TOWN OF RICHMOND


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

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1 Introduction

1.0 INTRODUCTION

The Town of Richmond 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 Richmond MVP-HMP Summary of Findings Report was adopted by the Board of Selectmen on Date to update and replace the Berkshire County Hazard Mitigation Plan from 2012.

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 and implementation saves lives and money. For every dollar spent on federal hazard mitigation grants, an average of six dollars are saved (NIBS, 2019). 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, 2020a)

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, local governments are required to prepare an HMP that meets the requirements summarized in Figure 1-2 (one page 1-4), 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 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 grant phase is the Planning Grant, 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 is the Action Grant, 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.

1.3 Combining Hazard Mitigation and Municipal Vulnerability Preparedness Planning in Richmond

The Town of Richmond received an MVP Planning Grant and a FEMA Grant to simultaneously prepare an MVP plan in coordination with an HMP process. This combined approach enabled Richmond 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 needs of the hazard mitigation planning process (see Figure 1-2).

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, Richmond was able to fulfill the requirements and enhance the impact of both processes.

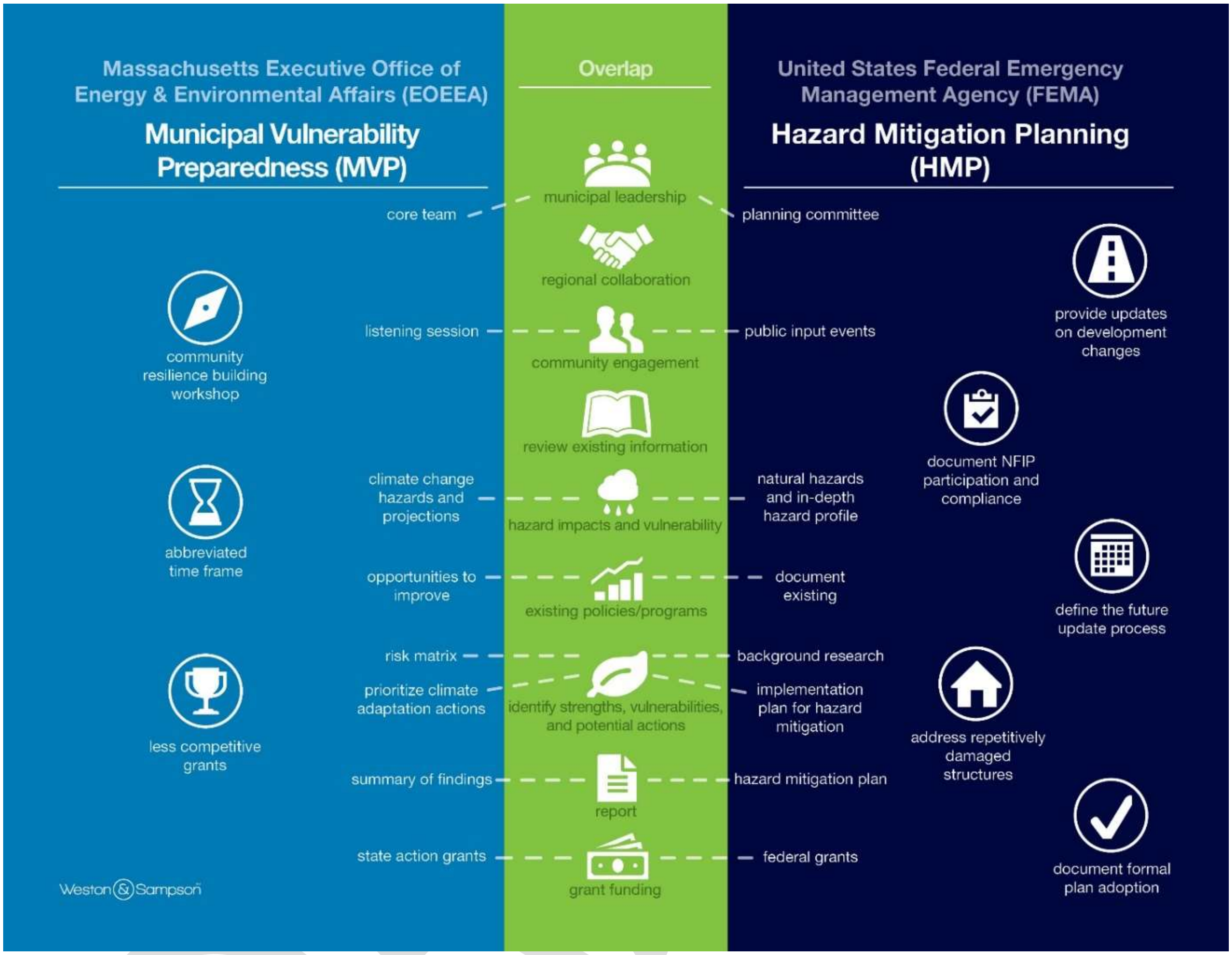


Figure 1-2. Comparison of the MVP and HMP Process

1.4 Planning Process Summary

An important aspect of the natural hazard and climate change impact mitigation planning processes is facilitating discussion among stakeholders, including about how to create a safer, more resilient community. 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

1.4.1 Core Team

