

TOWN OF WILBRAHAM



2021 MUNICIPAL VULNERABILITY PREPAREDNESS (MVP) - HAZARD MITIGATION PLAN (HMP)



Prepared by:

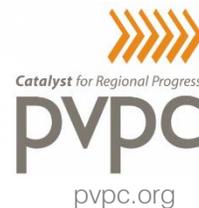


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1.0 INTRODUCTION

The Town of Wilbraham prepared a Municipal Vulnerability Preparedness and Hazard Mitigation Plan (MVP-HMP) to create an action roadmap to reduce the impacts of natural hazards and climate change within the community and the region. The Wilbraham MVP-HMP was adopted by the Board of Selectmen on DATE to update and replace The Town of Wilbraham Hazard Mitigation Plan from 2015.

1.1 What is a Hazard Mitigation Plan?

Natural hazards, such as earthquakes, hurricanes, and flooding, can result in loss of life, disruptions to everyday life, and property damage. Hazard mitigation is the effort to reduce these impacts through community planning, policy changes, education programs, infrastructure projects, and other activities (FEMA, 2020a). Hazard mitigation planning uses a multi-step process with the participation of a wide range of stakeholders to:

1. Define local hazards.
2. Assess vulnerabilities and risks.
3. Review current mitigation measures.
4. Develop priority action items.

HMPs focus resources and attention on the community's greatest vulnerabilities. The resulting plan identifies implementation measures that save lives and money. For every dollar spent on federal hazard mitigation grants, an average of six dollars are saved (FEMA, 2018a). There are many additional benefits of mitigation planning. HMPs increase public awareness of natural hazards that may affect the community. They help state, local, and tribal governments to collaborate and combine hazard risk reduction with other community goals and plans.



Figure 1-1. FEMA Hazard Mitigation Planning Saves Money Graphic (FEMA, 2018a)

Once an HMP is completed, hazard mitigation funding is available to address the community's top mitigation priorities through the Federal Emergency Management Agency (FEMA). To be eligible for FEMA grants, listed in Table 1-1, local governments are required to prepare an HMP that meets the requirements summarized in Figure 1-2, established in the *Robert T. Stafford Disaster Relief and Emergency Assistance Act*, as amended by the *Disaster Mitigation Act of 2000*.

Table 1-1. FEMA Grants (FEMA, 2020b)

FEMA Grants	Purpose
Hazard Mitigation Grant Program (HMGP)	Helps communities implement hazard mitigation measures following a Presidential Major Disaster Declaration.
Building Resilient Infrastructure and Communities (BRIC)	Assists in implementing a sustained pre-disaster natural hazard mitigation program, to reduce risk to the population and structures from future hazard events.
Public Assistance Grant Program (PA)	Provides supplemental grants so that communities can quickly respond and recover from major disasters or emergencies.
Fire Management Assistance Grant Program (FMAG)	Available for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands.

1.2 MVP-HMP Report Layout

The report presents the results of the planning process, which was informed by input received from the Core Team and during the CRB Workshop and Public Listening Sessions. This report is organized as follows:

Chapter 1: Project introduction and overview; summary of planning process

Chapter 2: Hazard mitigation and climate adaptation goals

Chapter 3: Community profile; societal, economic, infrastructural, and environmental features; land use and development, critical facilities, and vulnerable populations

Chapter 4: Detailed assessment of the Town's vulnerability and strengths by hazard type. The hazard types include flooding, wind-related risks (such as hurricanes, tropical storms, tornadoes, nor'easters, and severe thunderstorms), winter storms, geological hazards (such as earthquakes and landslides), brush fires, extreme temperatures, and drought. Each profile also describes the hazards' historic occurrences and impact, frequency, level of risk, and climate change projections.

Chapter 5: Summary of the existing mitigation measures the Town is currently undertaking

Chapter 6: An update of the progress made since the last HMP

Chapter 7: An action plan for next steps

Chapter 8: Plan adoption, maintenance, and implementation

1.3 What is a Municipal Vulnerability Preparedness Plan?

A Municipal Vulnerability Preparedness (MVP) plan identifies priority action items to address vulnerabilities and utilize strengths in preparation for climate change. In 2017, the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) initiated the state's MVP grant program to help communities become more resilient to the impacts of climate change. The program has two grant phases:

1. The first phase of grants are Planning Grants, which funds the vulnerability analyses, engagement, and planning processes. Towns convene a team of municipal staff, engage stakeholders in a Community Resilience Building (CRB) Workshop, and engage community members in developing the plan. Communities that complete the Planning Grant program and prepare an MVP plan are eligible for the second phase of MVP grant funding and receive increased standing for other state grants.
2. The second phase of the MVP program are Action Grants, which funds the implementation of priority climate adaptation actions described in the MVP plan. Since these Action Grants are only distributed to Massachusetts municipalities, they are less competitive than similar grants awarded at the national level.

Community Resilience Building Workshop

The Community Resilience Building Workshop was developed by the Nature Conservancy and provides a process for developing resilience action plans with stakeholder input. The process has been successfully implemented in over 400 communities.

The Community Resilience Building Workshop's central objectives are to:

- Define top local natural and climate-related hazards of concern
- Identify existing and future strengths and vulnerabilities
- Develop prioritized actions for the Community
- Identify immediate opportunities to collaboratively advance actions to increase resilience

Each step in the process (below) is rich in information and dialogue and results in actionable plans and strong collaboration.



1.4 Combining Hazard Mitigation and Municipal Vulnerability Preparedness Planning in Wilbraham

The Town of Wilbraham received an MVP Planning Grant and a FEMA Grant to simultaneously prepare an MVP plan in conjunction with an HMP plan. This combined approach enabled Wilbraham to consider the impacts of climate change in addition to historic hazard events as part of its planning process. Also, many of the required steps of the MVP process satisfy FEMA requirements for updating an HMP. For example, an MVP requires convening a Core Team and hosting a CRB Workshop and Public Listening Session, which are not required specifically by FEMA, but do meet the public input requirements of the hazard mitigation planning process.

The Town prepared this joint MVP-HMP in accordance with FEMA guidelines for hazard mitigation planning (*Title 44 Code of Regulations (CFR) 201.6*) and with the Massachusetts Executive Office of Energy & Environmental Affairs' (EOEEA) requirements for MVP plans. This approach followed the state's lead in adopting the first-ever Massachusetts State Hazard Mitigation and Climate Adaptation Plan (EEA and EOPSS, 2018). By completing a joint MVP-HMP, Wilbraham was able to fulfill the requirements and enhance the impact of both processes.

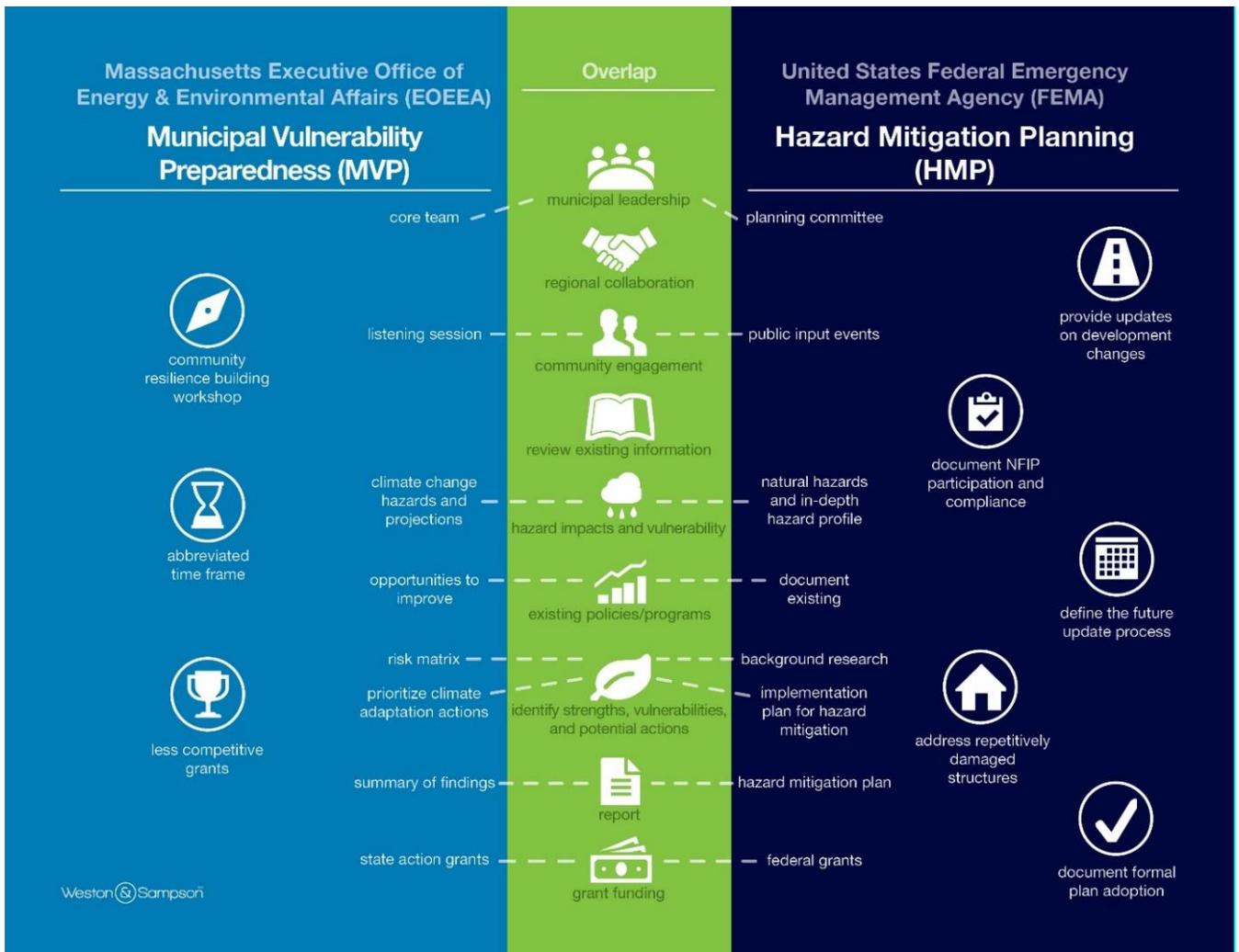


Figure 1-2. Comparison of the MVP and HMP Process

1.5 Planning Process Summary

Facilitating discussion among stakeholders about creating a safer, more resilient community is an important aspect of the natural hazard and climate change impact mitigation planning processes. The involvement of a variety of stakeholders in identifying mitigation strategies helps reflect the Town's values and priorities and builds greater community support and success in implementing actions that reduce risk. The planning and outreach strategy used to develop this MVP-HMP collected input from three categories of stakeholders:

1. The Core Team, which includes representation from municipal and local leadership.
2. Local, regional, and state-level stakeholders who could be vulnerable to, or provide strength against, natural hazards and climate change.
3. Residents, business owners, and all those who are interested in the Town's future.

1.5.1 Core Team

The Town of Wilbraham convened the Core Team to act as a steering committee for the development of the MVP-HMP. A kickoff meeting was held on January 5, 2021 to discuss the project overview and Core Team roles and responsibilities. The core Team was selected and the first meeting was held on February 2, 2021 to set goals for the planning process, provide input on historic hazard events, and plan for the CRB Workshop. More information on this meeting is included in Appendix A. The Core Team also provided regular input through email and interviews. The Core Team played an important role in identifying critical infrastructure, involving key stakeholders, and capturing the Town's capacity to mitigate hazard alongside ongoing operations. Members of the Core Team are listed in Table 1-2.

Table 1-2. Wilbraham's Core Team

Name	Title
Dena Grochmal	Engineer/DPW Coordinator
Tonya Basch	DPW Director/Town Engineer
Bill Sperrazza	Highway Department Superintendent
Jeff Smith	Planning Board Member
Mike Andrews	Fire Chief
Sue Bunnell	Finance Committee Member
Joe Lynskey	Engineering Technician

The Core Team and Pioneer Valley Planning Commission (PVPC) also suggested or made available reports, maps, and other pertinent information related to natural hazards and climate change impacts in Wilbraham. These included:

- Draft Open Space and Recreation Plan Update (Town of Wilbraham, 2021)
- Capital Improvement Plan (Town of Wilbraham, 2019)
- Hazard Mitigation Plan (PVPC, 2015)
- The Vision Task Force Report: Wilbraham Looks Forward (Town of Wilbraham, 2013)
- Community Development Strategy (Town of Wilbraham, 2006)
- Open Space and Recreation Plan (Town of Wilbraham, 2004)
- Wilbraham Master Plan (Town of Wilbraham, 1963)
- Massachusetts Climate Change Projections (NECSC, 2018)
- Massachusetts Climate Change Adaptation Report (EEA, 2011)
- Massachusetts State Hazard Mitigation and Climate Change Adaptation (EEA and EOPSS, 2018)
- Local Mitigation Planning Handbook, May 2017 (FEMA, 2017a)

- Storm Event Database, National Center for Environmental Information (NOAA, 2020)
- National Water Information System (USGS)
- Decennial Census (US Census Bureau, 2010)
- American Community Survey, 5-year estimates (US Census Bureau, 2019)

1.5.2 Stakeholder Involvement: Community Resilience Building (CRB) Workshop

Due to the COVID-19 pandemic, the Community Resilience Building (CRB) Workshop could not be conducted in person. Instead, the Town hosted a series of three online webinars on March 11th, March 12th, and March 16th, 2021. These meetings were organized around topic areas that included infrastructure, environment, and society. Stakeholders with subject matter expertise and local knowledge and experience, including public officials, regional organizations, neighboring communities, environmental organizations, and local institutions, were invited to attend. During these webinars, Weston & Sampson provided information about natural hazards and climate change, including the top four hazards impacting Wilbraham. Participants were invited to comment on and edit pre-selected infrastructural, societal, and environmental features in town that are vulnerable to, or provide strength against, these challenges.



Figure 1-3. Examples of infrastructural, environmental, and societal features in Wilbraham.

These include the Wilbraham police (left), Mt. Marcy Conservation Area (center) and Wilbraham Senior Center (right). Photos by the Town of Wilbraham and Wilbraham Police Department

Participants also identified and prioritized key actions that would improve the Town’s resilience to natural and climate-related hazards. A full list of community representatives who were invited and those who participated in the process are presented in Appendix C, along with the materials from each webinar. The broad representation of local and regional entities that participated in these webinars ensures that the MVP-HMP aligns with the operational policies and hazard mitigation strategies at different levels of government and implementation. Nineteen participants attended the infrastructure webinar, 17 participated in the community resilience webinar, and 16 at the natural resources webinar. A summary of key participants is included below.

- Municipal staff members from the Department of Public Works, Police Department, and Fire Department.
- Members of boards and committees, including the Planning Board, Community Preservation Committee, and Finance Committee.
- Representatives from local groups and companies, including Pioneer Valley Planning Commission, the Wilbraham Public Library, and New England Promotional Marketing.
- Representatives from State agencies, including the MVP Regional Coordinator.
- Delegate from the House of Representatives.

Health and other regional services			Use blackboard connect and rewrap website, flyers to provide information to community.	Heating and cooling stations. Heat resilience strategy		
Vector borne and infectious diseases	N/A	V	Send out flyers to community/post online information on mosquito, ticks. Don't leave standing water, etc. Use and rewrap relationships with local groups and organizations for outreach. Currently providing mosquito dunks on a limited basis to residents. Website will have information and press releases going in the local paper - residents need to apply. Get information out to people who are not aware of mosquito management (this isn't the people who are already managing mosquitoes) - mail flyers, get youth involved. Local public access, create infomercials, engage schools, promote them on the town website Library is a great resource for outreach and wifi access from the parking lot		Schools are mandated to spray their fields on a yearly basis and when EEE is noted. They also send out letters to parents. Mosquito district - funding to get started in this program and becoming regional partner - regional MVP Project	
Local Farms and Business Supply Chain	Wilbraham Grown effort (farmers market pre-covid)	S/V	Communicating to businesses through chamber of commerce		Food and refrigeration losses with loss of power	
People with possible barriers to building resilience (income, non-English speakers, immigrants, people of color, youth, seniors)		V	Hampton County Health Coalition - worked with residents to build grab and go kits, 3 days of supplies... used to have medical reserve corp, since this is regionalized now it's lost steam. Bring this back and provide residents with information on go kits and what they need to have in case of an emergency Communication list (get a master list of residents interested) to send out notifications to residents	Blackboard has a master list of residents, get a list from senior center and schools, create low, medium, high priority emails. Some may only want high priority emails. Check in on elderly neighbors to provide information, and create partnerships	Small, local businesses that the town can help with a response plan and getting a generator. Big V is near EJ area. How can other folks around town access supplies?	Glenn Drive wells - water main is being extended here. Evaluate hydraulic capabilities and cost to assess where water mains can be extended (part of risk and resiliency assessment). Other areas impacted - East Longmeadow Road
Food/Grocery/Gas Supplies		V	access to businesses can be limited (Woodland Dell flooding, Crane Park limited access - library, school, church, preschool; 2001 flood on Boston Road emergency repair can happen again)		power outages are a concern - look into which stores have backup power/type of power (Big V has generator supplied by a 1200 gallon diesel tank; home depot uses natural gas fuel cells has generator - these are both designed to get people out of the store and not to keep the store open and running) - what about smaller, local businesses? Do these businesses have a response plan if there is a hazard? - provide a response checklist for businesses limited access during rain or flooding/freeze	

Figure 1-4. A screenshot from Wilbraham's Community Resilience Building Webinar Recording

For each of these webinars, leadership from neighboring communities of Springfield, Ludlow, Palmer, Monson, Hampden, and East Longmeadow, Massachusetts were invited to participate.

The Wilbraham Planning Board is the primary Town agency responsible for regulating development. Additionally, residential development is regulated by the Zoning Board and the Building Department. Representatives from these three agencies were invited to participate in the Community Resilience Building workshops.

1.5.3 Public Listening Sessions

Due to the COVID-19 pandemic, the two required public listening sessions could not be conducted in person. As a solution, and to gather information from the community and educate community members on hazard mitigation and climate change, the Town pursued the following approach:

1. **Getting the Word Out:** This first step involved posting a video online along with an online survey to capture initial input. These online materials allowed residents to engage with the project on their own time, and as their scheduled allowed. The online materials were posted on the Wilbraham Town website and advertised through Wilbraham social media pages, email blasts, and other Town Facebook pages. The online survey received five responses. See Figure 1-5 for one response to the online survey.

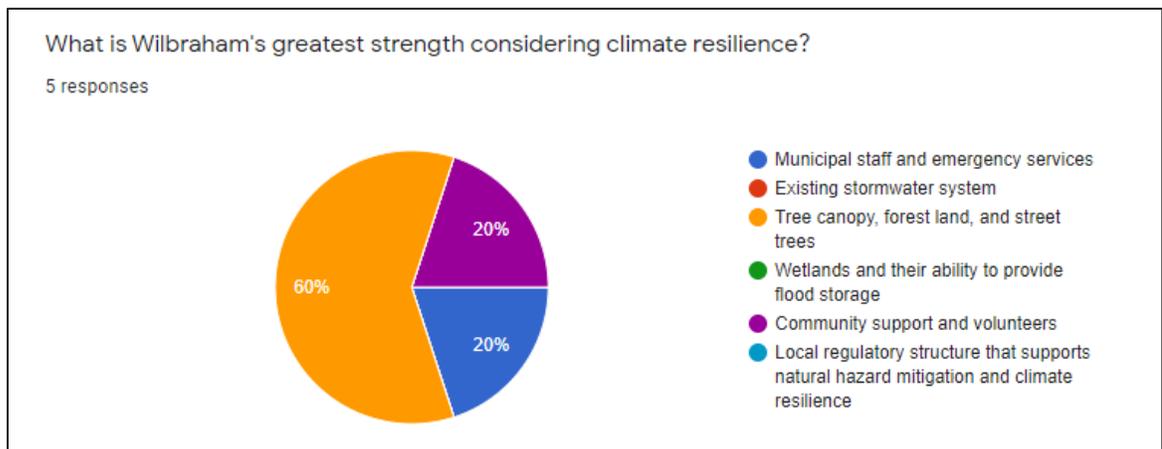


Figure 1-5. Responses to the Online Survey

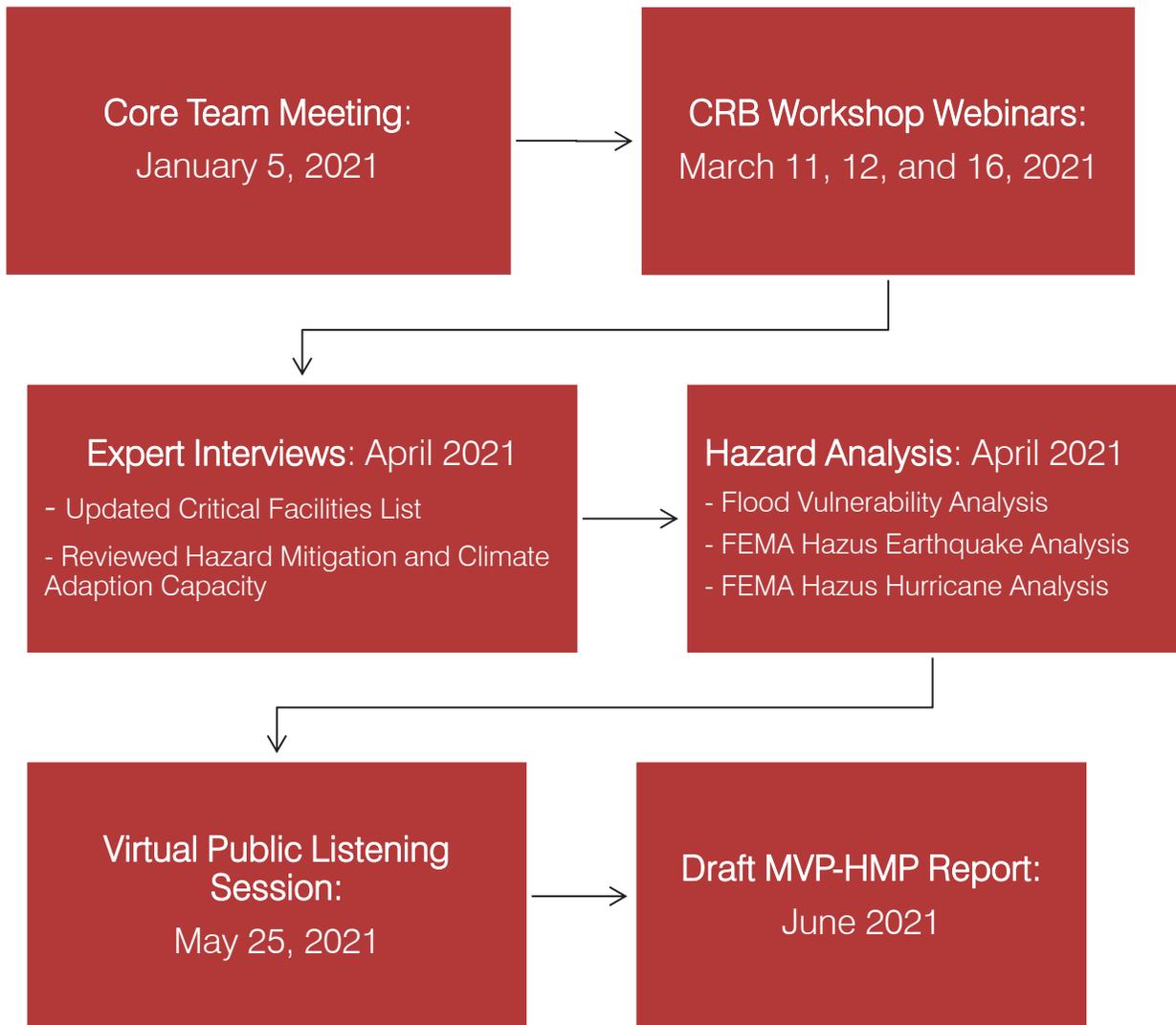
- 2. Virtual Webinar:** This second step involved hosting and recording a Virtual Public Listening Session Webinar. More information on this webinar is included below.

