation Fund Grant Program | Mass.gov.

LOCAL ACQUISITIONS FOR NATURAL DIVERSITY (LAND)

The Local Acquisitions for Natural Diversity (LAND) grant program assists cities and towns in acquiring new lands for conservation and passive recreation purposes. Grants are awarded at a maximum of $500,000 with reimbursement rates ranging from 52% to 70%. For more information, please refer to: Local Acquisitions for Natural Diversity (LAND) Grant Program | Mass.gov.

DRINKING WATER SUPPLY PROTECTION GRANT (DWSP)

The Drinking Water Supply Grant (DWSP) program provides financial assistance to public water systems and municipal water departments for the purchase of land or interests in land for the following purposes: 1) protection of existing DEP-approved public drinking water supplies; 2) protection of planned future public drinking water supplies; or 3) groundwater recharge. This is a reimbursement program. For more information, please refer to Drinking Water Supply Protection Grant Program | Mass.gov.

LAND AND RECREATION GRANTS AND LOANS

The Massachusetts Division of Conservation Services (DCS) manages several grant and 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: Land and Recreation Grants & Loans | Mass.gov.

LAND CONSERVATION ASSISTANCE GRANT PROGRAM

The Land Conservation Assistance Grant Program from the Massachusetts Division of Conservation Services (DCS) provides reimbursement funding to municipalities, qualified 501(c)(3) land trusts, tribal governments, and other public entities for the permanent protection of land as well as to Regional Planning Agencies (RPAs) and qualified 501(c)(3) land trusts which assist these entities in this goal. Eligible activities under this program include preparing grant applications for permanently protecting land, completing other tasks which progress transactions which permanently protect land, developing or updating municipal Open Space and Recreation Plans, and planning for developing and/or renovating a park to help with a grant application to DCS. For more information on this program, please refer to: Apply to the Land Conservation Assistance Grant Program | Mass.gov.

FOREST LEGACY GRANT PROGRAM (USDA-FS) (FLGP)

The Forest Legacy Grant Program (FLGP) is a voluntary grant funding opportunity for private landowners to either sell their land outright or to sell a conservation restriction on their land. A conservation restriction is a legally binding agreement which limits the types of land use on a property, in this case restricting land to forestry, recreation, or another conservation-related use. For more information about this program, please refer to: Forest Legacy Program | Mass.gov.

CULVERT REPLACEMENT MUNICIPAL ASSISTANCE GRANT PROGRAM

The Culvert Replacement Municipal Assistance Grant program provides a funding opportunity for local governments to replace undersized, perched, and/or degraded culverts in areas of high ecological value. For more information on this program, please refer to: Culvert Replacement Municipal Assistance Grant Program | Mass.gov.

DER PRIORITY PROJECTS

The Priority Project Program is an opportunity under the Division of Ecological Restoration (DER) for organizations to receive technical assistance, consulting, and/or direct grant funding for 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 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: Become a DER Priority Project | Mass.gov. This program can be used to remove significant or high hazard dams that communities no longer want to maintain; the removal of these dams may improve the health and resilience of aquatic systems.

MASS WILDLIFE HABITAT MANAGEMENT GRANT PROGRAM (MWHMGP)

The Mass Wildlife Habitat Management Grant Program (MWHMGP) is a program dedicated to the protection and restoration of wildlife habitat. MWHMGP awards grants ranging from $10,000 to $75,000 to private landowners for habitat restoration projects. The program places emphasis on the protection of endangered species, the expansion of outdoor recreation opportunities, and the enhancement of ecological communities disproportionally susceptible to climate change. For more information about this program, please refer to: MassWildlife Habitat Management Grant Program | Mass.gov.

AGRICULTURAL CLIMATE RESILIENCY AND EFFICIENCIES PROGRAM (ACRE)

The Agricultural Climate Resiliency and Efficiencies Program (ACRE) is a competitive grant program available to eligible farmers that funds materials and labor to improve climate and economic resilience and forwards the goals of the Massachusetts Local Food Action Plan. For more about this program, please refer to: Agricultural Climate Resiliency & Efficiencies (ACRE) Program | Mass.gov.

AGRICULTURAL PRESERVATION RESTRICTION PROGRAM (APR)

The Agricultural Preservation Restriction (APR) program is a voluntary program that allows farmers to be paid the difference between the "fair market value" and the "agricultural value" of their farms in exchange for a permanent deed restriction by the state. This restriction is meant to prevent any use of the property that will negatively impact the land's future agricultural viability. To qualify for this program, a farm must be at least 5 acres in size, must have been actively devoted to agriculture for at least the past 2 tax years, and must produce at least $500 in gross sales per year for the first five acres plus $5 for each additional acre or 50 cents per each additional acre of woodland and/or wetland; there are various other considered criteria which farms must meet to qualify for this program. For more information on this program, please refer to: Agricultural Preservation Restriction (APR) Program Details | Mass.gov.