The Town of Richmond convened the Core Team to act as a steering committee for the development of the MVP-HMP. The Core Team met on November 5, 2020 to set goals for the planning process, provide input on historic hazard events, and plan for the CRB Workshop. The Core Team met again on February

18, 2021 to prioritize the mitigation actions and review the implementation mechanisms. More information on these meetings 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. Richmond's Core Team

Name	Title
Danielle Fillio	Town Administrator
Peter Beckwith	Superintendent of Highway Department
Shepley Evans	Conservation Agent
John Hanson	Planning Board Chair
Steve Traver	Fire Chief

The Core Team also suggested or made available reports, maps, and other pertinent information related to natural hazards and climate change impacts in Richmond. These included:

- Comprehensive Emergency Management Plan (Town of Richmond, 2019)
- Open Space and Recreation Plan (BRPC, 2016)
- Richmond Community Development Plan (BRPC, 2003)
- Berkshire County Hazard Mitigation Plan (BRPC, 2012)
- BioMap2 Report and Map (MDFW, 2012)
- Massachusetts Climate Change Projections (NECSC, 2018)
- Massachusetts Climate Change Adaptation Report (EEA, 2011)
- Massachusetts State Hazard Mitigation and Climate Change Adaptation Plan (EEA and EOPSS, 2018)
- Local Mitigation Planning Handbook, March 2013 (FEMA, 2013)
- Storm Event Database, National Center for Environmental Information (NOAA, 2020b)
- Decennial Census (US Census Bureau, 2010)
- American Community Survey, 5-year estimates (US Census Bureau, 2015-2019)

1.4.2 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 December 15-17, 2020 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 Richmond. 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 Richmond. These include the Richmond roads (left), Richmond Pond (center) and Richmond Consolidated School (right). Photos by the Town of Richmond

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. For example, as the Planning Board has the authority to regulate development in Richmond, a representative of the Planning Board was invited and attended the CRB Workshop series. We also conducted an email interview with the Planning Board Chair.

A summary of key participants at each webinar is included below.