The project team planned the webinar to maximize participation and engagement. Step-by-step instructions for joining the webinar were shared with attendees in advance, and moderators were on-hand to assist participants with troubleshooting. The webinar started with an icebreaker that allowed attendees to introduce themselves as they joined the call, share their favorite thing about the Town, and test out the webinar's audio and "chat" function. The staffing plan for the meeting included a main facilitator to present information and encourage discussion and a second facilitator to help field questions and moderate the chat. The team also created a presentation that prioritized dynamic, accessible visuals over text-heavy slides.

The webinar presented information related to the MVP program, climate change in Wilbraham, local strengths and vulnerabilities, existing mitigation measures, and priority action items for future climate adaptation. More information about the virtual Public Listening Session, including a summary of survey responses, is available in Appendix D.

1.5.4 Planning Timeline

The MVP-HMP planning process proceeded according to the timeline below.



2.0 HAZARD MITIGATION AND CLIMATE ADAPTATION GOALS

The Town of Wilbraham's Core Team convened to discuss, review, and endorse the following hazard mitigation and climate adaptation goals for the MVP-HMP.

Protection: Develop programs, strategies, and actions to protect the following Town assets from natural hazards and climate change impacts:

- Residents, with an emphasis on supporting the elderly, young, and environmental justice neighborhoods
- Cultural and historic resources
- Critical infrastructure
- Utilities, including electric power, water, and wastewater
- Public facilities and services
- Homes and businesses
- Open space and other environmental features
- Future development

Planning: Incorporate climate adaptation and hazard mitigation measures into local plans, bylaws, regulations, and practices to protect critical infrastructure and property and to encourage resilient development, based on up-to-date information on climate change projections and emerging risks. Incorporate other ongoing planning efforts in the HMP update and find synergies for mitigating risks associated with terrorism and pandemics.

Nature-based Solutions: Investigate, design, and implement hazard mitigation and climate adaptation measures that employ nature-based solutions and protect the natural environment.

Coordination: Collaborate in hazard mitigation planning and climate adaptation with utility providers, local businesses, institutions, non-profits, surrounding communities, and state, regional and federal agencies.

Capacity: Increase the capacity for all Town departments, committees, and boards to respond to climate change impacts and natural hazard events with adequate data, guidance, staff, training, and equipment.

Public Outreach: Increase awareness and provide resources for hazard mitigation and climate resilience to businesses and residents through outreach and education.

Funding: Identify and seek funding for measures to mitigate or eliminate each known significant hazard area and reduce the impacts of climate change.



3.0 COMMUNITY PROFILE, LAND USE, AND DEVELOPMENT TRENDS



Figure 3-1. Fountain Park (Town of Wilbraham, 2013)

3.1. Community Profile

Wilbraham was once known as Minnechaug and was home to the Nipmuc, a group of Algonquin people. Today, over 500 remaining Nipmuc live in and around the Chaubunagunamaig Reservation in Webster and the Hassanamisco Reservation in Grafton (MHC, n.d.). When Wilbraham was settled by colonials in 1730, it was known as the Outward Commons and was a part of Springfield, Massachusetts. It was officially incorporated as its own Town in 1763, with a population of 400 residents. In the 19th century, the Collins Manufacturing Company in the northern end of town was the Wilbraham's main employer. At one point in time, Wilbraham was famous for its peach orchards, some of which can still be found growing at the foot of the Wilbraham Mountain Range. Wilbraham Center housed many farms, including Bennet's Turkey Farm, Pheasant Farm, and Rice's Fruit Farm. There were also several potato farms in the south end of town. None of these farms are still in operation today. Farming in Wilbraham is now limited to around a dozen specialized farms.

The developed areas of Wilbraham are primarily residential. This has led to a development of residential amenities, including an official fire department in 1920, a water system in 1926, a zoning and planning board developed 1928, and matured in 1946, and a police department was established around 1954. In 2019, the population of Wilbraham was 14,689, a 3% increase from 2010 (U.S. Census Bureau, 2019), and is expected to increase to 14,947 by 2040 (Donahue Institute, 2018).

Wilbraham is located on the east side of central Hampden County, bordered by Springfield to the west, Ludlow to the north, Palmer to the northeast, Monson to the east, Hampden to the south, and East Longmeadow to the southwest. Governance of Wilbraham is overseen by a Board of Selectmen with three members, each serving a three-year term. The town holds an annual town meeting every spring, and also has an open town meeting rule. The Town maintains a website at wilbraham-ma.gov.

A small neighborhood on the western side of Wilbraham, abutting Springfield, is classified as an environmental justice community based on income. Adjacent to Wilbraham, the city of Springfield has environmental justice populations based on minority populations, income, and English isolation. Table 3-1 overviews the population demographics in Wilbraham.

Table 3-1. Population Demographics

	2019	Wilbraham	Massachusetts
	Population	14,689	6,892,503
	Under the Age 18	21%	19.6%
65+	Over Age 65	21.2%	17%
	Bachelor's degree or higher	47.4%	45%
	Median household income	\$109,191	\$85,843
	Poverty Rate	2.8%	9.4%
	With a Disability	7.5%	11.5%
	Limited English-Speaking Skills	2.4%	9.2%
	Housing units	5,321	2,928,732
	Renter-Occupancy Rate	9.8%	37.6%

(US Census Bureau, 2019)



Figure 3-2. Minnechaug Regional High School
(Hampden-Wilbraham Regional School District 2020)

3.2. Societal Features

Wilbraham offers numerous social services including a public library, transportation services, a council on aging/senior center, a hiking club, and a regional YMCA. The Town's many services and community involvement are strengths that can be utilized for hazard mitigation and resiliency planning, especially to reach the Town's most vulnerable populations. Vulnerable populations include residents whose everyday stressors make it harder to adapt and recover when shocks or hazards occur. In Wilbraham, seniors, youth, people who are disabled, non-English speakers, and low-income individuals are considered vulnerable. Seniors are the largest vulnerable group in

Wilbraham and represent 21.2% of the total population, just slightly larger than youth who make up 20% of Wilbraham’s population (Table 3-1). Organizations representing older residents include the Council on Aging, the Library, and the Health Department. Wilbraham is home to the Minnechaug Regional High School and Wilbraham Middle School, as well as multiple day care centers. The former Pines School has been repurposed and expanded to its current use as a senior center, preschool, and elderly housing (OSRP, 2014).

3.2.1. CRB Workshop Discussion of Societal Features

Workshop participants identified key societal aspects of Wilbraham that are most vulnerable to, or provide protection against, natural hazards and climate change impacts (Table 3-2).

Table 3-2: Societal Features Identified in the CRB Workshop

Strengths	Vulnerabilities
<ul style="list-style-type: none"> • Health and other regional services • Local farms • Community outreach 	<ul style="list-style-type: none"> • Vector borne and infectious diseases • Business supply chain disruption during a hazard • People with possible barriers to building resilience



Figure 3-3: Societal features in Wilbraham.

Council on Aging Christmas Event, Wilbraham Community Gardens, and Senior Center Transportation (left to right; Town of Wilbraham 2020)

3.3. Economic Features

As a suburb of Springfield, Wilbraham’s identity has shifted since its founding as an agricultural community to a primarily residential community where the majority of the population (over 80%) commutes out of Town for professional employment. On average, Wilbraham residents travel twenty-seven minutes to work, which is four minutes shorter than the State average. The current unemployment rate of 1.4% is lower than the state average (Table 3-3). Some industries are located in the northern section of town, though Springfield remains the primary economic hub in the area: however, communication between businesses and the Town about hazard mitigation planning efforts and developing emergency protocols will remain key to increasing resilience.

Table 3-3: Economic Statistics

	Wilbraham	Massachusetts
Labor Force	7,975	3,858,104
Unemployment Rate	4.4%	6.0%
Employed in Top Employment Industry - Manufacturing	15.2%	8.9%
Mean Travel Time to Work (minutes)	36.8	29.7

(United States Census Bureau, 2019)

3.4. Infrastructure Features

The northern section of Wilbraham is bisected by I-90 and Route 20, both running east to west. The Town of Wilbraham Department of Public Works maintains the local roadways in town, while the Massachusetts Highway Department maintains state roads that are outside of municipal jurisdiction. The towns of Hampden and Wilbraham have a regional school system, and the high school, middle school, and three elementary schools are located in Wilbraham. Other important facilities in Wilbraham include the Police Station, Fire Department, Town Hall, and Department of Public Works headquarters. Wilbraham’s telephone infrastructure is serviced by Verizon.

Around two-thirds of Wilbraham residents receive drinking water from the Town. The Town of Wilbraham’s public water supply is drawn from the Chicopee Valley Aqueduct and Quabbin Reservoir, provided by Massachusetts Water Resource Authority (MWRA), and managed by the Wilbraham Water Department (WWD). The Quabbin Reservoir is located north of Wilbraham. The water is chlorinated at the MWRA disinfection facility in Ware and then piped through Ludlow to Wilbraham. The pipeline transfers over to WWD infrastructure when it reaches the area of the Miller Street meter valve. This facility houses a water use meter and chemical feed facilities. Water is then piped across the Chicopee River into Wilbraham. The bridge crosses in an area with two geological faults. The crossing was previously rehabilitated, and the bridge and pipeline were designed for seismic activity. Dual transmission mains are also installed under a railroad track after they enter the town.

The water distribution system in Wilbraham includes approximately 74 miles of pipes, ranging between 6 inches and 24 inches in diameter. The majority of the system is gravity fed, except for four higher elevation areas of town that require pumps. There is one water storage tank in Wilbraham, a 40-foot-high concrete structure with 2.1 million gallons of storage capacity. Wilbraham has received approval for a supplemental ground water supply but it has not been put into production or tied into the distribution system (Wilbraham, 2004).

Seventy percent of the town’s wastewater is serviced by private septic systems, while wastewater from the other thirty percent (approximately 1,000 customers) is pumped to Springfield for treatment and discharge. The town maintains eight sewer pump stations and 24 miles of sewer main in the town. In 2019, the system had an average daily flow of approximately 209,000 gallons per day (OSRP, 2021).

Hazardous materials are stored and transported nearby and within Wilbraham. There is a 10-million-gallon natural gas storage tank in Ludlow, located near the Cottage Ave Bridge that crosses the Chicopee River into Wilbraham. Wilbraham provides fire protection for this facility. There are also two natural gas pipelines that cross the Cottage Ave Bridge from Ludlow into Wilbraham directly above

the water main. Any event that compromised the bridge, storage tank, or natural gas pipelines would also compromise Wilbraham’s drinking water supply (Wilbraham, 2004).



Figure 3-4: Infrastructural features in Wilbraham.

The Police Department (left) and a Wilbraham Fire Truck (right; Town of Wilbraham)

3.4.1. CRB Workshop Discussion of Existing Infrastructure

Workshop participants identified key infrastructure features in Wilbraham that are most vulnerable to, or provide protection against, natural hazards and climate change impacts. As noted below in table 3-4, participants are concerned about unmaintained and undersized infrastructure as storm events continue to worsen with climate change.

Table 3-4: Infrastructural Features Identified in the CRB Workshop

Strengths	Vulnerabilities
<ul style="list-style-type: none"> Municipal Buildings 	<ul style="list-style-type: none"> Undersized culverts and stormwater infrastructure Electric grid and lack of redundant power Utility Infrastructure and pipelines (including water and wastewater infrastructure) Bridges require maintenance Dams Flooding at municipal buildings

3.5. Environmental Features

Wilbraham has a total land area of just over 22 square miles. The Chicopee River makes up the northern border of town and there are a plethora of ponds and streams throughout Wilbraham, some of which feed into the Chicopee. Other water bodies in Wilbraham include Spectacle Pond, Nine Mile Pond, Bennett Pond, Bruuer Pond, North Branch Mill River, South Branch Mill River, Spear Brook, Big Brook, Thayer Brook, Cadwell Brook, Twelve Mile Brook, Calkins Brook, and several other small or unnamed bodies of water. Among these, Sawmill Pond, Nine Mile Pond, Bruuer Pond and the upstream Woodland Dell are sources of localized flooding.

Additionally, there are ten Natural Heritage and Endangered Species Program (NHESP) certified Vernal Pools, three NHESP natural communities, and multiple areas of NHESP priority habitat of rare species. Nonpoint source pollution is a concern within many of the waterbodies (including stormwater runoff, yard fertilizers, etc.). There are several aquifers within the town boundaries and surrounding towns. A high yield aquifer is located on the border of Wilbraham and Ludlow, beneath

the Chicopee River and Spectacle Pond area. A medium yield aquifer runs north-south through the center of Wilbraham, and spreads as far as Springfield to the West and Connecticut to the south. Wilbraham is also home to designated cold-water fisheries that support brown, brook, and rainbow trout. Just over a quarter of Wilbraham is developed, and the majority of the remaining land is still natural land or open space. Wilbraham has been a Community Preservation Act town since 2004, allowing for the town to raise funds to expand their open space.

In 2021 Wilbraham completed its 2022-2028 Open Space and Recreation Plan Update, with the goal of preserving “significant open space by investigating, educating, planning and cooperating.” The plan serves as a guide for future management, development and protection of the precious resources which are at the very heart of the community character of Wilbraham (OSRP, 2021). The plan strikes a balance between competing demands associated with growth and economic development with those for preservation of the natural and historic environment. The plan looks towards the future and that is demonstrated by the climate resiliency measures that have been included since the previous plan.

Unlike many New England municipalities, Wilbraham does not have any hazardous waste or brownfields sites. Four previously identified clean-up sites have achieved Response Action Outcome (RAO) status, meaning that response actions were sufficient to achieve a level of no significant risk. Future potential development represents both a strength and vulnerability and proper oversight and consideration of natural resources needs to be paramount in siting and design. Wilbraham has many protected conservation areas made up of hardwood forests, swamps, parks, ponds, and fields, totaling nearly 1,000 acres. Although these assets are considered a strength, forests fires can be a threat because they occasionally burn and can spread quickly if not controlled. Future drought conditions and lack of forest management could perpetuate uncontrolled burns and shift this resource toward a vulnerability.



**Figure 3-5. Environmental features in Wilbraham
Sevey Park, Chicopee River, hiking trails (Town of Wilbraham, 2020)**

3.5.1. *CRB Workshop Discussion of the Environment*

Workshop participants identified key environmental features in Wilbraham that are most vulnerable to, or provide protection against, natural hazards and climate change impacts (Table 3-5).

Table 3-5: Environmental Features Identified in the CRB Workshop

Strengths	Vulnerabilities
<ul style="list-style-type: none"> • Need Planning and bylaws protect the town • Open space • Local agriculture • Strong volunteer base lead by OSRPC 	<ul style="list-style-type: none"> • Invasive species • Lack of new volunteers to maintain town-owned land • Flooding of open space • Agriculture runoff and other contaminants in waterbodies

3.6. Land Use

Wilbraham is approximately 14,293 acres in size. Just over one-half of the land in Wilbraham is undeveloped. Of the undeveloped land in Wilbraham, 16.5% is protected, 17.1% is semi-protected land with conservation, agricultural, or recreational restrictions, and 17.7% is unprotected. 48.6% of the land in Wilbraham is developed, as shown in Figure 3-6.

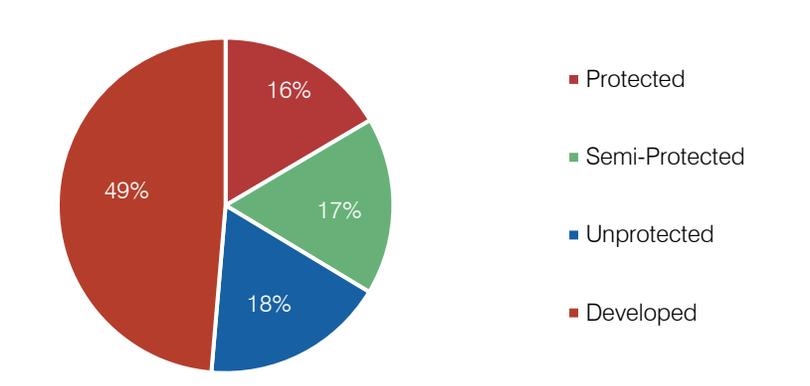


Figure 3-6. Land Use Distribution in Wilbraham, MA

3.7. Recent and Potential Development

Most recent and planned development in Wilbraham is new residential development or redevelopment. Since 2015, 175 residential developments have gone through planning board, zoning board, and building department permitting and approval. The Town tracks all permits through these three departments and boards by applicant, date, and a description of the development or redevelopment. Not all of the new developments are residential. In 2015, a 6.5-acre solar energy system was installed along Main Street, in 2016 a new school bus garage was constructed, and in 2018 a Cumberland Farms gas station and convenience store was constructed along Post Office Park. A full list of developments since 2015 can be found in Appendix B.

3.8. Community Lifelines and Critical Facilities

Community lifelines and critical facilities are extremely essential components to the Town's function and protecting them from natural hazards is paramount. Critical facilities include:

1. Resources that can be utilized to respond and recover from natural hazards.
2. Facilities where additional assistance might be needed.
3. Hazardous sites that could be dangerous if it is compromised during a natural disaster.

Community lifelines and critical facilities in the Town of Wilbraham have been identified with help from knowledgeable Town staff, MassGIS data, and existing Town and regional plans, including the Town of Wilbraham Hazard Mitigation Plan (PVPC, 2015). Community lifelines and critical facilities have been separated into eleven categories in Table 3-6 below.

Table 3-6: Community Lifelines and Critical Facilities

Feature Type	Name	Location
SAFETY AND SECURITY		
Emergency Operations Center	Wilbraham Police Station	2780 Boston Rd
	Wilbraham Fire Department Headquarters	2770 Boston Rd
Alternate Emergency Operations Center	Wilbraham Town Hall	240 Springfield St
Department of Public Works	Department of Public Works Headquarters	2721 Boston Rd
Other Public Safety Building	Fire Station #2	6 Woodland Dell Rd
FOOD, WATER, SHELTER		
Agriculture	Rice Fruit Farm	757 Main St
	Stony Hill Farm	899 Stony Hill Rd
	Merrick Farm	651 Main St
	Fern Valley Farms	758 Main St
	Suburban Artisan farm	33 Delmor Ave
Grocery	Big Y	2035 Boston Rd
Designated Shelter	Minnechaug Regional High School	621 Main St
Informal Shelters and Food Assistance Support	Senior Center/YMCA	45B Post Office Park
	Wilbraham Public Library	25 Crane Park Dr.
Drinking Water Supply	Corrosion Control Facility	Millers Street, Ludlow
	Old Orchard Pump Station	-
	Brookmont Pump Station	-
	McIntosh Pump Station	-
	Glen Drive Pump Station	-
	Storage Tank	Bartlett Court
	Private Wells	1/3 of town
Wastewater	Private Septic Systems	2/3 of town
	Former Wastewater Treatment Facility (used for backup storage only)	2480 Boston Rd
	Primary pump station #1	56 River Road
	Primary pump station #2	2840 Boston Road
	Secondary pumping station #1	31 Cottage Ave
	Secondary pumping station #2	30V Fernwood Dr

Feature Type	Name	Location
	Secondary pumping station #3	621 Main St
	Secondary pumping station #4	399-421 Main St
	Secondary pumping station #5	Wellfleet
	Secondary pumping station #6	Dudley St
	Secondary pumping station #7	Linwood
	Secondary pumping station #8	45 Post Office Park
	Secondary pumping station #9	-
HEALTH AND MEDICAL		
Ambulance Service	Wilbraham Fire Station Headquarters	2770 Boston Rd
	Wilbraham Fire Station #2	6 Woodland Dell Rd
End of Life Facilities	Wilbraham Funeral Home	2551 Boston Rd
	Adams Cemetery	Tinkham Rd
	East Wilbraham Cemetery	Boston Rd
	Glendale Cemetery	Glendale Rd
Health Services	Boston Road Medical Association	2377 Boston Rd
	Baystate Medical Practice (aka Wing Memorial Hospital)	2344 Boston Rd
	Urgent Care of Wilbraham	2040 Boston Rd
	Orchard Valley Rehab Center	Boston Road
	Life Care Center of Wilbraham	2399 Boston Rd.
Long-term Care or Assisted Living	Vero Nursing Home	Maple Street
	ENERGY	
Electricity – National Grid	Electrical substation	Main Street
	Power transmission line	Map forthcoming, western side of Town
Natural Gas - Eversource	Liquefied natural gas pipeline	Throughout town; high pressure main goes through the center of town
	Storage Tank	Ludlow
Portable Generators	DPW stores at former WWTP	2480 Boston Rd
Emergency Fuel Station	Wilbraham Fire Station Headquarters for all town facilities, diesel and gas	2770 Boston Road
Sites with Emergency Generators	Town Hall	240 Springfield Street
	Police Station	2780 Boston Road
	Fire Station	2770 Boston Road
	Department of Public Works	2721 Boston Rd

Feature Type	Name	Location
	Minnechaug High School	621 Main St
	IT/Facilities Building (generator)	Main Street
	10 wastewater pump stations	-
	5 drinking water pump stations	-
COMMUNICATIONS		
Cell Towers		On Merick's property off of Tinkham
		Ridge Road
Public Safety Communication Towers	Wilbraham Fire Station Headquarters	2770 Boston Road
		Ridge Road
External Communication	Blackboard Connect	-
TRANSPORTATION		
Evacuation Routes	-	Route 20
	-	Stony Hill Rd
	-	Springfield St
	-	Monson Rd
	-	Ridge Rd
Rail	CSX Railroad	Follows Boston Rd
Transit	Senior Center Van	On demand service
Salt Storage	Minnechaug Regional High School	621 Main St
	Department of Public Works Headquarters	2721 Boston Rd
HAZARDOUS MATERIAL AND WASTE MANAGEMENT		
Waste Management	Wilbraham Transfer and Recycling Station	2720 Boston Rd
	Private transfer station for MSW and CND, serviced by rail	120 Old Boston Rd
Former Landfills	Wilbraham Sullivan Landfill	2668 Boston Rd
	Wilbraham Lindsay Landfill	Boston Rd/Railroad Ave
	Wilbraham Grassy Hollow Landfill	2720 Boston Rd
Chapter 21E Potentially Tier Classified Site	Lower Maintenance Garage (Tier II)	2420 Boston Rd
	Unknown (Tier 1D)	7 Wilbraview Dr
Underground Storage Tanks	Oconnells Convenience Plus 34	1993 Boston Rd
	Friendlys Ice Cream Llc	1855 Boston Rd
	Exxonmobil Oil Corp	1828 Boston Rd, Springfield
	Wilbraham Fire Dept	2770 Boston Rd

Feature Type	Name	Location
	Lower Pioneer Valley Ed Collabora	10 Dollar Ave
	Rocky Mountain Wood Co Inc	2660-R Boston Rd
	Cs-Ma Llc DbA Construction Service	2420 Boston Rd
	Purr-Fect Auto	467 Main St
	Minnechaug Regional High School	621 Main St
Other – Large Quantity Toxic User (others designated with*)	Norpin Manufacturing Co Inc	2342 Boston Rd
Tier II Facility	U.S. Postal Service Wilbraham Post Office	40 Post Office Park
	CS-MA LLC DBA Construction Service*	2420 Boston Rd
	National Grid-Wilbraham 507	2 Church Ln
	Verizon WILBRAHAM CO (VZ-MA858706)	303 Main St
	Utility Mfg. Co.*	2443 Boston Rd
	Lower Pioneer Valley Educational Collaborative	2045 Boston Rd
	The Home Depot Store #2678	2001 Boston Rd
	Balise Ford of Wilbraham	1979 Boston Rd
	Friendly's Manufacturing and Retail, LLC*	1855 Boston Rd
	Keating Wilbert VaultCo.,Inc.	1840 Boston Rd
COMMUNITY AND CULTURAL SITES		
Economic Centers	Village Business District	
	Boston Road	
Religious Centers	Church of the Epiphany	20 Highland Ave
	Wilbraham United Church	500 Main St
	Christ the King Lutheran Church	758 Main St
	St. Cecelia's Parish	42 Main St
	Evangel Assembly of God	348 Stony Hill Rd
	Grace Union Church	10 Chapel St
Schools	Mile Tree Elementary	625 Main St
	Minnechaug Regional High School	621 Main St
	Soule Road Elementary	300 Soule Rd

Feature Type	Name	Location
	Stony Hill School	675 Stony Hill Rd
	Wilbraham Middle School	466 Stony Hill Rd
	Wilbraham and Monson Academy	423 Main St
	The Kids Place, Inc.	2149 Boston Rd
Historic Sites	Old Meeting House	450 Main St
	Maple Street Historic District	
	Grange Hall	485 Main Street
REGIONAL FACILITIES		
Hospital/Medical Response	Baystate Wing Hospital	40 Wright St, Palmer
	Baystate Medical Center	759 Chestnut St, Springfield
Wastewater	Springfield Regional Wastewater Treatment Facility	Bondi's Island in Agawam
NATURAL RESOURCE ASSETS		
BioMap2 Areas	-	See Appendix C Maps
Groundwater Protection Areas	-	See Appendix C Maps
Surface Water Protection Areas	-	N/A
Parks and Open Space	-	See Appendix C Maps
Waterbodies	-	See Appendix C Maps
OTHER		
Dams Listed with Hazard Class NJ: Non-Jurisdictional	Collins Hydroelectric Dam - Low	
	Red Bridge Dam – Significant	Ludlow
	Ludlow Manufact. Assoc. Dam - High	Ludlow
	Collins Pond Dam - Significant	Ludlow
	Rice Pond Dam (NJ) – Low	-
	Fruit Farm Pond Dam – Low	-
	Bennett Pond Dam – Significant	-
	Guidette Pond Dam (NJ) - High	-

4.0 HAZARD PROFILES, RISK ASSESSMENT & VULNERABILITIES

Each hazard profile contains information on the areas vulnerable to the hazard, documentation of historic events, a risk and vulnerability assessment, and related climate change projections. The risk and vulnerability assessment examines both the frequency and severity of hazards and their potential impact to the Town of Wilbraham. Each hazard risk and vulnerability assessment use previous occurrences and climate projections to identify high risk areas and the likelihood that a hazard will occur. The vulnerability analysis takes into consideration various factors in the community, including existing and future buildings, infrastructure, and critical facilities. In some cases, an estimate of the potential dollar loss to vulnerable structures is available. Land uses and development trends were also considered as part of the flood vulnerability assessment.