HAZARD MITIGATION GRANT PROGRAM (STATE) (HMGP)

The Hazard Mitigation Grant Program (HMGP) provides funds to areas after a natural disaster with the purpose of lowering the risk of damage and loss of life from future natural disasters. This grant program seeks to reduce the reliance on taxpayer-funded federal assistance for disaster recovery. For more information about this program, please refer to: Hazard Mitigation Grant Program (HMGP) | Mass.gov.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

The Community Development Block Grant (CDBG) program remains the principal source of revenue for many 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 Livable Communities (EOHLC). The program can fund certain critical infrastructure projects, and necessary housing improvements that benefit populations who may be more vulnerable to certain

natural hazards. The program can also fund the rehabilitation of municipal buildings serving low- and moderate-income populations, which in many cases also serve as Emergency Operations Centers for their communities. For more information, please refer to: Community Development Block Grant (CDBG) | Mass.gov.

EMERGENCY SOLUTIONS GRANT (EFG)

The Emergency Solutions Grant (EFG) program funds necessary services to help house/rehouse those who are homeless or at risk of homelessness and to provide shelter for those in need of emergency shelter. For more information on this program, please refer to: Emergency Solutions Grant Program (ESG) | Mass.gov.

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 this program is not specific to natural hazards per se, infrastructure enhancements under MassWorks can address identified hazard mitigation needs. 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. For additional information on this program, please refer to MassWorks Infrastructure Program | Mass.gov.

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/or creating affordable housing; these types of projects can benefit residents who may be the most vulnerable to natural hazards. More information on the CPA program can be found here: CPA: An Overview | Community Preservation Coalition.

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.

DISTRICT LOCAL TECHNICAL ASSISTANCE

District Local Technical Assistance (DLTA) is funding allocated by the Massachusetts General Assembly (Legislature) to the Central Massachusetts Regional Planning Commission (CMRPC) to provide technical assistance to member communities on eligible projects. DLTA planning dollars help

cities and towns take on necessary projects that they don't have the staff capacity to address on their own and partner with neighboring communities to tackle shared projects with reduced administrative burden.

According to the most recent guidelines of the Commonwealth's DLTA program, a proposed project must fall into one of the following four (4) general priority categories to be considered eligible for technical assistance:

1. Planning Ahead for Housing;
2. Planning Ahead for Growth;
3. Technical Assistance to support Community Compact Cabinet Activities including Regionalization; and
4. Supporting the Housing Choice Initiative

The goal of the DLTA Fund is to direct funds to projects and activities that result in change in the municipality/municipalities receiving DLTA Fund services, whether in law, regulation, program management, or practice, that serve to further the objectives listed above. Community Compact Cabinet (CCC) best practices should include both those that the Commonwealth of Massachusetts is seeking to fund as part of the CCC program as a first priority and best practices that explicitly align with CCC best practices but are not best practices identified in a signed CCC agreement. COVID-19 relief / recovery activities that fall under the above priority categories are eligible. For more information, please refer to 2024 District Local Technical Assistance (DLTA) Call for Concepts - CMRPC.

LOCAL PLANNING ASSISTANCE

The Local Planning Assistance (LPA) program was initiated to improve the direct services of CMRPC to its member communities. Under the LPA program, each CMRPC community annually receives a set number of hours of technical assistance to be used in any reasonable planning project authorized by the community's CMRPC commissioner.

SUPPORT AND INCENTIVE GRANT

The Support and Incentive Grant provides opportunity funding to public safety answering points (PSAPs) and regional emergency communication centers (RECCs) in providing enhanced 9-1-1 service. Entities eligible for the Support Grant include: primary or regional public safety answering points, regional secondary public safety answering points, and regional emergency communication centers. To be eligible for the Incentive Grant, a regional public safety answering point or regional emergency communication center must be expanding. For more on this program, please refer to: Apply for the Support & Incentive Grant | Mass.gov.

MUNICIPAL SMALL BRIDGE PROGRAM

The Municipal Small Bridge Program offers funding opportunities to Massachusetts municipalities for small bridge replacement, preservation, and rehabilitation projects. For more information about this program, please refer to: Municipal Small Bridge Program | Mass.gov.

CHAPTER 90 FUNDS

The statewide Chapter 90 program reimburses communities for roadway improvement projects, such as projects relating to resurfacing and related work, 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, and street lighting (excluding operating costs), as well as for such other purposes specifically authorized. Maintaining and upgrading critical infrastructure and evacuation routes is an important component of hazard mitigation. For more information, please refer to Chapter 90 Program | Mass.gov.

STATE TRANSPORTATION IMPROVEMENT PROGRAM (STIP)

The State Transportation Improvement Program (STIP) is an annual list of transportation infrastructure projects funded and planned through the combined effort of MassDOT and other state agencies. For more information on this program, please refer to: State Transportation Improvement Program (STIP) | Mass.gov.

COMPLETE STREETS (CS)

The Complete Streets (CS) Funding Program provides grants to municipalities in Massachusetts for projects that improve safety and accessibility for all modes of transportation. To qualify for the program, municipalities must pass a Complete Streets Policy and develop a Prioritization Plan. After these requirements have been met, municipalities can apply for up to $500,000 in construction funding. For more information about this program, please refer to: Complete Streets Public Overview (site.com).

DROUGHT RESILIENCY AND WATER EFFICIENCY GRANT PROGRAM

The Drought Resiliency and Water Efficiency Grant Program aims to provide funding for projects that will help the Commonwealth become more climate resilient, specifically by reducing indoor and outdoor water use, improving water loss control, and increasing drought management and planning in public water systems across the state. Target awards are up to $50,000 per project, with potential for larger awards depending on the number of applications received. This grant program helps implement actions in the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP). For more information about this program, please refer to: COMMBUYS.