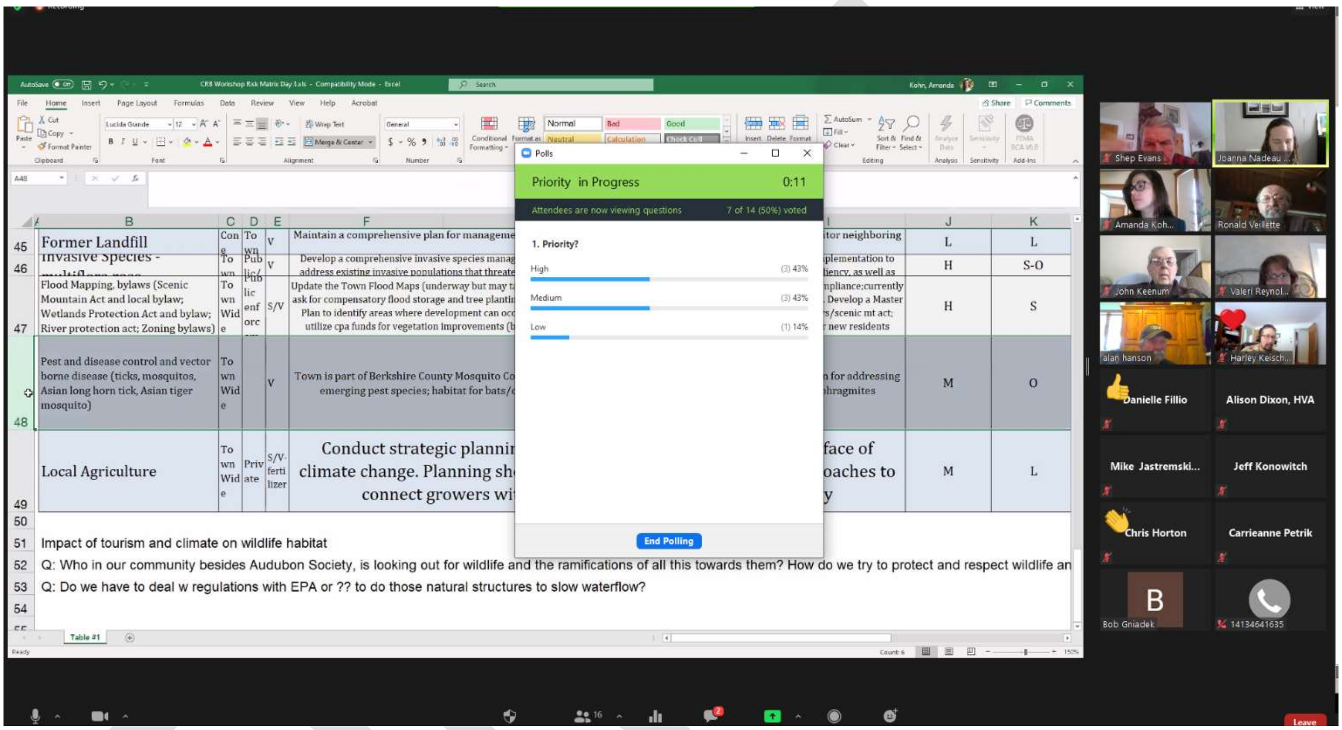
1. Infrastructure Webinar: 17 participants, including:
    - Municipal staff members from the Department of Public Works and Conservation Agent
    - Members of boards and committees, including the Board of Selectmen, Planning Board, Conservation Commission, Recreation Committee, and Finance Committee
    - Representatives from local groups, including the Richmond Pond Association
    - Representatives from State agencies and regional organizations, including the Massachusetts Department of Transportation, the MVP Regional Coordinator, Berkshire County Mosquito Control, Housatonic Valley Association, and Mass Audubon
    - State Senator Adam Hinds

2. Society Webinar: 16 participants, including:
    - Municipal staff members from the Department of Public Works and Conservation Agent
    - Members of boards and committees, including the Board of Selectmen, Planning Board, Conservation Commission, Finance Committee, Recreation Committee, and School Committee
    - Representatives from local groups, including the Richmond Pond Association
    - Representatives from State agencies and regional organizations, including the MVP Regional Coordinator, Massachusetts Department of Transportation, Berkshire County Mosquito Control, and Housatonic Valley Association

3. Environment Webinar: 17 participants, including:
    - Municipal staff members including the Town Administrator and Conservation Agent

- Members of boards, including the Planning Board, Conservation Commission, Finance Committee, Recreation Committee, and Agricultural Commission
- Representatives from local groups, including the Richmond Land Trust and Richmond Pond Association
- Representatives from State agencies and regional organizations, including the Housatonic Valley Association, Mass Audubon, Berkshire County Mosquito Control, and the MVP Regional Coordinator

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



For each of these webinars, leadership from neighboring communities of Lenox, Pittsfield, West Stockbridge, Stockbridge, and Hancock, MA; and Austerlitz, Canaan, and New Lebanon, NY were invited to participate in the Workshop but only one representative - from New Lebanon, New York - attended the society webinar.