The hazard profiles were updated with information from the 2013 Massachusetts State Hazard Mitigation Plan (MEMA and DCR, 2013); the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP; EEA and EOPSS, 2018) and additional research and assessment conducted by the project team. The Core Team, CRB Workshop, and Listening Session results provided local accounts of each hazard. A Geographic Information System (GIS) assessment was conducted to analyze the potential impact of flooding in Wilbraham on current and future development. FEMA's Hazus software was used to model the potential damage from hurricanes and earthquakes.

4.1 Overview of Hazards and Impacts

4.1.1 Massachusetts State Hazard Mitigation and Climate Adaptation Plans

The 2013 Massachusetts State Hazard Mitigation Plan (MEMA and DCR, 2013) and the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP; EEA and EOPSS, 2018) examined the natural hazards that have the potential to impact the Commonwealth. These plans summarize the frequency and severity of hazards of greatest concern. The frequency classification range from very low to high. Severity classifications range from minor to catastrophic.

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

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

Severity

- *Minor*: Limited and scattered property damage; limited damage to public infrastructure and essential services not interrupted; limited injuries or fatalities.
- *Serious*: Scattered major property damage; some minor infrastructure damage; essential services are briefly interrupted; some injuries and/or fatalities.
- *Extensive*: Widespread major property damage; major public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and/or fatalities.
- *Catastrophic*: Property and public infrastructure destroyed; essential services stopped; numerous injuries and fatalities.

Table 4-1 summarizes the frequency and severity of hazard risk in the State overall. These frequency and severity classifications for the State provide guidance to the Town in prioritizing their own mitigation actions for each hazard.

Table 4-1. Massachusetts Hazard Risk Summary

Hazard	Frequency Massachusetts	Severity Massachusetts
Inland Flooding	High (1 flood disaster declaration event every 3 years; 43 floods per year of lesser magnitude)	Serious to Catastrophic
Dam failures	Very Low	Extensive to Catastrophic
Coastal Hazards	High (6 events per year over past 10 years)	Serious to Extensive
Tsunami	Very Low (1 event every 39 years on East Coast, 0 in MA)	Extensive to Catastrophic
Hurricane/Tropical Storm	High (1 storm every other year)	Serious to Catastrophic
High Wind (Severe Weather)	High (43.5 events per year)	Minor to Extensive
Tornadoes (Severe Weather)	High (1.7 events per year)	Serious to Extensive
Thunderstorms	High (20 to 30 events per year)	Minor to Extensive
Nor'easter	High (1 to 4 events per year)	Minor to Extensive
Snow and Blizzard (Severe Winter Weather)	High (1 per year)	Minor to Extensive
Ice Storms (Severe Winter Weather)	High (1.5 per year)	Minor to Extensive
Earthquake	Very Low (10-15% probability of magnitude 5.0 or greater in New England in 10 years)	Minor to Catastrophic
Landslide	Low (once every two years in western MA)	Minor to Extensive
Brush Fires	High (at least 1 per year)	Minor to Extensive
Extreme Temperatures	High (1.5 cold weather and 2 hot weather events per year)	Minor to Serious

Hazard	Frequency	Severity
	Massachusetts	Massachusetts
Drought	High (8% chance of “Watch” level drought per month [recent droughts in 2020 and 1960s])	Minor to Serious

Table adapted from the 2018 SHMCAP and 2013 Massachusetts State Hazard Mitigation Plan

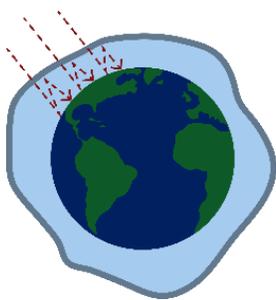
Not all hazards included in the 2018 State Hazard Mitigation and Climate Adaptation Plan or the 2013 Massachusetts State Hazard Mitigation Plan apply to the Town of Wilbraham. Given Wilbraham’s inland location, coastal hazards and tsunamis are unlikely to affect the Town. Given the type of fires that have occurred in Wilbraham’s history, the Town will focus on brush fires rather than wildfires. It is assumed that the entire Town of Wilbraham and its critical facilities are exposed to earthquakes, high wind events, hurricanes, winter storms, temperature extremes, and snow and ice, to a similar extent. Flood risk from riverine flooding is elevated in the vicinity of flood zones. Landslides are more likely in areas with more unstable soil types and steep slopes.

4.1.2 Federally Declared Disasters in Massachusetts

Tracking historic hazards and federally declared disasters that occur in Massachusetts, and more specifically Hampden County, helps planners understand the possible extent and frequency of hazards. Historically, Massachusetts has experienced multiple types of hazards, including flooding, blizzards, and hurricanes. Since 2000, there have been 29 storms in Massachusetts that resulted in federal disaster declarations. Seventeen disaster declarations occurred in Hampden County. Federally declared disasters present additional FEMA grant opportunities for regional recovery and mitigation projects. The hazard profiles included in this chapter contain more information about federally declared disasters.

4.1.3 Impacts of Climate Change

Many of the hazards that Wilbraham commonly experiences are projected to increase in both severity and frequency due to climate change. Climate change refers to changes in regional weather patterns that are linked to warming of the Earth’s atmosphere as a result of both human activity and natural fluctuations. The Earth’s atmosphere has naturally occurring greenhouse gases (GHGs) like carbon dioxide (CO₂) that capture heat and contribute to the regulation of the Earth’s climate. When fossil fuels (including oil, coal and gas) are burned, GHGs are released into the atmosphere and the Earth’s temperature tends to increase. The global temperature increase affects the jet stream and climate patterns.



Due to these changes, the future climate in Massachusetts is expected to resemble historic climate patterns of Southern New England or Mid-Atlantic States more closely, depending upon GHG emission scenarios. Climate change has already started to impact Massachusetts and these trends are likely to continue. Climate change is anticipated to affect Massachusetts’s typical precipitation cycle, leading to more intense rainfall and storms and more episodic or flash droughts. Temperatures will increase in both summer and winter. Each of the hazard profiles provided below includes more detail on how hazard frequency and intensity is likely to shift with climate change.

4.1.4 Top Hazards as Defined in the CRB Workshop

Workshop participants were asked to identify the top four hazards/climate change impacts that Wilbraham faces. Extensive discussion led to the selection of the following:

-  Intense Rainfall
-  Ice, Snow, and Wind
-  Drought
-  Extreme Temperatures

The workshop was designed to bring stakeholders together to brainstorm action items that will result in a more climate resilient future while also supporting the Town's unique features and characteristics. Concerns related to hazardous events such as flooding, and snowstorms were topics of discussion. Stakeholders cited multiple areas throughout town that experienced flooding, due to stream erosions, sedimentation, and buildup of vegetation in streambeds and culverts, and discussed possible improvements. Workshop participants also reviewed challenges impacting the school, isolated populations, and municipal infrastructure. There was extensive discussion about winter storms, wind events causing power outages and downed trees, and the potential for future events to worsen in frequency and severity. Stakeholders described how power outages from severe storms can leave many residents without power for extended periods, and how backup power is needed at critical Town buildings. Wilbraham has abundant forested areas, which can be a great strength to the community, but can also be a challenge when trees cause damage to overhead power lines and make roads impassable during strong storms. Workshop participants highlighted that access to communications, power, and backup power sources during natural hazard events is one of the most pressing issues. There was discussion about applying a "Dig Once" policy for underground power lines in Wilbraham to reduce costs while creating more resilient infrastructure overall.

Workshop participants discussed examples of localized flooding experienced during extreme precipitation events. Areas that experience recurring flooding may limit emergency access to assist vulnerable populations during an extreme event. The sizing of storm water drainpipes in lower lying areas, as well as hilly areas where drainage issues occur, is critical for resilience, as well as encouraging natural infiltration. Some drains may need to be updated to accommodate flash flooding events and recharge areas identified to manage increasing precipitation under climate change.

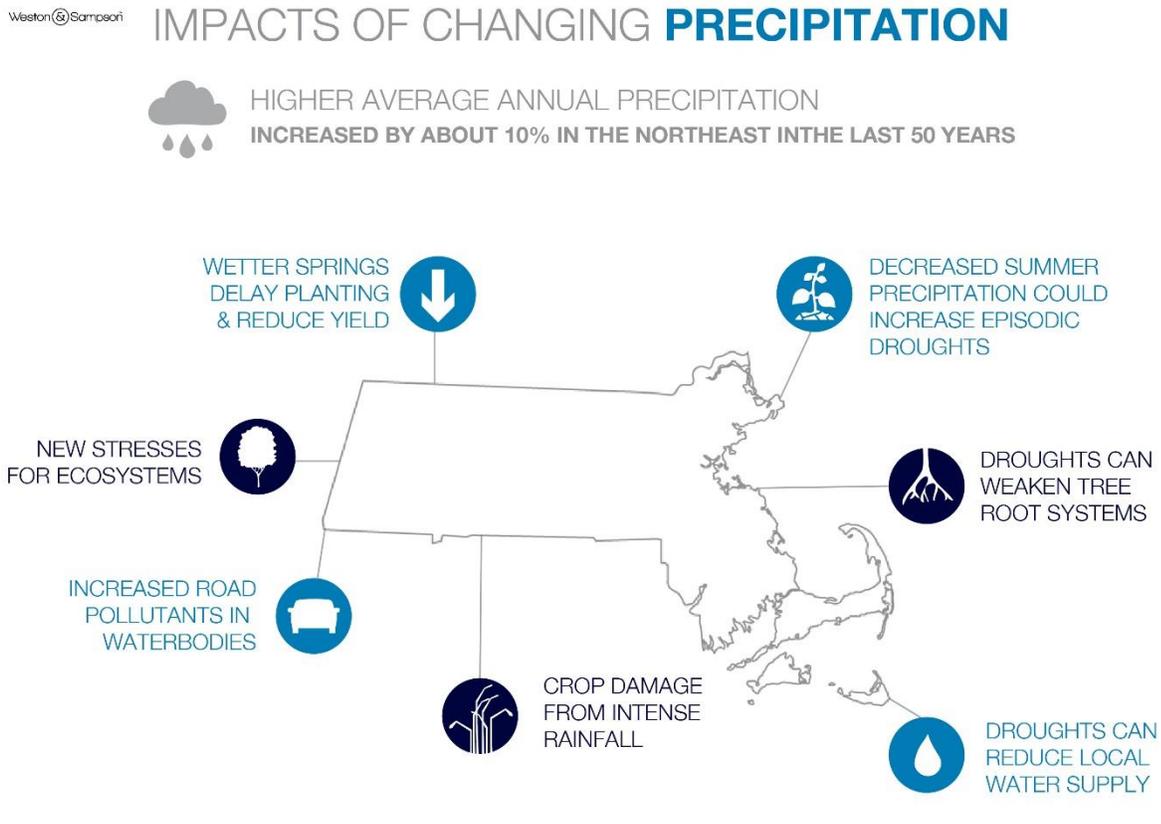
4.2 Flood-Related Hazards

According to NOAA's National Severe Storms Laboratory (NSSL) a flood is "an overflowing of water onto land that is normally dry" (NOAA, n.d.). Flood damage can occur with only a few inches of water, and larger storms combined with topography and inadequate drainage, may result in feet of water causing extreme damage for people and on infrastructure. Flooding can be both riverine (topping the banks of streams, rivers, ponds) and from stormwater that is not properly infiltrated into the ground. Flooding can be caused by various weather events including hurricanes, extreme precipitation, thunderstorms, nor'easters, and winter storms. The winter and spring thaw can also bring flooding challenges to the town with clogged catch basins. The impacts from flooding can include injury or death, property damage, and traffic disruption. While Wilbraham already experiences flooding, climate change will likely

lead to increasingly severe storms and intensity of rainfall, which may make flooding worse. Figure 4-1 shows additional potential consequences as a result of climate change.

Flood hazards can also cause erosion, which can compromise receiving water quality, slope stability, and the stability of building foundations. This puts current and future structures and populations located near steep embankments at risk. Erosion can also undercut streambeds and scour around stream crossing, creating a serious risk to roadways. Stakeholders identified erosion occurring along Woodland Dell, as well as the flood control bank at Brookmont and Hilltop.

Flooding events in Wilbraham have been classified as a high frequency event. According to the 2013 Massachusetts State Hazard Mitigation Plan, this hazard occurs more frequently than once in five years or greater than a 20% chance per year.



Massachusetts Executive Office of Energy & Environmental Affairs. 2019. "Changes in Precipitation." Massachusetts Climate Change Clearinghouse. <http://www.resilientma.org/changes/changes-in-precipitation>

Figure 4-1. Impact of changing precipitation in future on the State of Massachusetts

4.2.1 Areas Vulnerable to Flooding

Areas within FEMA Flood Zones, repetitive loss sites, and local areas identified as flood prone are more vulnerable to the impacts of flooding. The following sub-sections provide more information on historic flooding events, potential flood hazards, a vulnerability assessment, locally identified areas of flooding,

and information on the risk of dam failure. The vulnerability assessment of flood hazard areas was informed by the FEMA NFIP Flood Insurance Rate Maps (FIRMs) and a GIS vulnerability analysis.

4.2.1.1 Riverine Flooding

Flooding in Wilbraham primarily occurs in the form of riverine flooding along Spectacle Pond, Nine Mile Pond, Sawmill Pond, Bennett Pond, and Woodland Dell. Locally recognized areas of flooding have been identified along Main Street and Woodland Dell. This flooding could potentially be mitigated with improved stormwater management. Flooded and eroded roadways due to precipitation often restrict emergency access, posing a threat for many residents, especially those who are elderly.

4.2.1.2 FEMA Flood Zones

FIRMs designate areas likely to experience flooding. The FIRM delineates both the special flood hazard areas and the risk premium zones under the NFIP. This includes high risk areas that have a one percent chance of being flooded in any year (often referred to as the “100-year floodplain” or Zone A, AE, or A1-30) which, under the NFIP is linked to mandatory flood insurance purchase requirements for federally backed mortgage loans. It also identifies moderate to low-risk areas, defined as the area with a 0.2 percent chance of flooding in any year (often referred to as the “500-year floodplain” or Zone X). The definitions of these flood zones are provided below. A map of the FEMA-designated flood zones for Wilbraham (FEMA, 2013) are included in Appendix B. Most of the water bodies and wetlands areas listed above are surrounded by Zone A, including the Chicopee River, Bennet Pond, Nine Mile Pond, Twelve Mile Brook, Calkins Brook, Cadwell Brook, Thayer Brook, North Branch Mill River, South Branch Mill River, and White Cedar Swamp are surrounded by Zone X.

Flood Insurance Rate Map Zone Definitions

Zone A (1% annual chance): Zone A is the flood insurance rate zone corresponding to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Detailed hydraulic analyses are not performed for such areas, therefore, no BFEs (Base Flood Elevations) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone AE and A1-A30 (1% annual chance): Zones AE and A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zone X (0.2% annual chance): Zone X is the flood insurance rate zone that corresponds to the 500-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone.

Source: (FEMA, 2019b) <https://www.fema.gov/flood-zones>

4.2.1.3 Repetitive Loss Sites

As defined by FEMA and the NFIP, a repetitive loss property is any insured property which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978 (FEMA, 2019e). There are no repetitive loss properties in Wilbraham.

Notably, repetitive loss data only includes buildings that qualify for the repetitive loss designation, which does not represent all losses due to flooding. The number of buildings that experience losses due to flooding is likely higher than what is reported above.

4.2.1.4 Stormwater Flooding

Stormwater flooding occurs during a precipitation event where the rate of rainfall is greater than the capacity of the stormwater management system. This may be due to undersized culverts, poor drainage, topography, high amounts of impervious surfaces, or debris that causes the stormwater system to function below its design standard. In these cases, the stormwater management system becomes overwhelmed, causing water to inundate roadways and properties. In the Town of Wilbraham, several culverts are undersized and structurally deficient, and the town is undertaking a road/stream crossing assessment to identify priorities for repair and replacement with assistance from the Housatonic Valley Association.

Most stormwater systems in Massachusetts are aging and have been designed with rainfall data that is no longer accurate. Figure 4-2 shows how anticipated rainfall during design storms has increased from 1961 to 2015, especially for the larger 24-hour, 100-year event. Green infrastructure or low impact development improvements can help reduce demand on the existing stormwater system by increasing infiltration on-site. Rain gardens and pervious pavement are two examples of possible strategies. Upsizing culverts with new rainfall data is also recommended.

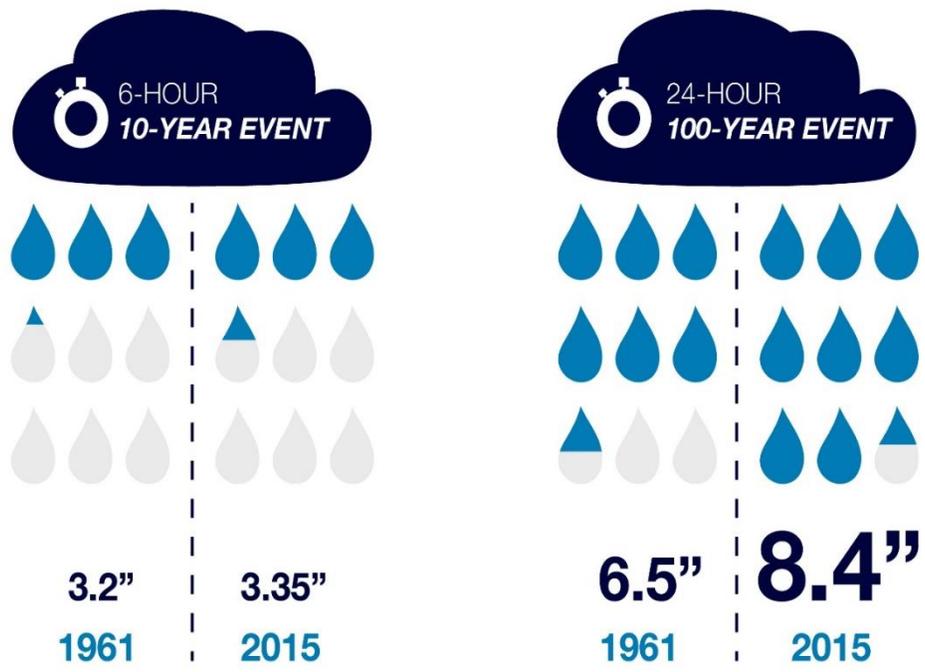


Figure 4-2. Stormwater Design Standards (NOAA, 1961 and NOAA, 2015)

4.2.1.5 Locally Identified Areas of Flooding

Wilbraham Town staff and CRB Workshop participants helped identify local areas of flooding. These areas may not directly overlap with the FEMA-designated flood zones previously discussed. However, these areas have been noted to flood during a significant rain event. This is often due to topography and/or insufficient drainage.

4.2.2 *Historic Flood Events*

4.2.2.1 Flood Events in Wilbraham

NOAA's National Centers for Environmental Information Storm Events Database (NOAA, 2020) provides information on previous flood and flash flood events for Hampden County. Flash flood events are considered by the NOAA's Storm Events Database as "A life-threatening, rapid rise of water into a normally dry area beginning within minutes to multiple hours of the causative event (e.g., intense rainfall, dam failure, ice jam)" (US Department of Commerce et al., 2018, p.A-15). Floods are considered, "Any high flow, overflow, or inundation by water which causes damage. In general, this would mean the inundation of a normally dry area caused by an increased water level in an established watercourse, or ponding of water, that poses a threat to life or property" (US Department of Commerce et al., 2018, p.A-20).

Between 2000 and 2020, the Town of Wilbraham had four flood and flash flood events that directly impacted the Town, which are identified in Table 4-2. Although Tropical Storm Irene caused \$1,000,000 in property damage, there were no deaths or injuries reported with any of these events.

Table 4-2. Wilbraham Flooding Events

Event Date	Type of Flooding	Description
9/6/2008	Flood	Heavy rain from Tropical Storm Hanna ranged from 3.5 to 5.5 inches in Hampden County. In Wilbraham, multiple roads were flooded, including Main Street and several other locations on Route 20 and Route 32. Minor mudslide occurred on Route 32
8/28/2011	Flood	After receiving nearly four inches of rain associated with Tropical Storm Irene, portions of Route 20 in Wilbraham were closed.
5/23/2014	Flash Flood	Slow moving showers and thunderstorms produced intense high rainfall rates. Boston Road in Wilbraham was flooded with a foot of water.
7/6/2019	Flood	A cold front produced a line of thunderstorms, causing 18 inches of street flooding on the southern end of Maynard Road in Wilbraham.

(NOAA, 2021)

4.2.2.2 Hampden County Flooding Events

A disaster declaration is a statement made by the community when the needs as a result of a disaster or emergency are beyond the capabilities of that community. Four disaster declarations were made in Hampden County due to flooding between 2000 and 2020, as can be seen in Table 4-4 below. These events may have also directly affected the Town of Wilbraham.

Table 4-3. Previous Federal Disaster Declarations - Flooding

Disaster Name and Date of Event	Disaster Number	Type of FEMA Assistance	Counties Under Declaration
Severe Storm and Flooding October 7-16, 2005	DR-1614	Public Assistance; Individual & Households Program	All 14 Massachusetts Counties
Severe Storm and Flooding April 15-25, 2007	DR-1701	Public Assistance Grant	Essex, Plymouth, Barnstable, Dukes, Hampshire, Hampden , Franklin, Berkshire

Disaster Name and Date of Event	Disaster Number	Type of FEMA Assistance	Counties Under Declaration
Severe Winter Storm and Flooding December 11-18, 2008	DR-1813	Public Assistance	All 14 Massachusetts Counties
Severe Winter Storm, Snowstorm, and Flooding February 8-9, 2013	DR-4110	Public Assistance	All 14 Massachusetts Counties

(FEMA, 2020)

4.2.3 GIS Flooding Exposure Analysis

Hazard location and extent of riverine flooding was determined using the FIRM for Zone A.

4.2.3.1 Flooding Vulnerability Assessment

A flood exposure analysis was conducted for critical facilities and vulnerable populations throughout the municipality utilizing MassGIS data, FEMA flood maps, and information gathered from the municipality. Table 4-4 displays critical facilities in Wilbraham that are located within the 100-year and 500-year FEMA flood zones.

Table 4-4. Critical Facilities Located within FEMA Flood Zones

Facility	Address	100-Year Flood Zone	500-Year Flood Zone
Christ the King – Epiphany Church	758 Main Street		X
Wilbraham United Church	500 Main Street	X	
DPW Stores (Generator)	2480 Boston Road		X
Fern Valley Farm	758 Main Street		X
Former WWTF	2480 Boston Road		X
Primary Pumping Station	N/A		X
Primary Pump Station #1	N/A	X	
Primary Pump Station #2	N/A		X
Secondary Pump Station #1	N/A		X
Rocky Mountain Wood Co Inc.	2660-R Boston Road	X	
Wilbraham Fire Station #2	6 Woodland Dell Road	X	

Out of 83 critical facilities in Wilbraham, four are located in the 100-year flood zone and seven are located in the 500-year flood zone (Table 4-4). It is important to protect these facilities from flooding. Many of these locations house emergency response infrastructure and pump stations, which could be devastating to the Town’s ability to respond if they lost functionality.

During the CRB Workshop, stakeholders discussed concern for residents who may be personally impacted by flooding. A Hazus flood analysis was conducted to determine flooding hazards in Wilbraham. Hazus Multi-Hazard (Hazus) is a GIS model developed by FEMA to estimate losses in a defined area due to a specified natural hazard. Through the analysis, it was determined that during a 500-year flood event, 90 households, or 271 residents of Wilbraham, could be displaced and at least three would need to seek temporary shelter.

4.2.3.2 Flood Exposure Tables

To determine the Town’s vulnerability to flooding, a Hazus flood analysis was conducted based on land use types in Wilbraham. The Town’s land use information was overlaid with FEMA flood zones, and the overlap was noted. Potential social and economic loss was also taken into account for this analysis.

The results of the vulnerability assessment conducted for Wilbraham’s existing community assets are summarized on the following pages. These include an exposure table for natural hazards with geographically defined risk areas (FIRM zones). Table 4-5 shows the detailed exposure of buildings in the 100-year flood zone by parcel type. The value of all buildings and their exposure to flooding within the FIRM zones is also listed. A total of 5,513 building is estimated to be located in Wilbraham, with a total building value of \$2,251,882,000. Approximately 91.42% of the buildings in Wilbraham are residential.

Table 4-5. Exposure of Parcels in 500-Year Flood Zones by Land Use Type

Land Use Type	Property Value of Parcels	Percentage of Total Buildings Value	Property Value in the Flood Zone	Percentage of Total Building Value Impacted
Residential	\$1,758,292,000	78.1	\$694,053,000	74.4
Commercial	\$315,891,000	14.0	\$110,940,000	11.9
Industrial	\$53,127,000	2.4	\$35,345,000	3.8
Religion	\$14,005,000	0.6	\$5,077,000	0.5
Agricultural	\$7,451,000	0.3	\$3,904,000	0.4
Government	\$12,442,000	0.6	\$3,452,000	0.4
Education	\$90,674,000	4.0	\$80,165,000	8.6
Total	\$2,251,882,000	100	\$932,936,000	100

Looking at building damage by occupancy, it is calculated that approximately 16 residential buildings with between 1 and 10 occupants, 19 buildings with between 11 and 20 occupants, and one building with 21 to 30 occupants, may sustain damage. All damage would occur to wood construction buildings, and 865 tons of debris may be generated during a 500-year flood. Total building related losses, including direct building losses and business interruption losses, are estimated to be \$26.49 million.

Recent and planned development were overlaid with FEMA flood zone maps to determine their vulnerability to flooding. The exposure of potential development was documented by the area and percentage of parcels that overlap with a flood zone. Two of the potential developments are within the 500-year flood zone, which consisted of one residential development and a solar field. **The vulnerability has slightly increased given the new development in the 500-year floodplain.**

4.2.4 Dams and Dam Failure

Dam failure is defined as a collapse of an impounding structure resulting in an uncontrolled release of impounded water from a dam (DCR, 2017a). There are two types of dam failures that can occur. Catastrophic failure occurs when there is a sudden, rapid, uncontrolled release of impounded water. The second type is design failure, which occurs as a result of minor overflow events. Dam overtopping occurs when water exceeds the capacity of the dam, which can be due to inadequate spillway design or other outside factors such as settlement of the dam crest or back of spillways. Thirty-four percent of all dam failures that occur in the United States are a result of overtopping (EEA and EOPSS, 2018). Many dam failures in the United States have been secondary results of other disasters. The prominent causes include earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage (MEMA and DCR, 2013). Dam failure can cause property damage, injuries, and potentially fatalities. These impacts can be at least partially mitigated through advance warning to communities impacted by a dam failure. In addition, the breach may result in erosion on the river and stream banks that are inundated.

Dam failure during flood events are of concern in Massachusetts given the high density of dams constructed in the 19th century (MEMA and DCR, 2013). Dam failure is classified as a low frequency event in the Town. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, a low frequency hazard may occur once in 100 years (a 1% chance per year). A dam failure can still present a high level of risk, which is indicated through a dam's classification (see Chapter 3 for MA Office of Dam Safety Hazard Classification definitions). According to the Massachusetts Department of Conservation and Recreation's (DCR) Office of Dam Safety, there are four non-jurisdictional dams in Wilbraham.

As of February 2017, all dams classified as high hazard potential or significant hazard potential were required to have an Emergency Action Plan (EAP) (DCR, 2019a). This plan must be updated annually and submitted to the DCR Commissioner and the Massachusetts Emergency Management Agency. The plan should also be retained by the dam owner and the Town in which the dam is located. Guidelines and a template were established by the Office of Dam Safety to ensure that all EAPs follow the proper format. Wilbraham may consider requesting EAPs for dams of interest located in adjacent towns.

4.2.5 Flooding and Climate Change

Extreme rain and snow events are becoming increasingly common and severe, particularly in the Northeast region of the country (Figure 4-3). Large rain or snow events that happened once a year in the middle of the 20th century now occur approximately every nine months. Additionally, the largest annual events now generate 10% more rain than in 1948. Regionally, New England has experienced the greatest increase in the frequency of extreme rain and snow events. These events now occur 85% more frequently than they did 60 years ago (Madsen and Willcox, 2012).

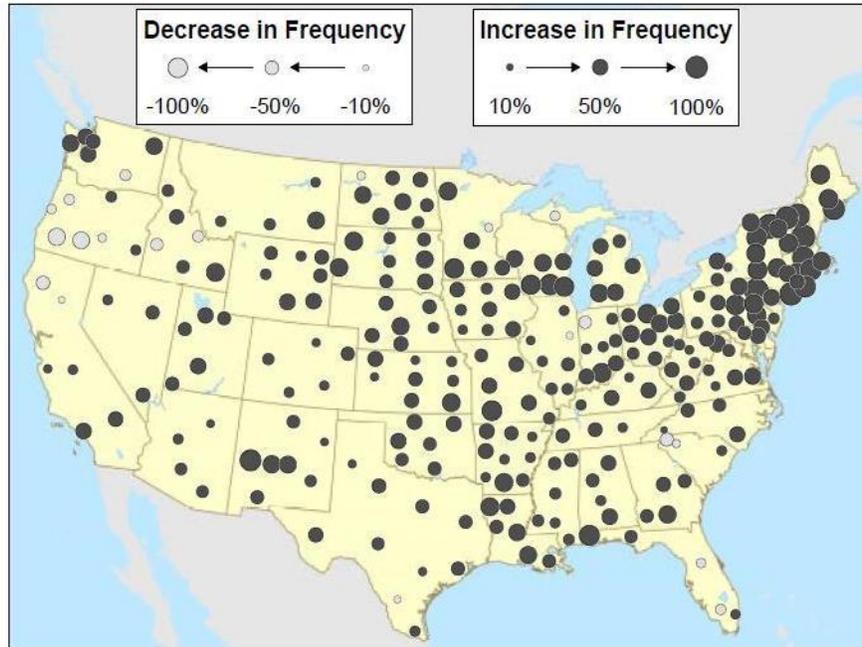


Figure 4-3. Changes in Frequency of Extreme Downpours
(Madsen and Willcox, 2012)

Climate change may indirectly affect dam breaches for a variety of reasons. Dams are typically designed based on historic water flows and known hydrology. Climate change projections indicate that the frequency, intensity, and amount of precipitation will increase in New England. Increased precipitation may push dams over capacity; therefore, dams will have to be monitored for safety. There are several mechanisms in place to manage increases in water, such as slowly releasing water. It is advised that these events are monitored as they can add additional stress on dam infrastructure.

4.3 Wind Related Hazards

High winds can occur during hurricanes, tropical storms, tornadoes, nor'easters, and thunderstorms. The entire Town of Wilbraham is vulnerable to the impacts of high wind. Wind can down trees and power lines. High wind and storm events can cause property damage and hazardous driving conditions. While Wilbraham's current 100-year wind speed is 96 mph, climate change will likely increase events and severity (ASCE, 2017).

The planning process identified vulnerabilities related to potential storm damage to power and phone wires from overhanging trees, as well as underground utilities, including pipelines, that may be impacted by tree roots from downed trees in wind storms. The Town discussed moving fiber and cabling underground and replacing trees with species that could better withstand storms. Falling trees and branches can also block traffic and emergency routes. This is a regional issue that affects cities and towns beyond Wilbraham. During Wilbraham's CRB Workshops in March 2021, attendees discussed the impact of past storms on power systems which often resulted in service disruptions.

Wilbraham does not have reliable backup power for communication infrastructure that is used by emergency management and DPW. Town officials stated that their communications systems are at risk during flooding and high wind events and would benefit from additional redundancies and backup

power. The development of emergency communication plans for vulnerable populations should be developed, this would include an inventory of current resources and an identification of additional needs.

NOAA's National Centers for Environmental Information offers thunderstorm wind, high wind, and strong wind data for Hampden County. Between 2000 and September of 2020, 149 wind entries were recorded in the database. Other wind events were related to low pressure cells, rain, and other hazard events. During this time period, there were no deaths, four injuries, and a total of \$5,035,700 worth of damage from thunderstorm wind events in Hampden County. In some cases, winds in excess of 70 miles per hour were reported.

4.3.1 *Severe Storms and Thunderstorms*

Thunderstorms are typically less severe than other hazard events discussed in this section; however, thunderstorms can cause local damage and are a town-wide risk in Wilbraham. The entire Town is equally susceptible to impacts from thunderstorms, which can include lightning, strong winds, heavy rain, hail, and sometimes tornados. Thunderstorms typically last for about 30 minutes and can generate winds of up to 60 mph. Winds associated with thunderstorms can knock down trees, resulting in power outages and blocked evacuation and transportation routes. Extreme rain during thunderstorms can cause inland flooding around waterbodies or as a result of surcharged drainage systems. During periods of drought, lightning from thunderstorm cells can result in fire ignition. Thunderstorms with little or no rainfall are rare in New England but have occurred (EEA and EOPSS, 2018). Thunderstorms are considered high frequency events in Wilbraham. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard may occur more frequently than once in five years (a greater than 20% chance per year).

NOAA's National Centers for Environmental Information offers thunderstorm and hail data for Hampden County (NOAA, 2020). Between 2000 and 2021, 132 thunderstorm events caused \$5,139,200 in property damages in Hampden County. Three injuries and no deaths were reported. The major thunderstorm events that affected Granville caused downed trees, branches, and powerlines, leading to roadblocks and power outages in parts of the Town.

Many of these thunderstorm events were also accompanied by hail. Between 2000 and 2021, there were 18 hail events, but no property damage, deaths, or injuries were reported. The size of hail ranged from 0.75 inches up to 2 inches (NOAA, 2020).

4.3.2 *Hurricanes and Tropical Storms*

Tropical cyclones (including tropical depressions, tropical storms, and hurricanes) form over the warm waters of the Atlantic, Caribbean, and Gulf of Mexico. A tropical storm is defined as having sustained winds from 39 to 73 mph. If sustained winds exceed 73 mph, it is categorized a hurricane. The Saffir-Simpson scale ranks hurricanes based on sustained wind speeds from Category 1 (74 to 95 mph) to Category 5 (156 mph or more). Category 3, 4, and 5 hurricanes are considered "Major" hurricanes. Wind gusts associated with hurricanes may exceed the sustained wind speed and cause more severe localized damage (MEMA and DCR, 2013). The Saffir-Simpson scale (Table 4-6) categorizes or rates hurricanes from 1 (minimal) to 5 (catastrophic) based on their intensity. This is used to provide an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on context (EEA and EOPSS, 2018).

Table 4-6. Saffir-Simpson Scale

Scale No. (Category)	Winds (mph)	Potential Damage
1	74 – 95	Minimal: damage is primarily to shrubbery and trees, mobile homes, and some signs. No real damage is done to structures.
2	96 – 110	Moderate: some trees topple, some roof coverings are damaged, and major damage is done to mobile homes.
3	111 – 130	Extensive: large trees topple, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131 – 155	Extreme: extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; and some curtain walls fail.
5	> 155	Catastrophic: roof damage is considerable and widespread, window and door damage are severe, there are extensive glass failures, and entire buildings could fail.

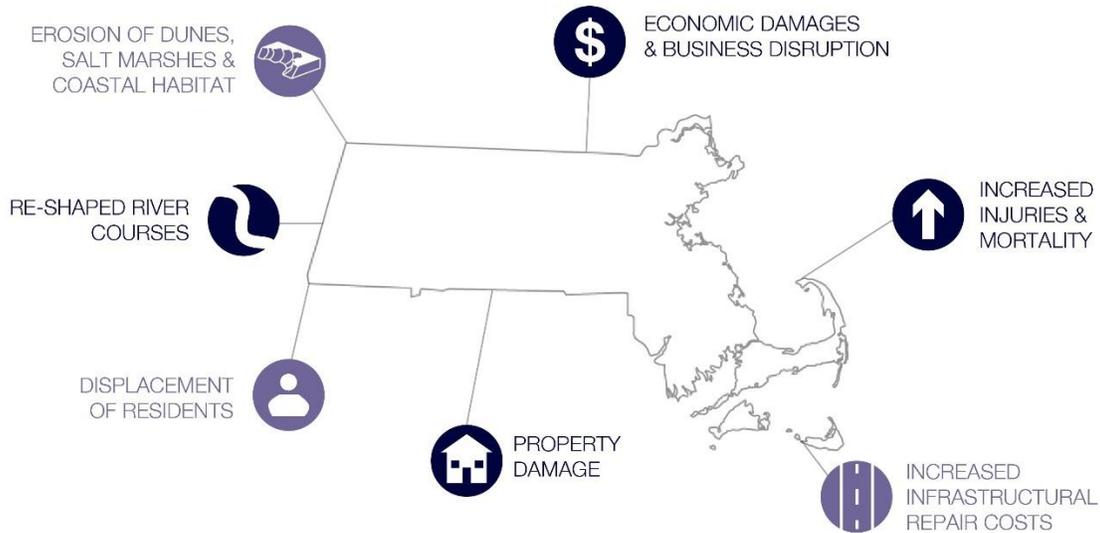
(MEMA and DCR, 2013)

The official hurricane season runs from June 1 to November 30. However, storms are more likely to occur in New England during August, September, and October (MEMA and DCR, 2013). When hurricanes and tropical storms occur, they will impact the entire planning area. Vulnerable populations and all existing buildings, including critical facilities, are at risk to hurricane and tropical storm hazards. Hurricane events have a large spatial extent and could potentially affect the entire Town of Wilbraham. Impacts include water damage to buildings from building envelope failure, business interruption, loss of communications, and power failure. Flooding is a major concern, as slow-moving hurricanes can discharge tremendous amounts of rain on an area. Figure 4-4 shows the impacts of extreme events on the State. Hurricanes are a town-wide hazard in Wilbraham and are considered a medium frequency event. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard can occur between once in 5 years to once in 50 years (a 2% to 20% chance per year).

IMPACTS OF EXTREME WEATHER



STORMS ARE BECOMING MORE INTENSE AND DAMAGING



Massachusetts Executive Office of Energy & Environmental Affairs. 2019. "Extreme Weather." Massachusetts Climate Change Clearinghouse. <http://www.resilientma.org/changes/extreme-weather>

Figure 4-4. Impacts of extreme events and stronger storms on the State of Massachusetts

The region has been impacted by hurricanes throughout its history, starting with the Great Colonial Hurricane of 1635. Massachusetts experienced 11 hurricanes and one named tropical storm between 1851 and 2012. This includes six category 1 hurricanes, two category 2 hurricanes, and three category 3 hurricanes (Blake et al., 2011). Hampden County faced one major tropical storm, Irene, in the last 10 years. During the August 2011 tropical storm, strong winds occurred across Hampden County, with frequent wind gusts of 35 to 55 mph, along with locally stronger wind gusts exceeding 60 mph. No hurricanes have occurred in the region since 1938 (NOAA, 2020).

Potential hurricane damage in Wilbraham was estimated using the Hazus hurricane modeling software. The Hazus hurricane model allows users to input specific parameters in order to model a defined hurricane magnitude, which is based on wind speed. The largest hurricane ever witnessed in Massachusetts was a Category 3 hurricane, which occurred in 1954.

In Massachusetts, the return period for a Category 2 hurricane is approximately 0.01 percent. Hazus models hurricanes based upon their return period. Therefore, a Category 2 was modeled as a 100-year hurricane. To model the hurricane, first the study region was defined. The Census Tract modeled is 22 square miles with 14,219 people (as of 2010). An estimated 5,513 buildings are located in the tract with \$2,252 million dollars value, and 91.42% of the buildings are residential.

Wilbraham was outlined in the model using the Census Tract that represents the Town, and the probabilistic scenario was used. This scenario considers the impact of thousands of storms that have a

multitude of tracks and intensities. The output shows the potential impact that could occur in Wilbraham's Census Tract if a Category 2 hurricane made landfall. Hazus is based on 2010 Census data and 2014 dollars. The Table 4-7 below shows the estimated damage from a Category 2 hurricane in the Town.

Table 4-7. Estimated Damages in Wilbraham's Census Tract from Probabilistic Category 2 Hurricane

Building Characteristics	
Estimated total number of buildings	5,513
Estimated total building replacement value (Year 2014 \$) (Millions of Dollars)	\$2,252
Building Damages	
# of buildings sustaining minor damage	54.65
# of buildings sustaining moderate damage	1.73
# of buildings sustaining severe damage	0.02
# of buildings destroyed	0
Population Needs	
# of households displaced	0
# of people seeking public shelter	0
Debris	
Total debris generated (tons)	3,422
Tree debris generated (tons)	3,247
# of truckloads to clear building debris (@25 tons/truck)	7
Value of Damages	
Total property damage	\$9,154,910
Total losses due to business interruption	\$9,169,370

In addition to the infrastructural damage, Hazus also calculated the potential societal impact of a Category 2 hurricane on the community. This calculation included monetary wage, capital-related, rental and relocation costs, as well as expected damages to essential facilities and damages by building material type. A full Hazus risk report for the hurricane can be found in Appendix B.

4.3.3 Tornadoes

A tornado is a narrow, rotating column of air that extends from the base of a cloud to the ground. Tornadoes are the most violent of all atmospheric storms (EEA and EOPSS, 2018). According to the 2018 SHMCAP, the following are common factors in tornado formation:

- Very strong winds in the middle and upper levels of the atmosphere.
- Clockwise turning of the wind with height.
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet).
- Very warm, moist air near the ground, with unusually cooler air aloft.

- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity.

Tornadoes can be spawned by tropical cyclones or the remnants thereof, and weak tornadoes can even form from little more than a rain shower if air is converging and spinning upward. The most common months for tornadoes to occur are June, July, and August. There are exceptions: The 1995 Great Barrington, Massachusetts tornado occurred in May; and the 1979 Windsor Locks, Connecticut tornado occurred in October (EEA and EOPSS, 2018).

The Fujita Tornado Scale measures tornado severity through estimated wind speed and damage. The National Weather Service began using the Enhanced Fujita-scale (EF-scale) in 2007, which led to increasingly accurate estimates of tornado severity. Table 4-8 provides more detailed information on the EF Scale.

Table 4-8. Enhanced Fujita Scale

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

(MEMA and DCR, 2013)

Massachusetts experiences an average of 1.7 tornadoes per year. The most tornado-prone areas of the State are the central counties. Tornadoes are rare in western Massachusetts, although Hampden County is considered an at-risk location (EEA and EOPSS, 2018). There have been 19 recorded tornadoes in Hampden County since 1950 (NOAA, 2020). In 2011, there was an EF3 tornado that touched down in Westfield and passed through southwest and south-central Massachusetts for a distance of over 38 miles. A second F-1 tornado passed through two hours later causing less damage but still uprooting some trees and causing damage.

These tornadoes passed directly through Wilbraham and wreaked havoc on the Town. The first tornado cut a path through Wilbraham from Tinkham Road, south of the town center, to Monson. The second caused minimal damage and only uprooted a few trees north of the center of Town. Roads were closed and power was out in parts of the Town for a few days. An emergency shelter was set up at Minnechaug Regional Highschool and housed 30-50 people. The police and fire departments checked on residents following the tornado and counselling was offered in schools. During the first week following the tornado, the Town spent more than \$100,000 on cleanup by town crews.

In total, three fatalities and 200 injuries were directly attributed to the tornado. It was estimated that 1,400 houses and at least 78 businesses were either damaged or destroyed. Roughly 300 houses were completely destroyed, and three public schools were severely damaged. Total property damage was estimated around \$227,600,000.