1.4.3 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 (Video/Survey): 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 Richmond Town website and advertised through the Richmond Town newsletter, local newspaper, a press release, email blasts, and a social media post on the Town Facebook page. The online survey received 36 responses.

Survey results suggested that winter weather (Nor'easters, snowstorms, blizzards, ice storms), severe wind events (tornado, thunderstorms, hurricane), and flooding are the hazards of most concern to the Richmond community. Residents shared stories of when winds and heavy snow had affected power and flooding had caused impassible roads and mosquito infestations. Respondents also indicated their priorities for Town mitigation activities. See Appendix D for survey questions and a summary of results.

> ***"We live in the Berkshires. Bad weather is part of our life."***
> *-survey response*

2. Virtual webinar on draft plan: 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 Public Library parking lot was advertised as a location with free Wi-Fi and an alternate call-in number was provided. 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.

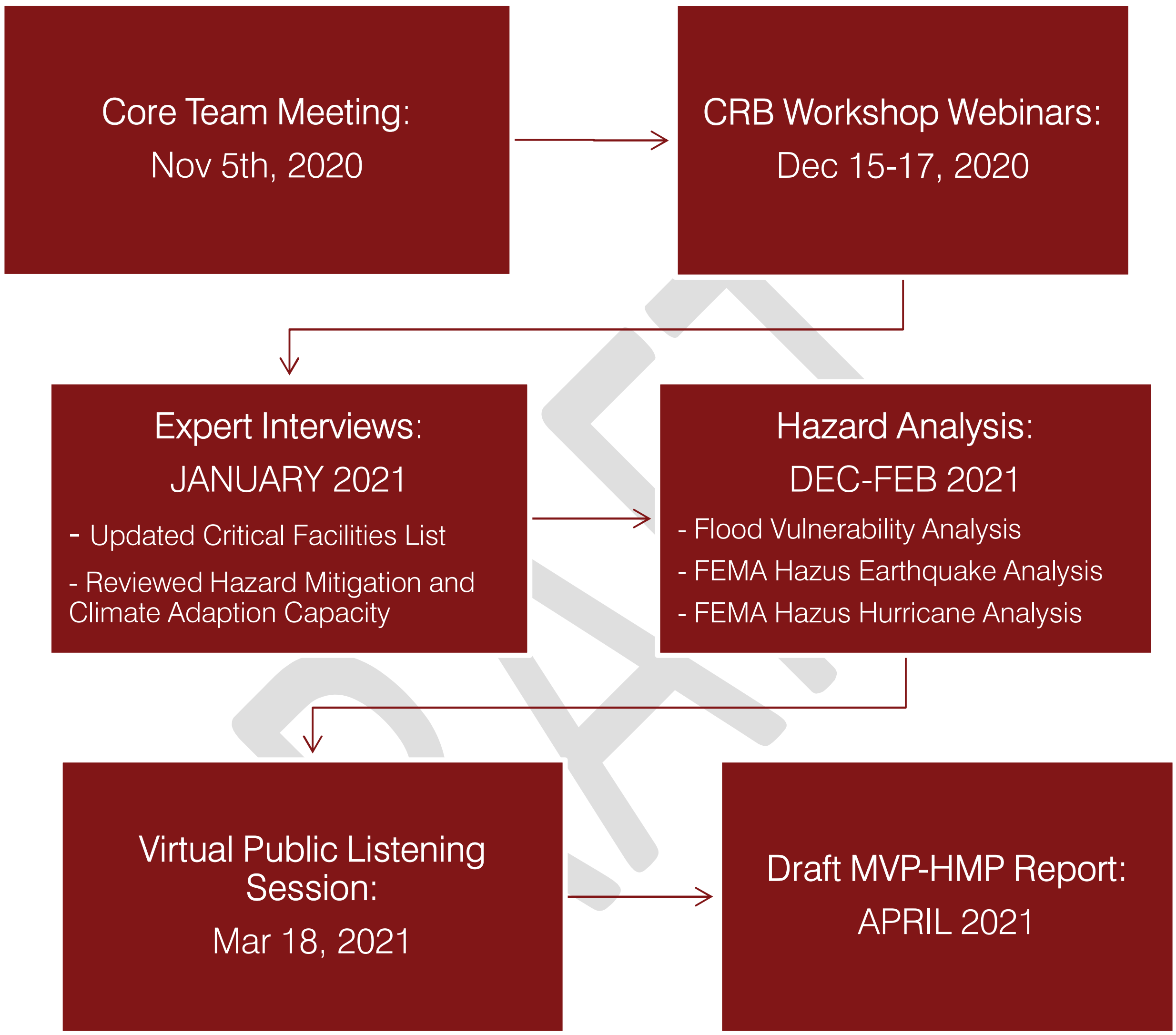
The webinar presented information related to the MVP program, climate change in Richmond, local strengths and vulnerabilities, existing mitigation measures, and priority action items for future climate adaptation. More information about the virtual Public Listening Session, including a summary of survey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