Tornado events in Wilbraham are a low frequency event and the entire Town is equally susceptible. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard may occur less than once in 100 years (a less-than 1% chance per year). Tornadoes are difficult to simulate well in climate models because of their small size; however, it is predicted that the frequency of tornadoes in central Massachusetts will rise in the future due to climate change.

4.3.4 *Nor'easters*

A nor'easter is characterized by large counterclockwise wind circulation around a low-pressure center that often results in heavy snow, high winds, waves, and rain along the East Coast of North America. The term nor'easter refers to their strong northeasterly winds blowing in from the ocean. The storm radius is often as much as 100 miles and sustained wind speeds of 20 to 40 mph are common, with short-term gusts of up to 50 to 60 mph. Nor'easters are commonly accompanied by a storm surge equal to or greater than two feet. High surge and winds during a hurricane can last from 6 to 12 hours, while these conditions during a nor'easter can last from 12 hours to three days (EEA and EOPSS, 2018). These winter weather events are among the season's most ferocious storms, often causing beach erosion, flooding, and structural damage (EEA and EOPSS, 2018).

Due to its inland location, Wilbraham is not subject to the coastal hazards often associated with nor'easters. The Town of Wilbraham is vulnerable to high winds, snow, and extreme rain during nor'easters. These impacts can lead to property damage, downed trees, power service disruptions, surcharged drainage systems, and localized flooding. These conditions can impact evacuation and transportation routes and complicate emergency response efforts. Some of the historic events described in the "Flood-Related Hazards" section of this report were preceded by nor'easters, including the 2015 Winter Storm Juno.

Nor'easters generally occur on at least an annual basis, typically in late fall and early winter. Some years bring up to four nor'easter events. Nor'easters in Wilbraham are high frequency events. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard may occur more frequently than once in five years (a greater than a 20% chance per year).

4.3.5 *Climate Change and Severe Storms*

There is evidence suggesting that nor'easters along the Atlantic coast are increasing in frequency and intensity. Future nor'easters may become more concentrated during the coldest winter months when atmospheric temperatures are still low enough to result in snowfall rather than rain (EEA and EOPSS, 2018).

4.4 **Winter Storms**

Winter storm events are atmospheric in nature and can impact the entire planning area. All current and future buildings and populations are at risk of winter storms, which have a variety of potential impacts. Heavy snow loads may cause roofs and trees to collapse, leading to structural damage. Deaths and injury are also possible impacts. Additional impacts can include road closures, power outages, business interruption, business losses (due to road closures), hazardous driving conditions, frozen pipes, fires due to improper heating, and second-hand health impacts caused by shoveling (such as a heart attack). Public safety is also a concern, as streets and sidewalks can become difficult to pass. This issue may be especially difficult for vulnerable populations such as elderly people who may have trouble crossing at intersections due to large accumulations of snow. Impassable streets can also complicate emergency response efforts during an extreme event.

Winter storms are a potential town-wide hazard in Wilbraham. These events can include wind, heavy snow, blizzards, and ice storms. Blizzards and ice storms in Massachusetts can range from an inconvenience to extreme events that cause significant impacts and require a large-scale, coordinated response. Table 4-9 lists winter storms that required a federal disaster declaration in Hampden County.

Table 4-9. Previous Federal Disaster Declarations – Winter Weather

Disaster Name and Date of Event	Disaster Number	Type of Assistance	Counties Under Declaration
Snowstorm December 6-7, 2003	EM-3191	FEMA Public Assistance	Middlesex, Essex, Suffolk, Norfolk, Bristol, Plymouth, Barnstable, Berkshire, Hampshire, Hampden , Franklin, Berkshire
Snowstorm January 22 - 23, 2005	EM-3201	FEMA Public Assistance	All 14 Massachusetts Counties
Severe Winter Storm and Flooding December 11-18, 2008	DR-1813	FEMA Public Assistance; FEMA Hazard Mitigation Grant Program	All 14 Massachusetts Counties
Severe Winter Storm December 11-18, 2008	EM-3296	None	Middlesex, Essex, Suffolk, Bristol, Berkshire, Hampshire, Hampden , Franklin, Berkshire
Severe Winter Storm and Snowstorm January 11-12, 2011	DR-1959	FEMA Public Assistance Grant	Middlesex, Essex, Suffolk, Norfolk, Hampshire, Hampden , Berkshire
Snowstorm October 29-30, 2011	DR-4051	FEMA Public Assistance	Middlesex, Worcester, Hampshire, Hampden , Franklin, Berkshire
Severe Winter Storm, Snowstorm, and Flooding February 8-9, 2013	DR-4110	FEMA Public Assistance	All 14 Massachusetts Counties

(FEMA, 2020)

4.4.1 Heavy Snow and Blizzards

A blizzard is a winter snowstorm with sustained wind or frequent wind gusts of 35 mph or more, accompanied by falling or blowing snow that reduces visibility to or below a quarter of a mile. These conditions must be the predominant condition over a three-hour period. Extremely cold temperatures are often associated with blizzard conditions but are not a formal part of the criteria; however, the hazard created by the combination of snow, wind, and low visibility increases significantly with temperatures below 20°F. A severe blizzard is categorized as having temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced to near zero (EEA and EOPSS, 2018).

Winter storms pose multiple risks, including wind, ice, and heavy snow. The National Weather Service defines “heavy snow” as snowfall accumulating to 4" or more in 12 hours or less; or snowfall accumulating to 6" or more in 24 hours or less (NOAA and National Weather Service, 2019). Winter

storms can be combined with the nor'easters discussed previously in the "Wind-Related Hazards" section.

There have been 40 winter storm entries between 2000 and 2020 totaling \$1,643,000 in storm damage in Hampden County (NOAA, 2020a). One recorded entry was categorized as a blizzard. No injuries or deaths were reported. The "Blizzard of 1978" is a well-known winter storm that deposited more than three feet of snow and led to multi-day closures of roads, businesses, and schools.

Blizzards are classified as high frequency events in Wilbraham. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard can occur more than once in five years (greater than a 20% chance of occurring each year).

4.4.2 Ice Storms

An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Ice storm conditions are defined by liquid rain falling and freezing on contact with cold objects creating ice build-ups of ¼ inch or more that can cause severe damage (NOAA, n.d.). This may lead to dangerous walking or driving conditions and the weighing down of power lines and trees. Icy roads can also complicate emergency response efforts during an extreme event. Four ice storms were reported in Hampden County between 2000 and Sept. 2020. However, climate shifts are leading towards a greater number of days hovering around freezing temperatures, resulting in more freezing rain than has previously been seen in Wilbraham (NOAA, 2020).

Ice storms are classified as high frequency events in Wilbraham and the entire Town is equally susceptible. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard can occur at least once in five years (greater than a 20% chance of occurring each year).

4.5 Geological Hazards

Geologic hazards can include earthquakes, landslides, sinkholes, and subsidence. Town officials did not identify any local areas that were previously recorded as being vulnerable to geologic hazards.

4.5.1 Earthquakes

An earthquake is the sometimes-violent vibration of the earth's surface that follows a release of energy in the earth's crust due to fault fracture and movement. The magnitude or extent of an earthquake is a seismograph-measured value of the amplitude of the seismic waves. The Richter Magnitude Scale (Richter Scale) was developed in 1932 as a mathematical device to compare the size of earthquakes. The Richter Scale is the most widely known scale that measures earthquake magnitude. It has no upper limit and is not a direct indication of damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, can have the same magnitude as an earthquake in a remote area that causes no damage. Table 4-10 summarizes Richter Scale magnitudes and corresponding earthquake effects (MEMA and DCR, 2013).

Table 4-10. Richter Scale and Effects

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

(Louie, 1996)

Earthquakes occur occasionally in New England compared to other parts of the country and are often so small that they are not felt. The first recorded earthquake was noted by the Plymouth Pilgrims and other early settlers in 1638. Historically, moderately damaging earthquakes strike somewhere in the region every few decades, and smaller earthquakes are felt approximately twice per year (MEMA and DCR, 2013). Since 2015, two earthquakes with a magnitude greater than 2.5 occurred in or directly adjacent to Massachusetts. One earthquake occurred in southern Massachusetts in 2020, and one occurred in New Hampshire just north of Essex County, Massachusetts in 2018. A summary of historic earthquakes in Massachusetts is included in Appendix B.

Ground motion during an earthquake is the primary cause of damage to structures. Soft soils amplify ground motion, while hard rock reduces it. Boston is a City built on fill, and these soft soils below the City would amplify impacts from an earthquake. In order to measure the ground motion during an earthquake, scientists look at the maximum horizontal acceleration (peak ground acceleration). This is expressed as a “percentage of gravity” or percentage of the force we experience from gravity. It is often shorted to %g. Probability of occurrence is described as the peak ground acceleration (%g) with a 2% probability of exceedance in 50 years. Peak ground acceleration in the state ranges from 8%g to 20%g (USGS, 2016).

A serious earthquake in Massachusetts is possible. Wilbraham is located in an area with a PGA of 6%g to 10%g with a 2% probability of exceedance in 50 years (Figure 4-5). This is the fourth highest zone in the state with two reported earthquakes of magnitude 3 in the past. However, none of the earthquakes have their epicenter recorded in Wilbraham. Thus, Wilbraham is a moderate area of earthquake risk. Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the Town pre-dates the current building code. These events can strike without warning and can have a devastating impact on infrastructure and buildings constructed prior to earthquake resistant design considerations. It can be assumed that all existing and future buildings and populations are at risk to an earthquake hazard. If an earthquake occurs, the entire region, not just the Town, would face significant challenges.

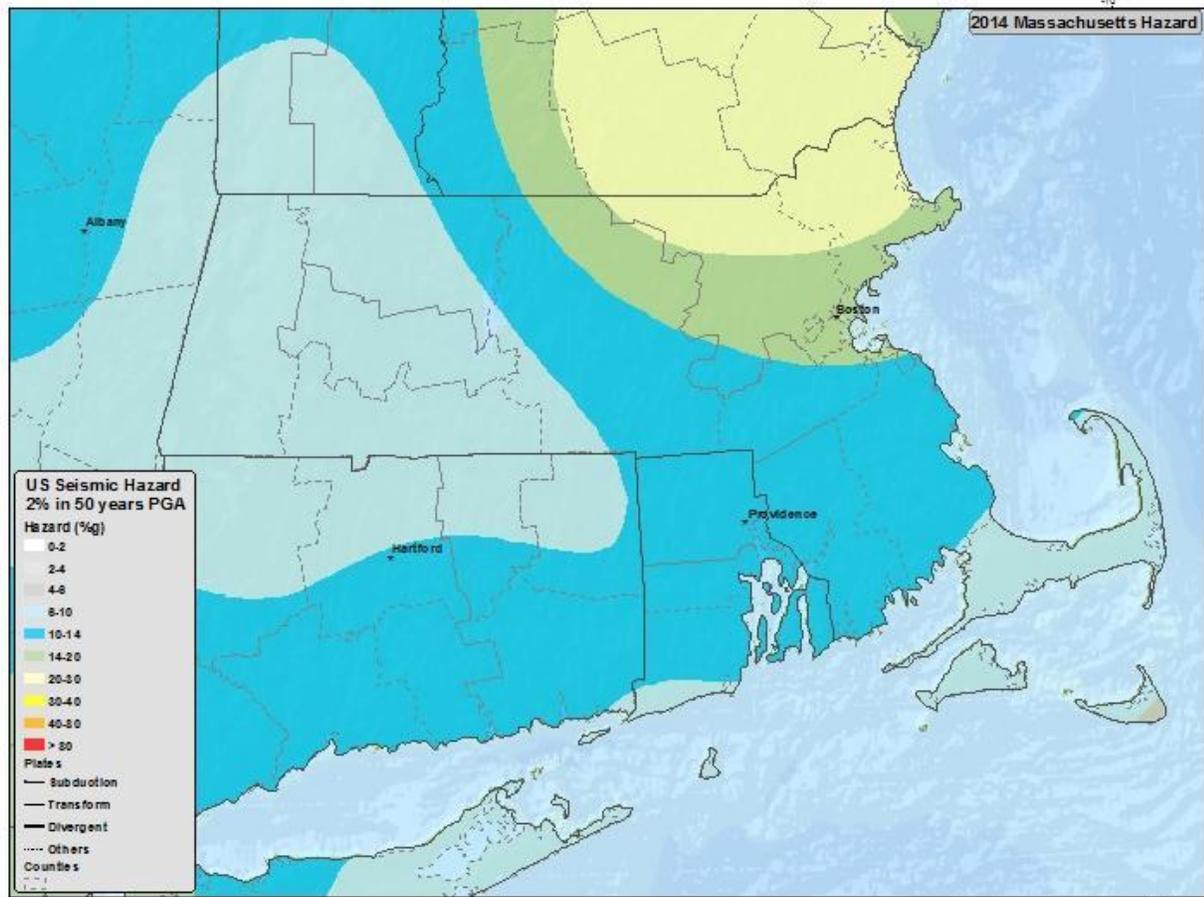


Figure 4-5. 2014 Seismic Hazard Map- Massachusetts
(USGS, 2014)

Impacts from earthquakes can range from slight to moderate building damage, to catastrophic damage and fatalities, depending on the severity of the earthquake event. Events may cause minor building damage such as cracked plaster and chimneys, or broken windows, or major damage resulting in building collapse. Liquefaction is the phenomenon that occurs when the strength and stiffness of a soil is reduced by earthquake. Liquefaction can make buildings more vulnerable during earthquakes. This is especially true for unreinforced masonry buildings, which are not designed to withstand this phenomenon. Based on the Massachusetts State Hazard Mitigation and Climate Adaptation Plan, the degree of exposure “depends on many factors, including the age and construction type of the structures where people live, work, and go to school; the soil type these buildings are constructed on; and the proximity of these building to the fault location.” Furthermore, the time of day exposes different sectors of the community to the hazard. Earthquakes can lead to business interruptions, loss of utilities and road closures which may isolate populations. Earthquakes often trigger fires, and the water distribution system may be disrupted, thus posing a risk for public health and safety.

Potential earthquake damage was modeled in Wilbraham using Hazus. The Hazus earthquake model allows users to input specific parameters in order to model a defined earthquake magnitude, with the epicenter located at the center of the municipality. In this analysis, a magnitude 6.5 historic earthquake was modeled. The Cape Ann magnitude 6.5 earthquake was used as a historic model for Wilbraham.

While large earthquakes are rare in Massachusetts, there was a magnitude 5.0 earthquake recorded in 1963. Table 4-11 below show the estimated damage from the magnitude 6.5 earthquake in Wilbraham. In addition to the infrastructural damage, Hazus also calculated the potential social impact, property damage, and business interruption loss. This calculation included utility system inventory, building damage by construction type, damage to essential facilities and transportation systems, and casualty estimates. A full Hazus risk response report for each earthquake category can be found in Appendix B.

Table 4-11. Estimated Damage in Wilbraham from Historic Magnitude 6.5 Earthquake

Building Characteristics	
Estimated total number of buildings	5,513
Estimated total building replacement value (Year 2014 \$) (Millions of dollars)	2,251
Building Damages	
# of buildings sustaining slight damage	204
# of buildings sustaining moderate damage	42
# of buildings sustaining extensive damage	5
# of buildings completely damaged	0
Population Needs	
# of households displaced	2
# of people seeking public shelter	1
Debris	
Building debris generated (tons)	1,000
# of truckloads to clear building debris (@25 tons/truck)	40
Building-Related Economic Loss	
Income Losses	\$2,221,400
Capital Stock Losses	\$7,740,000
Direct repairs (transportation and utility)	\$370,270,000

Earthquakes are classified as a low frequency event in Wilbraham. As defined by the 2013 State Hazard Mitigation Plan, these events occur from once in 50 years to once in 100 years or have a chance of occurrence of 1% to 2% per year. According to the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan, the probability of a magnitude 5.0 or greater earthquake centered in New England is about 10-15% in a 10-year period.

4.5.2 Landslides

Landslides include a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors. These contributing factors can include erosion by rivers or ocean waves over steepened slopes, rock and soil slopes weakened through saturation by snowmelt or heavy rains, earthquake-created stresses that make weak slopes fail, excess weight from accumulation of rain or snow, and stockpiling of rock or ore from waste piles or man-made structures (USGS, 2019).

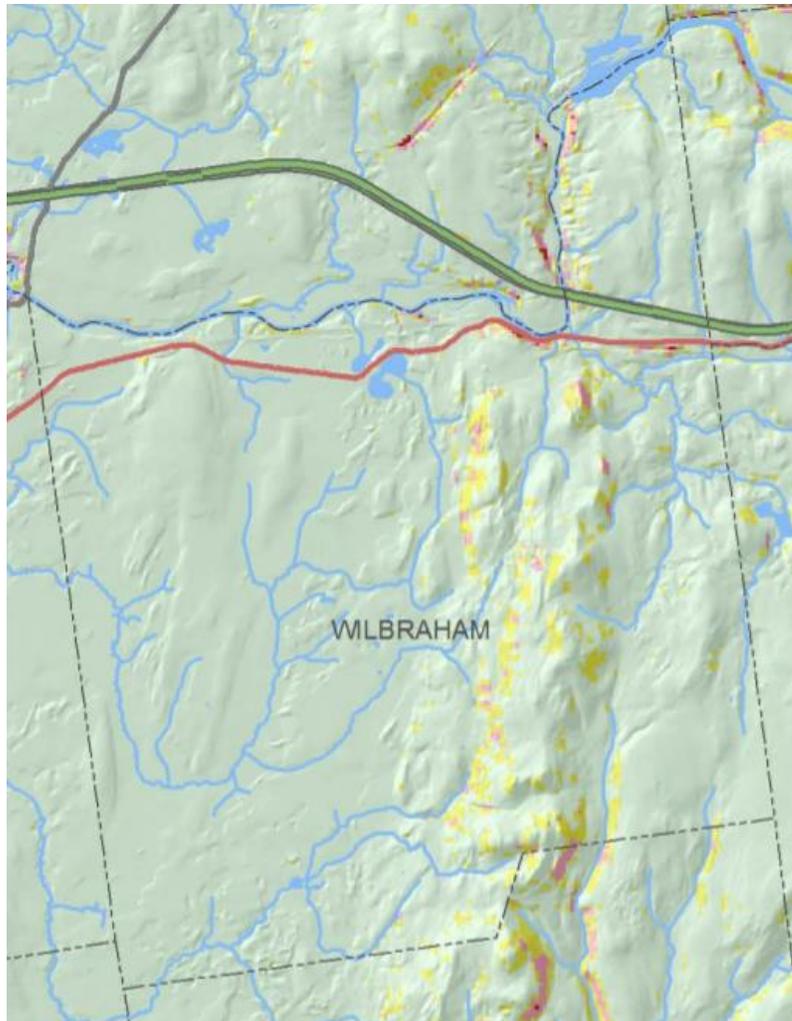
Landslides occur throughout the United States, causing an estimated \$1 billion in damage and 25-50 deaths each year. Any area composed of very weak or fractured materials resting on a steep slope will likely experience landslides. Although the physical cause of many landslides cannot be removed, geologic investigations, good engineering practices, and effective enforcement of land-use management regulations can reduce landslide hazards (USGS, 2019). Landslides can damage buildings and infrastructure and cause sedimentation of water bodies. Landslide intensity can be measured in terms of destructiveness, as demonstrated by Table 4-12 below.

Table 4-12. Landslide Volume and Velocity

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

(Cardinali et al., 2002)

Wilbraham is classified as stable and therefore having a low risk for landslides (Figure 4-6). No significant landslides have been recorded for Wilbraham or Hampden County (Appendix B of EEA and EOPSS, 2018). Local officials in Wilbraham indicate that there are occasionally localized issues of erosion along stream banks but are working to stabilize these areas. Landslides are classified as low frequency events in Wilbraham. According to the 2013 State Hazard Mitigation Plan, these events occur from once in 50 years to once in 100 years or have a chance of occurrence of 1% to 2% per year.



Map Color Code	Predicted Stability Zone	Relative Slide Ranking ²	Stability Index Range ²	Factor of Safety (FS) ³	Probability of Instability ²	Predicted Stability With Parameter Ranges Used in Analysis	Possible Influence of Stabilizing or Destabilizing Factors ⁵
Dark Red	Unstable	High	0	Maximum FS<1	100%	Range cannot model stability	Stabilizing factors required for stability
	Upper Threshold of Instability		0 - 0.5	>50% of FS1	>50%	Optimistic half of range required for stability	Stabilizing factors may be responsible for stability
Light Red	Lower Threshold of Instability	Moderate	0.5 - 1	≥50% of FS>1	<50%	Pessimistic half of range required for instability	Destabilizing factors are not required for instability
Yellow	Nominally Stable	Low	1 - 1.25	Minimum FS=1	–	Cannot model instability with most conservative parameters specified	Minor destabilizing factors could lead to instability
	Moderately Stable		1.25 - 1.5	Minimum FS=1.25	–	Cannot model instability with most conservative parameters specified	Moderate destabilizing factors are required for instability
Light Green	Stable	Very Low	>1.5	Minimum FS=1.5	–	Cannot model instability with most conservative parameters specified	Significant destabilizing factors are required for instability

Figure 4-6. Slope Stability Map of Massachusetts focusing on Wilbraham
(The Massachusetts Geological Survey, 2013)

4.6 Fire Related Hazards

Wildfires and brushfires can occur in the vegetative wildland, including grass, shrub, leaf litter, and forested tree fuels. Fires can be caused by natural events, human activity or in an intentional controlled

manner, as in the case of prescribed fire (MEMA and DCR, 2013, 252). The State Hazard Mitigation and Climate Adaptation Plan (EEA and EOPPS, 2018) states:

“Portions of the Commonwealth susceptible to wildfire, particularly at the urban-wildland interface..., are defined as those in the vicinity of contiguous vegetation, with more than one house per 40 acres and less than 50 percent vegetation, and within 1.5 miles of an area of more than 500 hectares (approximately 202 acres) that is more than 75 percent vegetated.”

Wilbraham is more likely to experience a brushfire compared to a wildfire (or a fire with a large impact area). Brush fires are classified as medium frequency events in Wilbraham and occur frequently in the Town. As defined by the 2013 State Hazard Mitigation Plan, brushfires occur between once in five years to once in 50 years (a 2% to 20% chance of occurring per year) across the state. Fire risk is influenced by fuel (the type of material), terrain, and weather. Strong winds can exacerbate extreme fire conditions, especially wind events that persist for long periods, or ones with significant sustained wind speeds that quickly promote fire spread through the movement of embers or exposure within tree crowns. Fires can spread quickly into developed areas. The areas of Wilbraham most vulnerable to brush fire are primarily heavily wooded areas and forests directly adjacent to developed areas.

Brushfires can lead to injury, death, and property damage. All homes or workplaces located in brush fire hazard zones are exposed to this hazard. The most vulnerable members of this population are those who would be unable to evacuate quickly, including those over the age of 65, households with young children under the age of five, people with mobility limitations, and people with low socioeconomic status (EEA and EOPSS, 2018). Secondary effects from brush fire include contamination of reservoirs, destroyed power, gas, water, broadband, and oil transmission lines. Brush fires can also contribute to flooding as they strip slopes of vegetation, thereby exposing them to greater amounts of runoff which can cause soil erosion and ultimately increase the chance of flooding. Additionally, subsequent rain events can worsen erosion on bare slopes.

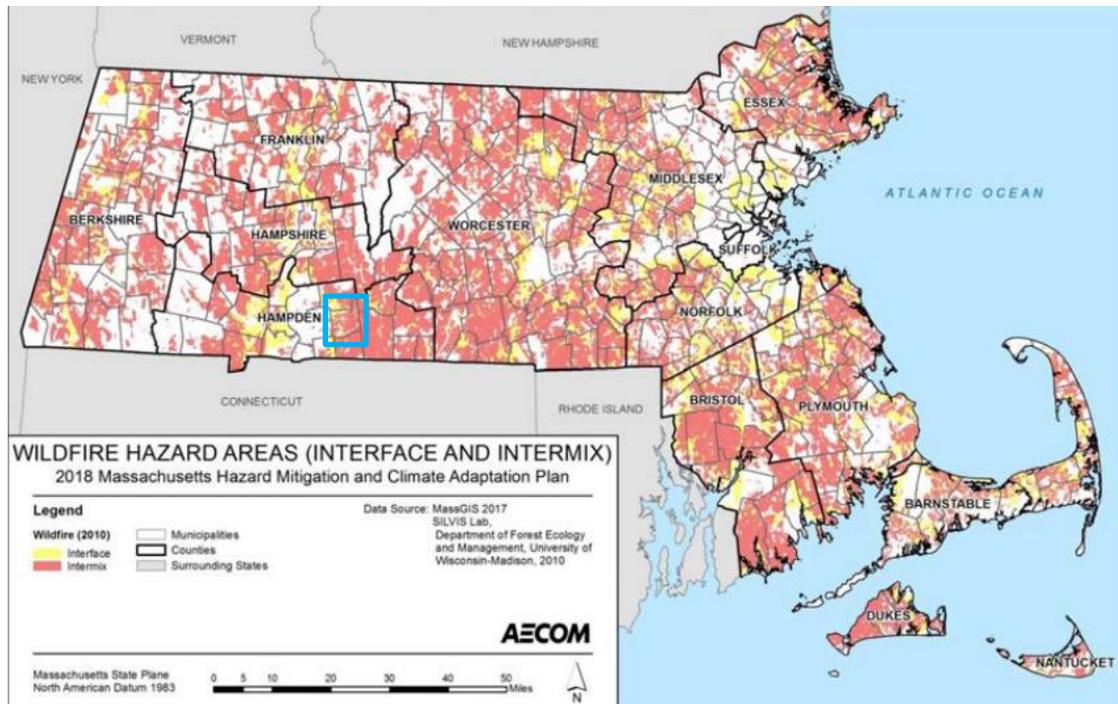


Figure 4-7. Wildfire related hazard areas in Massachusetts, Wilbraham is outlined in light blue.
 Source: (EEA and EOPSS, 2018)

4.7 Extreme Temperatures

Massachusetts has four clearly defined seasons. Extreme temperatures are considered outliers, or temperatures that fall outside the typical range for each season. Extreme temperatures can last from an afternoon to a few days. Day and nighttime temperature fluctuations also factor into the overall effects of temperature. For example, when the temperature does not cool off at night during an extreme heat wave, the risk of heat related illnesses is intensified.

4.7.1 Extreme Cold

Extreme cold does not have a threshold temperature, but rather is defined as prolonged periods of excessively cold weather. This may vary by region based on average temperatures in the region. In Massachusetts, where temperatures regularly go below freezing during winter months, the community is often used to these temperatures. However, this does not lessen the risk. Extremely cold temperatures can create dangerous conditions for homeless populations, stranded travelers, and residents without sufficient insulation or heat. The homeless, the elderly, and people with disabilities are often most vulnerable. In Wilbraham, 21.2% of the population is over 65 years old and 7.5% of the population has a disability (US Census Bureau, 2019). Cold weather events can also have significant health impacts such as frostbite and hypothermia. Furthermore, power outages during cold weather may result in inappropriate use of combustion heaters, cooking appliances, and generators in poorly ventilated areas, which can lead to increased risk of carbon monoxide poisoning. During extreme cold, pipes may freeze and burst in many buildings with unreinforced masonry.

Extremely cold temperatures are measured using the Wind Chill Temperature Index provided by the National Weather Service (NWS). The updated index was implemented in 2001 and helps explain the impact of cold temperatures on unexposed skin. Figure 4-8 below provides more information. NOAA's

National Centers for Environmental Information Storm Events Database records data for extreme cold events. Between 2000 and September 2020, Berkshire County experienced 20 extreme cold and wind chill events, no deaths, injuries, or property damage were reported.

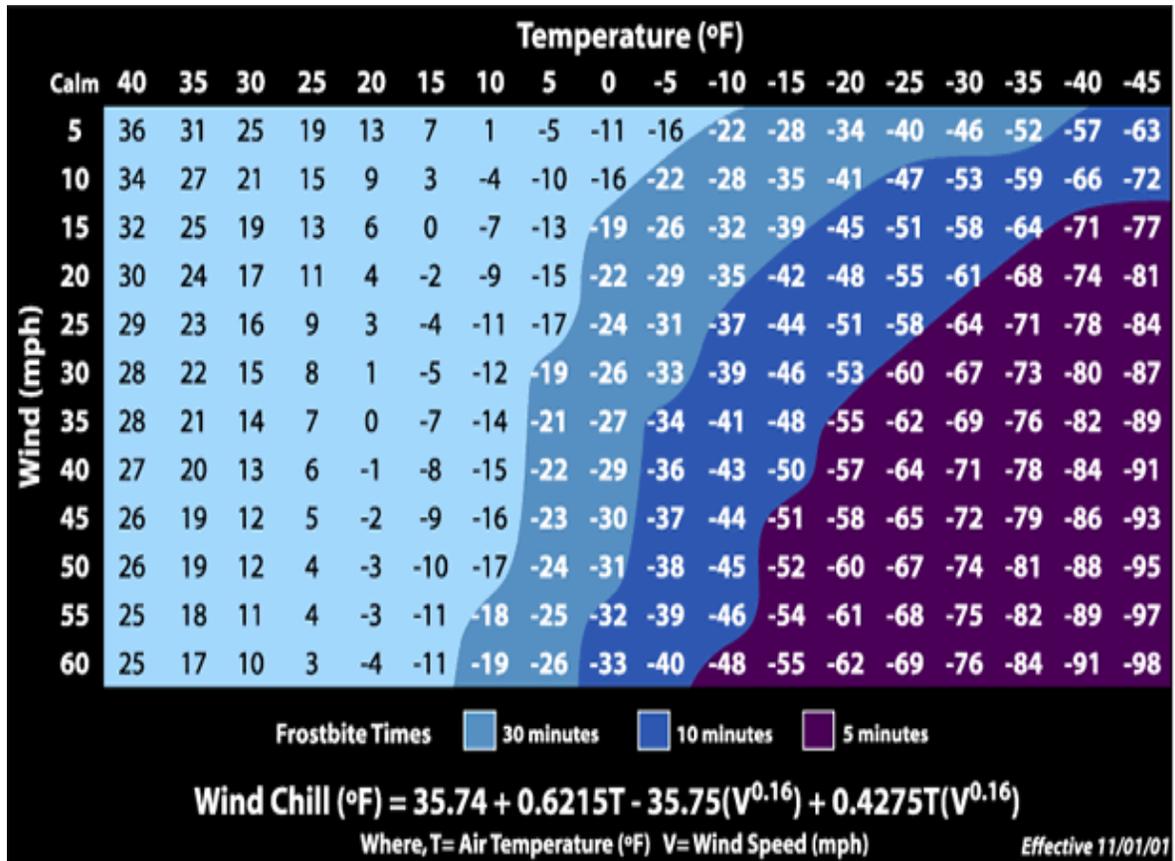


Figure 4-8. Windchill Temperature Index and Frostbite Risk (NOAA, n.d.)

4.7.2 Extreme Heat

Extreme heat is when the maximum temperature reaches above 90°F during the day. Projected heat days and heat waves can have an increased impact in areas with a greater amount of impervious surface, such as buildings, roads, parking lots, and driveways. These can become “heat islands” as dark asphalt and roofs store the heat from the sun. Impacts from heat stress can exacerbate pre-existing respiratory and cardiovascular conditions.

Increased temperatures will impact the entire Town of Wilbraham. July is the hottest month in Wilbraham and average high temperature is July is around 78°F (NEIC, 2021). The Town of Wilbraham does not collect data on heat occurrences, but residents noted past experiences with and concerns about extreme heat events in the Town. NOAA's National Centers for Environmental Information Storm Events Database provides data on excessive heat. Between 2000 and 2021, Hampden County experienced seven heat or excessive heat days, which did not result in any injury or property damage. Extreme temperatures are classified as medium frequency events. As defined by the 2013 State Hazard Mitigation Plan, these events occur from once in 5 years to once in 50 years or have a chance of occurrence of 2% to 20% per year. According to the 2018 Massachusetts State Hazard Mitigation and

Climate Adaptation Plan, between four and five heat waves (3 or more consecutive days of 90° +F temperatures) occur annually in Massachusetts.

The NWS issues a Heat Advisory when the Heat Index (Figure 4-9) is forecast to reach 100-104° F for two or more hours (NOAA, n.d.). The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105° +F for two or more hours. Heat waves cause more fatalities in the U.S. than the total of all other meteorological events combined. From 1979-2012, excessive heat exposure caused in excess of 8,000 deaths in the United States (MEMA and DCR, 2013). During this period, more people in this country died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined.

		Temperature (°F)															
		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
Relative Humidity (%)	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
	50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
	60	82	84	88	91	95	100	105	110	116	123	129	137				
	65	82	85	89	93	98	103	108	114	121	128	136					
	70	83	86	90	95	100	105	112	119	126	134						
	75	84	88	92	97	103	109	116	124	132							
	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	126	135								
	90	86	91	98	105	113	122	131									
	95	86	93	100	108	117	127										
100	87	95	103	112	121	132											
Category		Heat Index		Health Hazards													
Extreme Danger		130 °F – Higher		Heat Stroke or Sunstroke is likely with continued exposure.													
Danger		105 °F – 129 °F		Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.													
Extreme Caution		90 °F – 105 °F		Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.													

Figure 4-9. Heat Index Chart
(NOAA, n.d.)

Because most heat-related deaths occur during the summer, people should be aware of who is at greatest risk and what actions can be taken to prevent a heat-related illness or death. According to the Centers for Disease Control and Prevention, the populations most vulnerable to extreme heat impacts include the following:

- People over the age of 65.
- Children under the age of five.
- Individuals with pre-existing medical conditions that impair heat tolerance.
- Individuals without proper cooling.
- Individuals with respiratory conditions.
- Individuals that overexert themselves during extreme heat events.

Homeless individuals are increasingly vulnerable to extreme heat. The capacity of homeless shelters is typically limited. In Wilbraham, children under five years old make up 21% of the population, and 21% are over 65 years old; however, even young, and healthy individuals can succumb to heat if they

participate in strenuous physical activities during hot weather. Some behaviors also put people at greater risk, including drinking alcohol, taking part in strenuous outdoor physical activities in hot weather, and taking medications that impair the body's ability to regulate its temperature or that inhibit perspiration (MEMA and DCR, 2013; ACS 2014-2018).

The Massachusetts Department of Public Health Bureau of Environmental Health provides a community profile related to public health metrics (MA DPH, 2021). Wilbraham's largest concern during heat waves is likely to be older adults (over 65) that make up 21% of the population and are more likely to have pre-existing health conditions.

4.7.3 Climate Change Impacts: Extreme Temperatures

The average summer temperature in Wilbraham is 76.5 degrees. On average, there are 9.3 days per year where the temperature is greater than 90°F. There are 137.5 days annually when the nighttime low temperature falls below freezing. Both the average temperature and number of extreme heat days are predicted to increase in future climate conditions. Under these conditions, by the end of the century, Massachusetts's climate could more closely resemble that of Maryland or the Carolinas (refer to Figure 4-10 below). These changes in temperature would also have a detrimental impact on air quality and public health concerns, including asthma and other respiratory conditions (Frumhoff et al., 2007). Increased temperatures can lead to a longer growing season, which in turn leads to a longer pollen season. Warmer weather can also support the migration of invasive species and lead to an increase in vector-borne diseases. Increasing temperatures can also exacerbate air pollution, which can lead to negative health impacts such as respiratory problems.

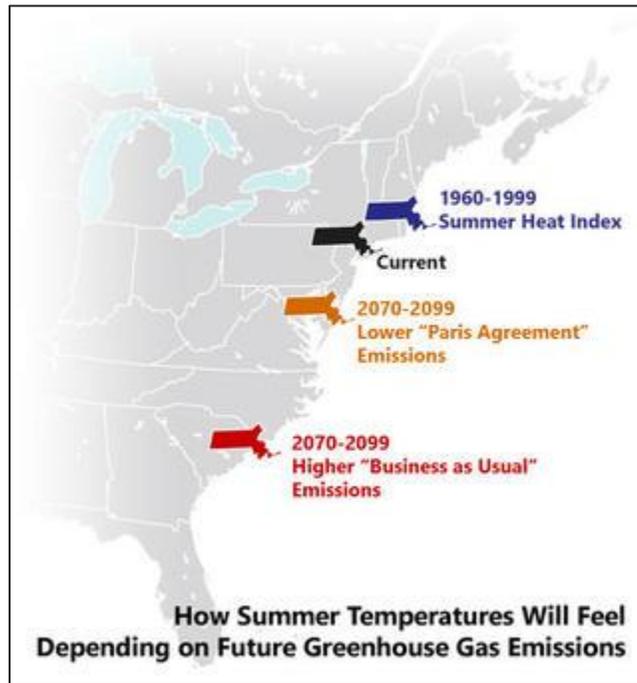


Figure 4-10. Massachusetts Extreme Heat Scenarios.
(Frumhoff et al., 2007)

4.8 Drought

Drought is an extended period of deficient precipitation and occurs in virtually all climatic zones. Since each region has a different baseline precipitation amount, the characteristics of drought vary significantly from one region to another. Agriculture, the water supply, aquatic ecosystems, wildlife, and the economy are vulnerable to the impacts of drought (EEA and EOPSS, 2018).

Although Massachusetts is relatively small, it has a number of distinct regions that experience significantly different weather patterns and varying impacts from changes in precipitation. In accordance with the Massachusetts Drought Management Plan, the Drought Management Task Force provides recommendations to the Secretary of Energy & Environmental Affairs about the location and severity of drought in the Commonwealth. The Drought Management Plan (2019) divides the state into seven regions: Western, Central, Connecticut River Valley, Northeast, Southeast, Cape, and Islands. Wilbraham is located within the Connecticut River Valley region (EEA and MEMA, 2019).

According to the updated Drought Management Plan (2019) there are five levels of drought that characterize drought severity.

- Level 0 – Normal,
- Level 1 - Mild Drought,
- Level 2 - Significant Drought,
- Level 3 - Critical Drought, and
- Level 4 – Emergency Drought,

These drought levels are based on the severity of drought conditions and their impacts on natural resources and public water supplies.

Although the Town has the potential to implement water restrictions, they have not yet had to. The Town's drinking water supply is serviced by MWRA, which comes from the Quabbin Reservoir, and under normal conditions contains enough water to supply all the Towns serviced under present water demands.

The Drought Management Plan specifies agency response and interagency coordination and communication based on various drought levels. During normal conditions, data is routinely collected. There is additional data collection during an advisory, and increased assessment and proactive education during a watch. Water restrictions might be appropriate at the watch or warning stage, depending on the capacity of each individual water supply system. A warning level indicates a severe situation and the possibility that a drought emergency may be necessary. A drought emergency is one in which the use of emergency supplies becomes necessary, or in which the Governor may exercise their authority to require mandatory water restrictions (EEA and MEMA, 2019).

A variety of drought indices are available to assess the various impacts of dry conditions. The Commonwealth uses a multi-index system to determine the severity of a drought or extended period of dry conditions. A determination of drought level is based on seven indices:

1. Standardized Precipitation Index
2. Precipitation (percent of normal)
3. Crop Moisture Index
4. Keetch-Byram Drought Index (KBDI)
5. Groundwater levels
6. Stream flow levels
7. Index Reservoir levels

In the updated Drought Management Plan, the Drought Management Task Force has eliminated the precipitation index that is based on percent of normal precipitation.

Drought level is determined monthly, based on the number of indices that have reached a certain level. A majority of the indices need to be triggered in a region in order for a drought designation to move to a more severe level. Drought levels are declared on a regional basis for each of the seven regions in Massachusetts. Drought levels may also be made county by county or be watershed specific. The end of a drought is determined by precipitation and groundwater levels, since these have the greatest long-term impact on streamflow, water supply, reservoir levels, soil moisture and potential for forest fires (EEA and MEMA, 2013).

Hampden County experienced one recorded drought period from 2000 to 2020 that lasted for seven months, according to the National Center for Environmental Information Storm Events Database. Figure 4-11 illustrates statewide drought levels in Massachusetts from 1850 to 2012, using the Standardized Precipitation Index (SPI). Table 4-13 below summarizes a history of Massachusetts droughts between 1879 and 2020.

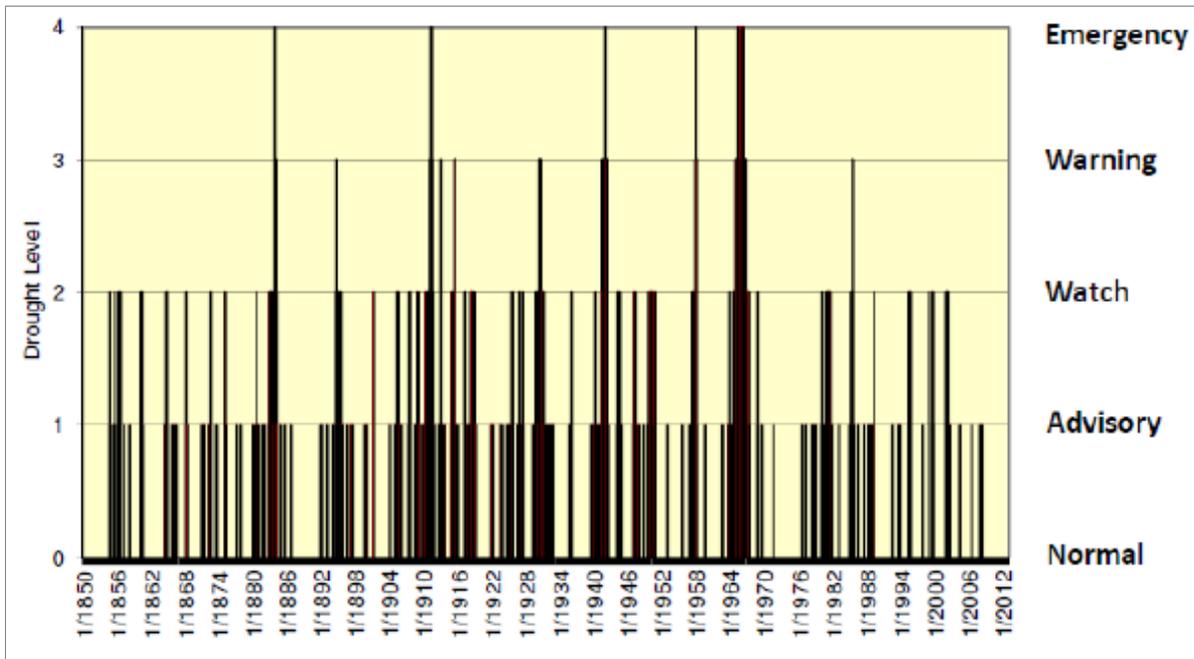


Figure 4-11. Statewide Drought Levels Using SPI Thresholds, 1850 to 2012.
Source: EEA and MEMA, 2013, page 37.

Table 4-13. Droughts in Massachusetts Based on Instrumental Records

Date	Area Affected	Recurrence Interval (years)	Remarks
1879 to 1883	–	–	–
1908 to 1912	–	–	–
1929 to 1932	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.

Date	Area Affected	Recurrence Interval (years)	Remarks
1939 to 1944	Statewide	15 to >50	More severe in eastern and extreme western Massachusetts. Multistate.
1957 to 1959	Statewide	5 to 25	Record low water levels in observation wells, northeastern Massachusetts.
1961 to 1969	Statewide	35 to >50	Water-supply shortages common. Record drought. Multistate.
1980 to 1983	Statewide	10 to 30	Most severe in Ipswich and Taunton River basins; minimal effect in Nashua River basin. Multistate.
1985 to 1988	Housatonic River Basin	25	Duration and severity unknown. Streamflow showed mixed trends elsewhere.
1995	–	–	Based on statewide average precipitation.
1998 to 1999	–	–	Based on statewide average precipitation.
2001 to 2003	Statewide	–	Level 2 drought (out of 4 levels) was reached statewide for several months.
2007 to 2008	Statewide except West and Cape and Islands regions	–	Level 1 drought (out of 4 levels)
2010	Connecticut River Valley, Central and Northeast regions	–	Level 1 drought (out of 4 levels)
2014	Southeast and Cape and Islands regions	–	Level 1 drought (out of 4 levels)
2016-2017	Statewide	–	Level 3 drought (out of 4 levels).
2019	Connecticut River Valley		Level 1 drought (out of 4 levels)
2020	Statewide		Level 2 drought (out of 4 levels) was reached statewide for several months.

(EEA and EOPSS, 2018, page 4-45; DCR, 2021)

In the 2000s, Drought Watches occurred in 2001 and 2002. The overall frequency of being in a Drought Watch is eight percent on a monthly basis over the 162-year period of record (EEA and MEMA, 2019).

There were six Drought Watches in Massachusetts in 2002, five Drought Watches in 2016, and two drought watches in 2017 (DCR, 2017b). Figure 4-12 presents an example of drought conditions in the six drought regions.

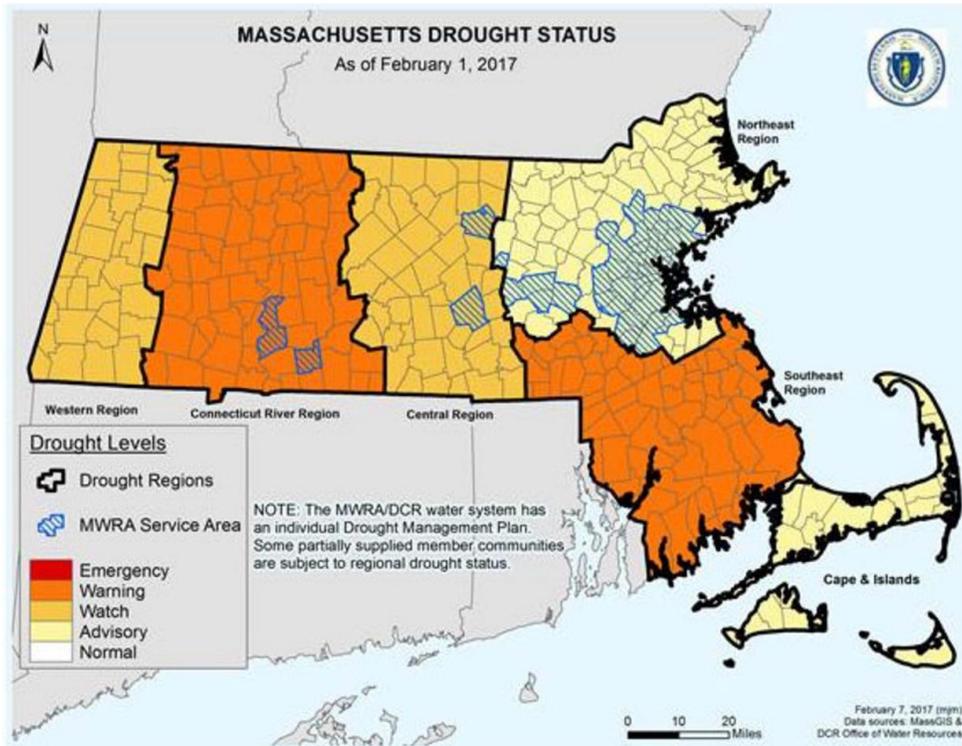


Figure 4-12. Massachusetts Drought Status, February 2017
(DCR, 2017b)

Drought is a potential Town-wide hazard in Wilbraham. As noted previously, temperature is projected to increase and may lead to exacerbated drought conditions especially in summer and fall months. Droughts can also increase fire risk when vegetation is exceptionally dry. Fires can be caused by lightning, and a 2014 study found that the frequency of lightning strikes could increase by more than 10% for every degree Celsius of warming (EEA and EOPSS, 2018). During Wilbraham’s core team meeting in March 2021, Town staff discussed the connections between multiple hazards and their potential combined impact on the Town, such as brush fire, wind, and drought.