[placeholder]

Figure 1-5. A screenshot from Richmond's Public Listening Session Webinar

1.4.4 *Planning Timeline*

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



1.5 MVP-HMP Report Layout

The report that follows 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 into these chapters:

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, including:

- 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 hazard's 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

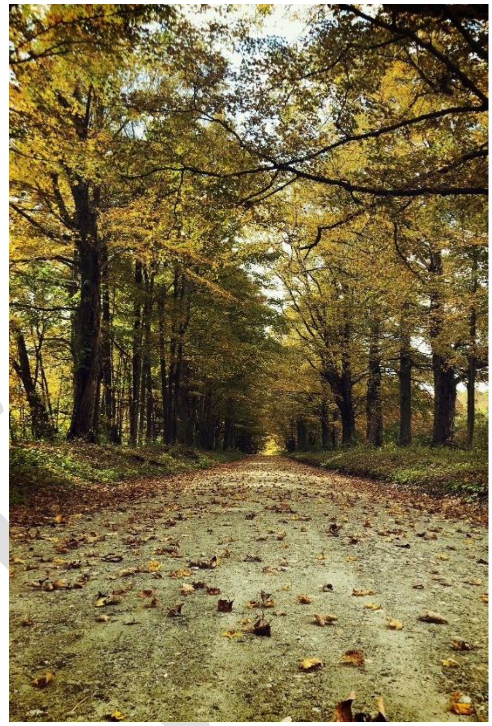
Chapter 7: An action plan for next steps

Chapter 8: Plan adoption, maintenance, and implementation

Chapter 9: References

2

Goals



2.0 HAZARD MITIGATION AND CLIMATE ADAPTATION GOALS

The Town of Richmond'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 low-income populations
- 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.

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

Community Profile

3.0 COMMUNITY PROFILE, LAND USE, AND DEVELOPMENT TRENDS

3.1 Community Profile

The Town of Richmond is a community with a rich history of people enjoying the rural, scenic setting for many centuries.

The area was originally inhabited by the Mohican tribe until it was purchased from Chief Ephraim and Chief Yokun (Lenox Historical Society, 2015). Europeans settled in Richmond around 1759, and the municipality was officially incorporated in 1765 (Town of Richmond, 2016) as a farming community with sheep, dairy farming, and orchards. With the discovery of iron ore, the Richmond Iron Works and Richmond Furnace began in the early 1800s and fueled associated industries (charcoal production, wagon construction, and blacksmithing) and population growth. The Iron Works would operate until 1923 in alignment with a decline of industrial and agricultural activity in the area, though some agriculture remains. The Richmond Furnace Historical and Archeological District covers a former iron production site, which is listed on the National Register of Historic Places. Sheep farming and lime quarries were two other major components of the historic economy up until the late 1800s.