A long-term drought could impact Wilbraham’s wetlands and streams, MWRA drinking water supply, and ponds and streams in the Town. Commercial, municipal, and residential water conservation is important during times of drought or low water levels. The Town also sells water to local industries, so a drought could affect economic operations in Wilbraham. To better plan for a drought emergency affecting the water supply, a vulnerability assessment on Wilbraham’s water supply and infrastructure could be conducted to identify potential areas that might be most affected and the potential economic impacts of water use restrictions if they were imposed.

Droughts are classified as a low frequency natural hazard event. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, these events can occur between once in 50 years to once in 100 years (a 1% to 2% chance of occurring per year).

4.8.1 *Drought and Climate Change*

Under climate change, drought conditions will be exacerbated with projected increasing air temperatures and changes in precipitation. Between 1970 and 2000, the median number of consecutive dry fall days in Massachusetts was 11.4 days. This is in comparison to a projected median of 13.5 consecutive days by the end of the century (EEA, 2018a). The same report also mentions that the occurrence of droughts lasting 1 to 3 months could go up by as much as 75% over existing conditions by the end of the century, under the high emissions scenario in the Northeastern States.

5.0 EXISTING MITIGATION MEASURES

The Town of Wilbraham already engages in measures to mitigate local hazards. This chapter (Chapter 5) documents the Town's current hazard mitigation operations and recommends potential improvements. FEMA's *Local Mitigation Planning Handbook* categorizes hazard mitigation measures into four types (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, and Education and Awareness Programs), as displayed in Table 5-1 below (FEMA, 2013). As this chapter demonstrates, Wilbraham already uses many of these tools.

Table 5-1. FEMA's Types of Mitigation Actions

Measure	Action	Examples
Local Plans and Regulations	These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.	<ul style="list-style-type: none"> • Comprehensive plans • Land use ordinances • Subdivision regulations • Development review • Building codes and enforcement • NFIP Community Rating System • Capital improvement programs • Open space preservation • Stormwater management regulations and master plans
Structure and Infrastructure Projects	These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.	<ul style="list-style-type: none"> • Acquisitions and elevations of structures in flood prone areas • Utility undergrounding • Structural retrofits • Floodwalls and retaining walls • Detention and retention structures • Culverts • Safe rooms
Natural Systems Protection	These are actions that minimize damages and losses and preserves or restores the functions of natural systems.	<ul style="list-style-type: none"> • Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements • Wetland restoration and preservation
Education and Awareness Programs	These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential mitigation strategies. A greater understanding and awareness of hazards and risks among local officials, stakeholders,	<ul style="list-style-type: none"> • Radio or television spots • Websites with maps and information • Real estate disclosure for properties in the floodplain • Presentations to school groups or neighborhood organizations • Mailings to residents in hazard-prone areas.

Measure	Action	Examples
	and the public is more likely to lead to direct actions.	<ul style="list-style-type: none"> • Participation in the National Weather Service's StormReady community preparedness program • Participation in Firewise Communities through the National Fire Protection Association's community preparedness program

(FEMA, 2013)

As mentioned there are numerous existing natural hazard mitigation measures already in place in Wilbraham. These were identified through feedback from the Core Team, CRB Workshop participants, interviews with local experts, and additional research by the project team. The hazard mitigation measures outlined below are organized by hazard type, including multi-hazards, floods, dam mitigation, wind, winter weather, drought, fire, extreme temperatures, and geologic hazards.

5.1 Existing Multi-Hazard Mitigation Measures

Local Emergency Planning Committee –

Under the Emergency Planning and Community Right to Know Act of 1986, communities are required to establish a Local Emergency Planning Committee (LEPC) to develop a response plan for chemical emergencies. Wilbraham has established a LEPC. In accordance with this legislation, the Town of Wilbraham has identified locations where hazardous materials are stored, used, and transported.

The LEPC consists of members from Wilbraham Public Access, Town Administration, the Board of Selectmen, the School Department, the Conservation Commission, the Health Department, the Department of Public Works, the Police Department, and the Fire Department, among others.

Comprehensive Emergency Management Plan

Wilbraham has a Comprehensive Emergency Management Plan (CEMP) that is currently being updated, with an estimated completion date of the summer of 2021. Every community in Massachusetts is required to have a CEMP. This plan addresses mitigation, preparedness, response, and recovery from a variety of natural and man-made emergencies. Included in this plan is important information regarding flooding, hurricanes, tornadoes, dam failures, earthquakes, and winter storms.

List of Critical Facilities – The list of critical facilities was updated during this planning process and mapped (see Appendix C for mapping). PVPC has the capacity to digitize this map so that it can be accessed and updated online.

Recommended Improvements

Continue to update materials and provide resources for the community.

None at this time, plan is currently being updated

Work with PVPC to digitize the critical facilities map if it becomes a priority in the future.

Regional Support from Surrounding Communities –

Wilbraham has provided and received additional support from surrounding communities. The support is informally structured.

None at this time.

FEMA Deployment – FEMA can deploy support vehicles in the case of an emergency.

None at this time.

Salvation Army Emergency Assistance and Disaster Services – Assistance is offered by Salvation Army Emergency Assistance for families and individuals experiencing financial hardships, including food, clothing, and utility/heating assistance. Additionally, Service Unit volunteers act as first responders and assist those impacted by fires, flood and other disasters using a mobile kitchen truck, as part of the Salvation Army Disaster Services.

None at this time.

Emergency Medical Services – A team of trained volunteers organized by the Fire Department who can be called upon to assist and respond during emergencies. The Fire Department will provide CPR and First Aid training for anyone requesting it.

Expand the number of volunteers and create a Certified Emergency Response Team (CERT).

Western Massachusetts Medical Reserve Corp – A non-profit organization providing medical care, counseling, and other social services in Western Massachusetts.

None at this time.

Blackboard Connect and Reverse 911 systems – The Town of Wilbraham has Blackboard Connect and Reverse 911 systems, which provides Town officials the ability to contact residents to alert them of a hazard. Residents can update their contact information on the Town website.

Expand outreach to increase the number of residents receiving alerts.

Emergency Shelters – The Senior Center/YMCA and the Wilbraham Public Library are the two informal emergency shelters and can provide food assistance support.

Designate an official emergency shelter and ensure there are adequate resources.

Backup Generators – An emergency backup generator was installed in the Department of Public Works facility.

Install backup generators at critical facilities, including private entities (gas stations and grocery stores).

Buried Utilities – As roadwork occurs, some utilities are buried to increase resilience

Implement a “dig once” policy to underground utilities.

Multi-Department Review of Developments – Depending upon the type of development, extent of construction, and location, multiple departments, including the Planning Board, Building Department, Board of Health, Department of Public Works, Conservation

None at this time.

Commission, the Fire Department, and Zoning Board of Appeals, may review site plans prior to approval.

Massachusetts State Building Code – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing, and snow loads.

Open Space and Recreation Plan 2014 - 2021 – The Town has a wealth of conservation areas and recreation spaces that help reduce urban heat island effect and provide flood storage, among other climate resilient co-benefits. The Open Space and Recreation Plan (OSRP) aims to maintain, promote use, and increase the number of these spaces. The Town is currently drafting a 2022 – 2028 OSRP plan.

Zoning Bylaws – Zoning bylaws permit, prohibit, and regulate the new construction and redevelopment of land uses. Bylaws also establish standards for various land uses such as lighting, landscaping, circulation, and public safety elements. The Zoning Code includes a Floodplain Protection Overlay District and a Water Resource Protection Overlay District, which are further described in the following sections.

Rules and Regulations for Special Permits & Site Plan Review – Special permits are intended to provide detailed review of certain uses and structures, which may have substantial impact upon abutters, traffic, utility systems, public services, and the character of the Town. Special permits are granted by the Planning Board, the Board of Appeals, or the Board of Selectmen acting as the Special Permit Granting Authority.

None at this time.

The Town is currently drafting a 2022 – 2028 plan.

Zoning bylaws were last revised in 1990 and may require updates in the coming years.

None at this time.

5.2 Existing Town-Wide Mitigation for Flood Related Hazards

Wilbraham employs a number of practices to help minimize potential flooding, reduce impacts from flooding, and proactively maintain existing drainage infrastructure. Existing Town-wide mitigation measures include the following.

Participation in the National Flood Insurance Program – Wilbraham participates in the National Flood Insurance Program (NFIP) (FEMA, 2019c). The NFIP is a Federal program administered by FEMA enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. NFIP offers flood insurance to communities that comply with the minimum standards for floodplain management.

Recommended Improvements

Continue participation in the National Flood Insurance Program to enable property owners to purchase insurance protection against flood losses. Increase outreach to property owners with the floodplain.

There are 34 policies in force in Wilbraham as of December 10, 2020 (DCR, 2020). FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website.

The Town complies with the NFIP by enforcing floodplain regulations, maintaining up-to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements.

NFIP uses a Community Rating System (CRS) to award communities that go beyond the minimum standards with lower flood insurance premiums for property owners. The incentives are awarded upon a credit system for various activities. Points are awarded to communities that prepare, adopt, implement, and update a comprehensive flood hazard mitigation plan using a standard planning process. As of December 2020, Wilbraham is not currently participating in the CRS Program (FEMA, 2020).

FEMA FIRMS – Flood Insurance Rate Maps (FIRMs) denote areas of the 100-year and 500-year floodplain, which is used for the NFIP and other regulatory controls. For example, the Building Inspector and the Wilbraham Conservation Commission enforce a federal law requiring elevation above the 100-year flood level of new and substantially improved residential structures in the floodplain. These floodplains are also used in wetland protection and floodplain control regulation. Wilbraham's FEMA FIRMs were last updated in 1979.

Stormwater System Maintenance– The Department of Public Works regularly clears debris from its catch basins, storm drains, and culverts throughout Town. Catch basins that regularly have more debris and manage more stormwater are prioritized. The Town improved a 1.5 mile stretch of drainage and constructed improvements on two culverts that were listed in the 2015 HMP, in order to reduce flooding. There is an ongoing project to clear debris from waterways that will be extended from Brentwood and Jeffrey Lane to Sawmill Pond.

Maintenance of Public Water Bodies – The DPW periodically clears debris to keep the waterways clean. Bruuer Pond was dredged to increase storage capacity and to reduce downstream flooding. The Town is working on a bank stabilization project at Woodland Dell.

When FEMA FIRMs are updated, update regulations referencing the old map. Consider requiring regulatory controls out to the 500-year floodplain to account for climate change.

Design and build new culverts with climate projection data.

None at this time.

National Pollution Discharge Elimination Systems Phase II Stormwater Program or Municipal Separate Storm Sewer System (MS4) Permit–

The Town continues to implement an National Pollution Discharge Elimination System (NPDES) stormwater program in within the Town’s urbanized area, that includes measures for public education and outreach, illicit discharge detection and elimination, construction and post-construction controls, and Town-wide good housekeeping and stormwater maintenance procedures. The Town continues to implement its NPDES Phase II stormwater program, which includes public education programs. In addition, the Town provides educational stormwater materials on the Town website.

None at this time.

Massachusetts Stormwater Management Standards and Handbook –

Massachusetts administers stormwater standards through provisions of the Wetlands Protection regulations (310 CMR 10.00) for wetland notices of intent and surface water discharge permits. The Conservation Commission and Planning Board regulate this at the local level. The Massachusetts Stormwater Handbook provides guidance on how to meet the regulations and manage stormwater pollution.

The Massachusetts Stormwater Handbook is currently being updated by MassDEP.

Stormwater Management Bylaw – The Town’s Stormwater Phase II Comprehensive Bylaw manages land alteration and development in order to protect, maintain, and enhance the health, safety, and general welfare of Wilbraham’s infrastructure and residents. The bylaws establish minimum requirements and procedures to control adverse impacts associated with stormwater runoff.

The stormwater standards currently reference the Massachusetts Stormwater Management Standards that are being reviewed and updated to incorporate climate resilience. Consider updating fees and fines to appropriately cover the expense of the program.

Floodplain Protection Overlay District – The Town’s Floodplain Protection Overlay District (FPOD) is defined by the 100-year floodplain as designated by FEMA. The FPOD regulates certain activities within a flood zone supplementing federal and state laws.

Considering increased the FPOD to the 500-year floodplain to accommodate the anticipated impacts of climate change.

Stream and Lake Protection District – This overlay district establishes restrictions on the location of septic tanks and leach fields, as well as the impacts of the flood storage capacity of the land.

None at this time

Massachusetts Wetlands Protection Act and Local Wetlands Protection – The Commonwealth’s Wetlands Protection Act (Chapter 131, Section 40 MGL) regulates the protection of resource areas in and around wetlands, including land subject to flooding. This regulates development and activity within a 100-foot

Consider the incorporation of climate change in the local Wetlands Protection bylaws and corresponding Rules and Regulations.

buffer around wetlands, and a 200-foot buffer around riverfront areas. The Wetlands Protection Act is locally enforced by the Conservation Commission and Planning and Community Development. The Town further regulates wetlands through the local Wetlands Protection bylaws.

Beaver Management – The Town has a licensed beaver and wildlife removal control service on contract on an as needed basis.

Grants – The Town regularly researches and applies for grants to support the implementation of climate resiliency and hazard mitigation projects.

None at this time.

Continue to apply for grants to support the implementation of this plan and other climate and hazard resiliency projects.

5.3 Existing Dam Mitigation Measures

Division of Conservation and Recreation Dam Safety Regulations and Inspections (2017) – All jurisdictional dams are subject to the Division of Conservation and Recreation’s (DCR) dam safety regulations (302 CMR 10.00). All dams must be inspected regularly, and reports filed with the DCR Office of Dam Safety.

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

Emergency Action Plans – DCR requires that all dams classified or reclassified as high hazard potential and significant hazard potential have an Emergency Action Plan.

Recommended Improvements

None at this time.

None at this time.

Develop updated Emergency Action Plans using the DCR template.

5.4 Existing Town-Wide Mitigation for Wind-Related Hazards

Massachusetts State Building Code (Ninth Edition, 2018) – The Town enforces the Massachusetts State Building Code whose provisions are generally adequate to protect against most wind damage.

Tree Maintenance – The Tree Warden and National Grid maintain trees to reduce the risk of power outages and damage to powerlines during high wind events. Information is shared between the Town and National Grid regularly and during wind hazard events.

Recommended Improvements

None at this time.

Develop a tree management plan.

5.5 Existing Town-Wide Mitigation for Winter-Related Hazards

Wilbraham Snowplowing Policy – The Wilbraham snowplowing policy requires private property owners or tenants to clear snow

Recommended Improvements

None at this time.

from public sidewalks abutting their property, and recommends they clear snow from any fire hydrants nearby.

Snow Plowing and De-icing Operations – The Public Works Department Highway Division provides standard snow plowing and salting operations on main arterials. Certain roads in the Town are subject to ice build-up and require additional attention during cold weather, regardless of snowfall.

Snow Emergency Parking Bans – The Town institutes parking restrictions and bans when a snow emergency is declared.

Fuel Assistance – Fuel assistance is available to renters and homeowners meeting income guidelines through the New England Farm Workers' Council.

None at this time.

None at this time.

Expand programs to assist low-income households by providing fuel assistance.

5.6 Existing Town-Wide Mitigation for Drought-Related Hazards

Water Conservation Public Outreach – The Town's drinking water is supplied by MWRA. Public education materials are available that discuss the social cost of water loss.

Recommended Improvements

Increase drinking water storage capacity to reduce stress on existing system during a drought.

5.7 Existing Town-Wide Mitigation for Fire-Related Hazards

Open Burning Permits Required – The Town allows residential and agricultural burning upon applying for a burn permit. The Fire Department has the right to inspect burn piles on the day of burning.

Review of Construction – The Fire Department and Building Department review buildings for proper fire protection systems, alarms, and sprinklers.

Public Education – The Fire Department educates residents about home fire prevention through a variety of avenues, including the development and distribution of pamphlets.

Fire Department Services – There are currently two fire stations in Wilbraham, both of which are staffed 24/7. The Fire Prevention Officer conducts safety inspections of homes, fuel storage tanks, and special events.

Statewide Fire Mobilization Plan (Massachusetts Fire and EMS Mobilization Plan, 2018)– The state has a fire mobilization plan for

Recommended Improvements

None at this time.

None at this time.

Continue public education efforts and update materials, as necessary. Expand outreach across available platforms.

None at this time.

None at this time.

brush fires. Wilbraham is prepared to respond to small local bushfires.

“Senior SAFE” program – Wilbraham received grant funding for the Senior SAFE Program, which aids in providing fire safety to seniors through the fire department. It also aims to improve safety in senior housing.

Brush Clearing - Brush clearing to provide access to emergency service vehicles.

None at this time.

None at this time.

5.8 Existing Town-Wide Mitigation for Extreme Temperature-Related Hazards

Tree Maintenance by Town – The Town’s Tree Warden maintains street trees and numerous trees on public grounds, historic sites, conservation areas, park areas and cemeteries. National Grid, the area’s electric provider, also conduct preventive tree maintenance.

Heating and Cooling Shelter – The Wilbraham Public Library can be used as a heating or cooling facility.

Recommended Improvements

Continue to plant trees in areas that have lost tree cover due to storm and the emerald ash borer.

Explore other ways to provide refuge from the heat.

5.9 Existing Town-Wide Mitigation for Geologic Hazards

Massachusetts State Building Code – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is “...to minimize the hazard to life of occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake”. This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be “prudent and economically justified” for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, is not economically achievable for most buildings.

Section 1612.2.5 establishes seismic hazard exposure groups and assigns all buildings to one of these groups according to Table 1612.2.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

Recommended Improvements

None at this time.

5.10 Existing Town-Wide Sustainability Measures

Subdivision Regulations – The Town has subdivision regulations designed to protect the natural and built environment from natural hazards.

Recommended Improvements

Require more onsite stormwater BMPs.

5.11 Mitigation Capabilities and Local Capacity for Implementation

Under the Massachusetts system of “Home Rule,” the Town of Wilbraham is authorized to adopt and, from time to time amend, a number of local ordinances and regulations that support the Town’s capabilities to mitigate natural hazards. These include the Zoning Bylaws, Stormwater Bylaws, Subdivision and Site Plan Review Regulations, and Wetlands Bylaws. Local bylaws may be amended to improve the Town’s capabilities, and changes to most regulations simply require a public hearing and a vote of the authorized board or commission. The Town of Wilbraham has recognized several existing mitigation measures that require implementation or improvements, and has the capacity based on these Home Rule powers, within its local boards and departments to address them. The Town also has the ability to expand on and improve the existing policies and programs listed above.

6.0 STATUS OF MITIGATION MEASURES FROM THE 2015 PLAN

6.1 Implementation Progress on the Previous Plan

The Town has taken steps to implement the 2015 HMP by integrating the findings of the plan into the policies, programmatic areas, and plans in the Town. Some of these included continuing fire department educational program in schools, assisting and encouraging residents in applying through NRCS for tree clearing at Brookside Circle, and regular identification and reduction of flooding.

Additionally, the 2015 Town of Wilbraham Hazard Mitigation Plan listed several priority actions items specific to the Town of Wilbraham. Wilbraham staff and Core Team members reviewed these previous mitigation measures for their status and to determine if the measures were still a priority. As indicated in Table 6-1, the Town has completed several mitigation measures. Some of the measures have become continual operation and maintenance and are captured in Chapter 5. Some actions were deferred because of lack of funding or capacity. The measures that were not completed were evaluated with the Core Team. The decision on whether to remove or retain a particular measure was based on the Core Teams' assessment of continued relevance or effectiveness. Table 6-1 summarizes the status of the 2015 mitigation measures and their priority.

Table 6-1. Status of Mitigation Measures from the 2015 HMP

Description of Action	Implementation Responsibility	2021 Update
Install an emergency backup generator at the Department of Public Works facility.	Board of Selectmen, Department of Public Works, EMD	Completed with an HMP grant
Continue Fire Department educational program in schools.	Fire Department	This was completed but was put on hold due to Covid.
Clear debris out of waterways from storms in the Brentwood and Jeffrey Lane Area.	Board of Selectmen, Highway Department, EMD	Not completed – extend this work to Sawmill Pond
Assist and encourage residents in applying for funding through NRCS for tree clearing at Brookside Circle.	Board of Selectmen, Highway Department, EMD	Not completed, continue to work with residents.
Update Wilbraham's Hazard Mitigation Plan every 5 years, using procedures identified in the plan.	LEPC, Police Chief, Fire Chief, DPW	Completed every five years.
Regularly update plan and continue implementation of plan's strategies, including: 1. Identification of areas in the community that are flood prone and define methods to minimize the risk. 2. Review of National Flood Insurance Maps.	Board of Selectmen, EMD	Not completed. Some flood mitigation work has been completed throughout Town and future flood mitigation projects are planned.

Table 6-1. Status of Mitigation Measures from the 2015 HMP

Description of Action	Implementation Responsibility	2021 Update
<p>3. Dissemination of emergency public information and instructions concerning flood preparedness and safety.</p> <p>4. Following of land use and building codes (e.g. Wetlands Protection Act).</p> <p>5. Regular testing of flood control mechanisms to ensure good operating conditions at all times.</p> <p>6. Preservation of natural water storage areas as per OSRP.</p> <p>7. Maintain plans for managing all flood emergency response activities including addressing potentially hazardous dams.</p>		
<p>Create a local debris management plan to address debris after hazards and reduce potential of debris causing wildfire or other hazards (storm cleanup).</p>	<p>EMD, Police Department, Fire Department, Board of Selectmen</p>	<p>Not completed. Educate residents about debris management during storms and add information to the Town website.</p>
<p>Continue Fire Department review of subdivision plans, and commercial and industrial development plans.</p>	<p>Fire Department, Planning Board</p>	<p>Completed.</p>
<p>Improve a 1.5 mile stretch of drainage on Hunting Lane and Main Street (waiting for contract from FEMA).</p>	<p>Board of Selectmen, Highway Department, EMD</p>	<p>Not completed. An underground box culvert was installed on Woodland Dell across Main Street to Hunting Lane. Upper section of Woodland Dell has been improved.</p>
<p>Construct improvements of Woodland Dell culvert system, installing trash racks, walls, and bank stabilization</p>	<p>Board of Selectmen, EMD, Highway Department</p>	<p>Completed.</p>
<p>Improve drainage and stabilize the flood control bank at Brookmont and Hilltop.</p>	<p>Board of Selectmen, Highway Department, EMD</p>	<p>Not completed. An emergency pipe replacement was completed. Banks haven't been stabilized. Woodland Dell bank stabilization should be added to this action, as well as upstream stormwater management detention and stormwater BMPs.</p>

Table 6-1. Status of Mitigation Measures from the 2015 HMP

Description of Action	Implementation Responsibility	2021 Update
Construct twin 50" culverts under Soule Road that drains from Sawmill Pond.	Board of Selectmen, Highway Department, EMD	Not completed. Repair or replace.
Culvert improvements of the Mountain Road/Sunset Rock drainage system.	Board of Selectmen, Highway Department, EMD	Not completed.
Construct culvert improvement and drainage improvements at Upper Monson Road/Glendale.	Board of Selectmen, Highway Department, EMD	No longer an issue, remove.
Install detention basin at Upper Tinkham Road and drainage to Main Street.	Board of Selectmen, DPW, EMD	Not completed. Add Bolles Road.
Dredge Bruuer Pond.	Board of Selectmen, Highway Department, EMD	Completed. Improve the watercourse between Bruuer Pond and Minnechaug Lake. Remove sediment to improve natural grade.
Stabilize Rice Drive Brook.	Board of Selectmen, Highway Department, EMD	Not completed. Add a detention basin.
Improve detention basin at Pigeon Drive and Gary Drive.	Board of Selectmen, Highway Department, EMD	Not completed. Stabilize upstream watercourse.
Make seismic improvements to 2-million-gallon water tower to prevent tower rupture from damaging critical infrastructure.	DPW, Building Inspector	Not completed. Evaluate for tower rupture; altitude valve and overflow are both very old. The entire structure needs to be evaluated and updated.
Install new SCADA alarm system at wastewater treatment plant and pump stations.	Board of Selectmen, Highway Department, EMD	Completed. Build a new wet well at River Road pump station for flood mitigation.
Install trash racks over various existing culverts to prevent blockages.	Board of Selectmen, Highway Department, EMD	Not completed. Trash racks have been installed on some culverts, but this is still an issue.
Determine the Town's feasibility to enroll in NFIP's Community Rating System.	Board of Selectmen, Emergency Management Director, Building Inspector	Completed.
Develop a Beaver Management Strategy in cooperation with the Wilbraham Board of Health. There is a	Board of Health, DPW, Board of Selectmen	No longer an issue, remove.

Table 6-1. Status of Mitigation Measures from the 2015 HMP

Description of Action	Implementation Responsibility	2021 Update
need for controlling the beaver population in critical locations whereby dam flooding can cause significant damage to public and private property as well as produce public safety hazards.		
Water ban establishing measures in the general bylaws for restricting water use in the extreme events. Institute watering ban as necessary.	Fire Department, DPW	Completed through Risk and Resilience Assessment.

7.0 HAZARD MITIGATION AND CLIMATE ADAPTATION STRATEGY

7.1 Identification of Hazard Mitigation and Climate Adaptation Strategies

The Town developed a list of priority hazard mitigation and climate adaptation strategies through a multi-faceted approach. Strategies were discussed and developed upon review of the:

- Hazard and climate change risk assessment.
- Existing measures and the capacity to mitigate and respond to hazardous events.
- Progress on the previous plan.
- Input from stakeholders.

Stakeholders were engaged through Core Team meetings, the CRB Workshop webinars, and the public input session. The full list of action items from the CRB Workshop is available in Appendix C.



Figure 7-1. Environmental priority action items were presented during Wilbraham's Community Resilience Building Webinar

Hazard mitigation strategies often provide protection against more than one natural or climatic hazard. Table 7-1 presents each mitigation measure with its estimated cost, timeframe, and implementation responsibility. These considerations were used to inform the prioritization of the identified mitigation measures. A description of the prioritization categories used in Table 7-1 is included below.

Prioritization Categories Used



Action Item

A description of a hazard mitigation or climate adaptation measure with details, such as a specific location, strategy, or technique to be used to work towards fulfilling the general objective.



Implementation Responsibility

Most hazard mitigation and climate adaptation measures will require a multi-department approach among Town departments that share responsibility, but are often led by a single department (bolded). The governing body of the community ultimately decides responsibility. In addition, some action items require extensive involvement with various departments of the Commonwealth of Massachusetts or private entities. In those cases, the relevant entities have been listed in addition to a municipal department. Section 7.2 specifically addresses regional collaboration.



Time Frame

The time frames represented below are assigned based on the complexity of the measure, the overall priority of the measure, and generally reflect when the mitigation measure is intended to be initiated. The identification of time frames is not meant to prevent a community from actively seeking out and taking advantage of funding opportunities as they arise. The time frames are divided into the categories below.

> 1 year	5-10 years
1-3 years	10+ years
3-5 years	Ongoing



Estimated Cost

The estimated cost is provided using the classifications below. All costs are estimates and would need to be updated at the time of design and construction. When applicable, costs have been divided between preliminary assessments and cost of construction.

\$: <\$10,000	\$\$\$\$: \$250,000-\$500,000
\$\$: \$10,000-\$100,000	\$\$\$\$: \$500,000+
\$\$\$: \$100,000-\$250,000	



Priority

Designation of high, medium, or low priority was based on overall potential benefits, areas affected, and estimated project costs. A high priority action is very likely to have political and public support and necessary maintenance can occur following the project, and the costs seem reasonable considering likely benefits from the measure and available funding sources. A medium priority action may have political and public support and necessary maintenance has the potential to occur following the project. A low priority action may not have political and public support for implementation or the necessary maintenance support following the project.



Potential Funding Sources

Potential sources of funding are identified in Table 7-1 and further summarized in Table 7-2. This column in Table 7-1 focuses on projects that would be competitive for each funding source. While

Prioritization Categories Used

acronyms are used in Table 7-1, the full names of potential funding sources can be found in Table 7-2. An additional description of municipal funding is available in Section 7.3.

Table 7-1: Priority Hazard Mitigation and Climate Adaptation Actions

General Objective	Action Item	Implementation Responsibility	Time Frame (years)	Estimated Cost	Priority	Potential Funding Sources
Culverts and Stormwater Infrastructure	Conduct a Town-wide stream and subbasin assessment to identify stream maintenance, stormwater detention, wetland creation, and culvert update projects that will alleviate flooding	<ul style="list-style-type: none"> • Department of Public Works • Planning Department 	1-3	\$\$\$	H	MVP, BRIC,
	Implement findings from stream and subbasin assessment	<ul style="list-style-type: none"> • Department of Public Works • Planning Department 	3-5	\$\$\$	H	MVP, BRIC,
	Develop community outreach in the form of flyers, pamphlets, and training sessions on how to reduce localized flooding*	<ul style="list-style-type: none"> • Department of Public Works • Planning Department 	1-3	\$	H	Staff Time
	Clear debris out of waterways between Brentwood/Jeffrey Drive to Sawmill Pond*	<ul style="list-style-type: none"> • Department of Public Works 	1-3	\$\$	H	Staff Time
	Continue to improve a 1.5 mile stretch of drainage on Hunting Lane and Main Street*	<ul style="list-style-type: none"> • Department of Public Works 	1-3	\$\$	H	DER Culvert Replacement,

General Objective	Action Item	Implementation Responsibility	Time Frame (years)	Estimated Cost	Priority	Potential Funding Sources
	Improve drainage and stabilize flood control bank at Brookmont and Hilltop and Woodland Dell*	<ul style="list-style-type: none"> • Department of Public Works 	1-3	\$\$	H	DER Culvert Replacement
	Construct twin 50" culverts under Soule Road that drains from Sawmill Pond*	<ul style="list-style-type: none"> • Department of Public Works 	1-3	\$\$	H	DER Culvert Replacement
Electric Grid	Conduct a feasibility study for to install renewable backup power (microgrid and storage options) for Town facilities, including the library, schools, public safety communications infrastructure, water and sewer stations, and police and fire department.	<ul style="list-style-type: none"> • Planning Department 	1-3	\$\$	H	DOER
	Implement a "Dig-Once" policy and install fiber and cabling underground alongside other utility work.	<ul style="list-style-type: none"> • Department of Public Works • Planning Department 	1-3	\$	H	Staff Time
Water and Wastewater Infrastructure	Fortify pump stations and add surge protectors	<ul style="list-style-type: none"> • Department of Public Works • Sewer Division 	1-3	\$\$	H	BRIC, MVP
	Install wet well storage on critical wastewater stations	<ul style="list-style-type: none"> • Department of Public Works • Sewer Division 	1-3	\$\$	H	BRIC, MVP

General Objective	Action Item	Implementation Responsibility	Time Frame (years)	Estimated Cost	Priority	Potential Funding Sources
	Protect water main and other utility infrastructure on Cottage Ave Bridge	<ul style="list-style-type: none"> • Conservation Commission 	1-3	\$\$	H	BRIC
	Build a new water storage tank to reduce stress on current water infrastructure	<ul style="list-style-type: none"> • Department of Public Works • Conservation Commission 	3-5	\$\$\$\$	H	DWSRF
	Make seismic improvements to 2-million-gallon water tower to prevent tower rupture from damaging critical infrastructure*	<ul style="list-style-type: none"> • Department of Public Works • Conservation Commission 	1-3	\$\$\$	H	DWSRF
	Evaluate hydraulic capabilities and cost to assess where water mains can be extended on Glenn Drive.	<ul style="list-style-type: none"> • Water Department 	3-5	\$\$	M	DWSRF
	Develop a mitigation plan for residents on private drinking water wells, who are vulnerable during droughts and hazard events.	<ul style="list-style-type: none"> • Water Department • Planning Department 	1-3	\$\$	H	Water Management Act Grant
Municipal Buildings	Build energy resiliency into high school to function as a designated emergency shelter, create designated heating and cooling stations, expand public outreach about different shelters available (warming, cooling, charging, emergency)	<ul style="list-style-type: none"> • Planning Department 	1-5	\$\$	H	BRIC, MVP, EMPG

General Objective	Action Item	Implementation Responsibility	Time Frame (years)	Estimated Cost	Priority	Potential Funding Sources
Bridges	Implement small bridge prioritized projects for maintenance and improvements	<ul style="list-style-type: none"> Department of Public Works 	3-5	\$\$	M	STIP, Municipal Small Bridge Program
Health and Other Regional Services	Increase utilization of Blackboard Connect, revamp website, and create to provide and distribute more information to residents.	<ul style="list-style-type: none"> Health Department 	1-3	\$	M	Staff Time
	Develop a heat resilience strategy	<ul style="list-style-type: none"> Health Department 	1-3	\$\$	M	Healthy Communities Grant Program
Vector-borne and Infectious diseases	Distribute information to residents about ticks and mosquitos. Utilize relationships with local groups, organizations, youth, and local public access for outreach.	<ul style="list-style-type: none"> Conservation Commission Health Department 	1-3	\$	H	Staff Time
Local Businesses	Help local businesses get resources they need to prepare for a hazard, including access to a generator and an emergency response plan	<ul style="list-style-type: none"> Planning Department 	1-3	\$\$	M	BRIC
People with Possible Barriers to Building Resilience	Develop a partnership with Hampden County Health Coalition to create local programs providing residents with information about hazards and building a grab and go kit.	<ul style="list-style-type: none"> Health Department 	1-3	\$	H	Staff Time
	Develop a program to check on elderly neighbors and provide them with information	<ul style="list-style-type: none"> Planning Department 	1-3	\$	H	Senior SAFE

General Objective	Action Item	Implementation Responsibility	Time Frame (years)	Estimated Cost	Priority	Potential Funding Sources
	Update wetland and zoning bylaws to include climate change	<ul style="list-style-type: none"> • Planning Department • Conservation Commission 	1-3	\$	H	MVP
Open Space	Develop a study to determine potential land acquisitions and partnerships	<ul style="list-style-type: none"> • Conservation Commission 	3-5	\$	M	Community Forest Grant Program, Conservation Assistance Grant Program, LAND Grant, Mass Land and Water,
	Develop an assessment to identify town-owned locations to install green infrastructure	<ul style="list-style-type: none"> • Conservation Commission • Planning Department 	1-3	\$\$	H	MVP, Water Quality Management Planning Grant
	Install a strategically placed green infrastructure pilot project with an education component	<ul style="list-style-type: none"> • Conservation Commission • Planning Department 	1-3	\$\$	H	MVP, Water Quality Management Planning Grant
	Develop a Tree Management Plan	<ul style="list-style-type: none"> • Conservation Commission • Planning Department 	3-5	\$\$	M	MVP, TD Green Space Grant
	Assist and encourage residents in applying for funding through NRCS for tree clearing at Brookside Circle*	<ul style="list-style-type: none"> • Tree Warden • Board of Selectmen • Highway Department • Emergency Management 		\$	L	Staff Time
Contaminants	Create outreach and education for farm and property owners about fertilizer application and BMPs.	<ul style="list-style-type: none"> • Conservation Commission 	1-3	\$	M	Staff Time

General Objective	Action Item	Implementation Responsibility	Time Frame (years)	Estimated Cost	Priority	Potential Funding Sources
	Sample downstream ponds after heavy rain event	• Conservation Commission	1-3	\$	M	Healthy Communities Grant Program
	Conduct a Water Quality Study at Nine Mile Pond, Sawmill Pond, Bennett Pond	• Conservation Commission	1-3	\$\$	H	Healthy Communities Grant Program
	Coordinate and develop a Chloride Reduction Plan with the State	• Conservation Commission	1-3	\$\$	H	MVP
Invasive Species	Develop an Invasive Species Removal Plan, include community outreach and growing volunteer base	• Conservation Commission	1-3	\$\$	H	MVP

Note: *Carryover from 2015 HMP

7.2 Regional Partnerships

Mitigating natural hazards is not a strictly local issue. For example, the drainage systems that serve communities are often complex systems of storm drains, roadway infrastructure, pump stations, dams, and other facilities owned and operated by a wide variety of agencies, including Massachusetts Department of Transportation (MassDOT), Massachusetts Emergency Management Association (MEMA), and the Department of Conservation and Recreation (DCR). The planning, construction, operation, and maintenance of these structures are integral to the hazard mitigation and climate adaptation efforts of communities. The Town will strive to share and obtain vulnerability data in coordination with state and regional agencies with land ownership in the Town. State agencies also operate with budgetary and staffing constraints, like communities. Similarly to municipalities, they must make decisions about numerous competing priorities. In order to implement many of the mitigation measures identified by the Town, all parties will need to work together towards a mutually beneficial solution.

Wilbraham also has strong working relationships with the Pioneer Valley Planning Commission (PVPC), who has supported past projects to address regional issues and solutions. Regional entities will also be key partners in implementing measures from this plan.

7.3 Potential Funding Sources

The identification of funding sources herein is preliminary and actual funding availability varies depending on numerous factors. These factors include, but are not limited to, if a mitigation measure is conceptual or has been studied, evaluated, or designed. In most cases, the measure will require a combination of funding sources. The funding sources identified are not a guarantee that a specific

project will be eligible for, or receive, funding. Upon adoption of this plan, the local representatives responsible for implementation should begin to explore potential funding sources in more detail.

Traditional funding sources within the Town of Wilbraham, such as funding from the operating and capital budgets, may be able to cover some of the costs associated with the action items detailed in Table 7-1. This has been noted as General Fund in the Potential Funding Sources column. State revolving funds and other no- or low-interest loans may also be of interest. There is a great variety of funding available for Massachusetts municipalities, both through the state and federal governments. A full list of funding opportunities can be found on the [Community Grant Finder webpage](#). The Community Grant finder provides a streamlined interface where municipalities can easily learn about grant opportunities. Specific funding options related to action items developed by Wilbraham are listed in Table 7-2 below.

Table 7-2: Potential Funding Sources

Grant	Description	Category	Limitations & Stipulations
604b Grant Program	Water quality assessment and management planning	Environment	None
Building Resilient Infrastructure and Communities (BRIC)	Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event, with a focus on infrastructure projects and “community lifelines.” Replaced FEMA’s Pre-Disaster Mitigation (PDM) Program.	Emergency Management and Planning	None
Chapter 90 Program	Reimbursable grants on approved projects	Public Works and Transportation	None
Community Forest Grant Program	Funding to establish community forests	Environment	None
Culvert Replacement Municipal Assistance Grant Program	Grant to replace undersized, perched, and/or degraded culverts located in an area of high ecological value	Environment	None
DER Priority Projects	Funds cranberry bog wetland restoration, streamflow restoration, and urban stream revitalization projects.	Environment	None
DOER	The DOER provides grant funding for clean energy-related programs	Energy	None
Emergency Management Performance Grant (EMPG)	Reimbursable grant program to assist local emergency management departments to build and maintain an all-hazards emergency preparedness system	Public Safety	Reimbursable

Grant	Description	Category	Limitations & Stipulations
Federal Clean Water Act, 604b Grant Program: Water Quality Management Planning	Funds nonpoint source assessment and planning projects, including projects related to green infrastructure	Environment	None
Federal Clean Water Act, Section 319 Nonpoint Source (NPS) Competitive Grant Program	Implementation projects that address the prevention, control, and abatement of NPS pollution.	Environment	None
Federal Land & Water Conservation Fund	Funding for the acquisition, development, and renovation of parks, trails, and conservation areas.	Environment	Municipality must have an Open Space & Recreation Plan
Flood Mitigation Assistance Grant Program (FMA)	Implement cost-effective measures that reduce or eliminate the long-term risk of flood damage	Emergency Management and Planning	For buildings and other structures insured under the National Flood Insurance Program (NFIP).
Green Communities Designation and Grant Program	Provides a road map along with financial and technical support to municipalities that pledge to cut municipal energy and meet other criteria	Energy	None
Hazard Mitigation Grant Program	Provides funding after a disaster to significantly reduce or permanently eliminate future risk to lives and property from natural hazards	Emergency Management and Planning	None
LAND Grant Program	Helps cities and towns acquire land for conservation and passive recreation	Environment	Reimbursement rate: 52-70%
Land Use Planning Assistance Grants	Supports efforts to plan, regulate, and act to conserve and develop land consistent with the Massachusetts' Sustainable Development Principles (from Executive Office of Energy and Environmental Affairs (EEA))	Environment	None
Massachusetts Downtown Initiative (DHCD)	Offers services and assistance to communities seeking help on how to revitalize their downtowns	Community Development	None

Grant	Description	Category	Limitations & Stipulations
Massachusetts Land and Water Conservation Fund Grant Program	Funding for the acquisition, development, and renovation of parks, trails, and conservation areas.	Environment	Municipality must have an OSRP
MassDEP Water Quality Monitoring Grant Program	Enhance MassDEP surface water quality assessment data by building or expanding capacity for bacteria monitoring data collection.	Environment	None
MassWorks Infrastructure Program	Provides grants to communities to help them prepare for success and contribute to the long-term strength and sustainability of the Commonwealth.	Community Development	None
MEMA Citizen Corps Program (CCP) Grant	Supports local Community Emergency Response Teams (CERT) and Volunteers in Police Service (VIPS) in preparing for all-hazards. Can be used for planning activities, equipment, training, and exercises.	Emergency Management and Planning	None
Municipal Small Bridge Program	Funding for small bridge replacement, preservation, and rehab projects	Public Works and Transportation	Bridges with spans between 10' and 20'
Municipal Vulnerability Preparedness (MVP) Program	Provides support to implement climate change resiliency priority projects	Environment	Requires 25% match of total project costs
Natural Resource Damages Program	Funding for restoration projects. Funding comes from settlements, so it does not follow a set schedule.	Environment	None
Pre-Disaster Mitigation (PDM) Grant Program	Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event	Emergency Management and Planning	None
Public Assistance Program	The state reimburses governments and other applicants for disaster related costs	Public Safety	75% reimbursable
Senior SAFE	Supports fire and life safety education for seniors	Public Safety	None
Student Awareness of Fire Education (S.A.F.E.)	Grants for local fire departments to teach fire and life safety to schools	Public Safety	None

Grant	Description	Category	Limitations & Stipulations
Surface Transportation Block Grant Program (STBG)	Includes funding for bridge projects on any public road and facilities for nonmotorized transportation	Transportation	None
Water Management Act Grant	Funds planning projects to identify implementation actions to improve ecological conditions, conservation projects and drought resiliency planning, and withdrawal mitigation projects that increase porosity and water quality.	Environment	None

8.0 PLAN ADOPTION AND MAINTENANCE

8.1 Plan Adoption

The Town of Wilbraham's 2021 MVP-HMP was adopted by the Board of Selectmen on [ADD DATE]. See Appendix E for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

8.2 Plan Implementation

The Core Team will use Table 7.1 as a guide for taking action to mitigate hazards and improve the Town's climate resilience. The time frame, responsible department(s), and funding mechanisms in lay out an implementation plan for the Core Team. The Core Team will be held accountable through the tracking mechanisms explained in the following sections. The 2021 MVP-HMP will also inform future planning and budgeting processes.

8.3 Plan Maintenance

8.3.1 Tracking Progress and Updates

FEMA's initial approval of this plan is valid for five years. During that time, the Town will continue to track progress, document hazards, and identify future mitigation efforts. This can be achieved through a combination of two methods:

1. **Meetings:** The Core Team, coordinated by the Department of Public Works, will meet once a year during regularly scheduled staff meetings to monitor plan implementation. The Core Team will be amended as needed but will likely include representatives from the Fire Department, Highway Department, Planning Board, and the Conservation Commission. These meetings will provide an opportunity for regular implementation updates and to identify capital planning needs related to hazard mitigation.
2. **Surveys:** The coordinator of Core Team will prepare and distribute a survey every year. The survey will be made available to all Core Team members and any interested local stakeholders. The survey will assist in determining any necessary changes or revisions to the plan regarding existing and proposed action items. In addition, it will provide written documentation of status updates, accomplishments, and progress related to the action items listed in the MVP-HMP. The surveys will help document new hazards or problem areas that have been identified since the 2021 MVP-HMP. The information collected through the survey will be used to formulate any needed updates and/or addendums to the plan.

8.3.2 Continuing Public Participation

The adopted plan will be posted on the Town's website with a mechanism for citizen feedback, such as an e-mail address, for questions and comments. The Town will encourage local participation whenever possible during the next five-year planning and implementation cycle. The Core Team will also incorporate engagement into the implementation of the priority action items. All updates to the plan, including implementation progress, will be placed on the Town's website.

8.3.3 Integration of the Plans with Other Planning Initiatives

Upon approval of the Town of Wilbraham's 2021 MVP-HMP by FEMA, the Core Team will make the plan available to all interested parties and all departments with an implementation responsibility. The group will initiate a discussion with those various departments regarding how the plan can be

integrated into their ongoing work. At a minimum, the plan will be reviewed and discussed with the Core Team's departments.

Appropriate sections of the MVP-HMP will be integrated into other plans, policies and documents as those are updated and renewed, including the writing of, or updates to, the Town's Master Plan, Open Space Plan, Comprehensive Emergency Management Plan, and Capital Investment Program. Coordination with the Pioneer Valley Planning Commission and adjacent communities, local organizations, businesses, watershed groups, and state agencies will be required for successful implementation and continued updating.

8.4 Process of Updating

By maintaining the 2021 MVP-HMP as described above, the Town will have a competitive application when applying to FEMA for funding to update the plan. Once the resources have been secured to update the plan, the Core Team will need to determine whether to undertake the update itself or hire a consultant. If the Core Team decides to update the plan itself, the group will need to review the current FEMA hazard mitigation plan guidelines for any change in the requirements. The update to the Town of Wilbraham's 2021 MVP-HMP will be forwarded to MEMA for review and to FEMA for ultimate approval. The Core Team will begin drafting the full update of the plan in four years. This will help the Town avoid a lapse in its approved plan status and grant eligibility when the current plan expires at the end of year five.

9.0 LIST OF REFERENCES

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Appendix A

Core Team Materials

Appendix B

Additional Hazard Data

Appendix C

Workshop Materials

Appendix D

Public Engagement

Appendix E

Plan Adoption

Appendix F

FEMA Approval