As industry and agriculture declined, Richmond become a destination for summer and seasonal residents with an influx as early as the mid-1800s. Residents also began to commute to nearby towns for work. From the early 1900s to the 1980's, the largest industry in the area was a General Electric (GE) plant in Pittsfield. Today, Richmond is mostly a residential community nestled in a forested landscape. In 2019, the population was 1,489 people (U.S. Census Bureau, 2019) which is fairly consistent with the 2010 population of 1,475. The population is projected to decline to 969 by 2040 (Donahue Institute, 2015).

Richmond is located in the south-central section of Berkshire County on the border of Massachusetts and New York. Richmond is bordered by Hancock and Pittsfield, MA on the north; Lenox, MA on the east; Stockbridge and West Stockbridge, MA on the south; and Canaan, NY, on the west. Richmond's town center is approximately 10 miles southwest of the City of Pittsfield, the largest city in the county and a major regional employer. Governance of Richmond is overseen by three elected Board of Selectmen who hire a Town Administrator to manage the day-to-day operations of the Town. The Town maintains a website at https://www.richmondma.org/. Due to its size, Richmond relies on regional services for waste management, secondary education, food and fuel assistance, police, and more.

Fifty-four critical facilities and community lifelines in the Town of Richmond have been identified. For a full list of critical facilities and community lifeline information, please see Appendix B. The Town Building committee is also proposing construction of a new Town Hall and Library Building to start later this year.

Table 3-1. Population Demographics

2019	Richmond	Massachusetts
Population	1,489	6,892,503
Under the Age 18	15.3%	19.6%
Over Age 65	30.0%	17.0%
Bachelor's degree or higher	49.8%	45.0%
Median household income	$92,313	$85,843
Poverty Rate	6.9%	9.4%
With a Disability	8.5%	11.5%
Limited English-Speaking Skills	1.3%	9.2%
Housing Units	679	2,928,818
Renter-Occupancy Rate	5.2%	37.8%

(US Census Bureau, 2019)

3.2 Societal Features

Richmond offers numerous social services including a public library, on demand van services, volunteer fire department, and youth programming. The Town's volunteer base, high rates of home ownership, and services are strengths that can be utilized for hazard mitigation 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 Richmond, seniors, youth, people who are disabled, non-English speakers, and low-income individuals are considered vulnerable. Seniors are the largest vulnerable group in Richmond and represent 30.4% of the total population, 14% more than Massachusetts as a whole (Table 3.1). Organizations supporting older residents include the Council on Aging, Library, and Board of Health. Richmond is home to the Consolidated School, supporting early childhood through eighth grade education, as well as private early education and day care services.

The number of senior residents rose from 252 in 2000 to 395 in 2013, an increase of 56.7%, compared to a decrease of 7.2% for the general population, according to the Richmond Open Space Plan (2016). The aging of the Baby Boomers will likely cause the senior population to continue increasing through 2030. As the population continues to grow older, emergency service capacity will need to grow at the same rate. Seniors and children are vulnerable to heat-related illnesses and possible isolation in extreme storms, and extended heat waves and more storms are predicted with climate change. The only Census Blocks with a designated environmental justice population located near the Town of Richmond are in Lenox, where there is one Census Block designated based on income, and in Pittsfield, where there are two based on income and/or minority population (MassGIS 2020b).

3.2.1 *CRB Workshop Discussion of Societal Features*

Workshop participants identified key societal aspects of Richmond that are most vulnerable to, or provide protection against, natural hazards and climate change impacts.

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

Vulnerabilities	Both Vulnerability and Strength
• Residents at risk of isolation, including seniors, people with disabilities, and children, in the presence of increasingly frequent severe storms and flooding • Residents and outdoor workers with challenges to prepare for extreme temperatures, including low-income residents • Shelters needing additional support/supplies and cooling centers	• Local Businesses (including local farms) • Open spaces and trails • Municipal services (EMS, Code Red, Fire, Highway Department) • Food and transportation outreach services • Seasonal visitors/second-home owners

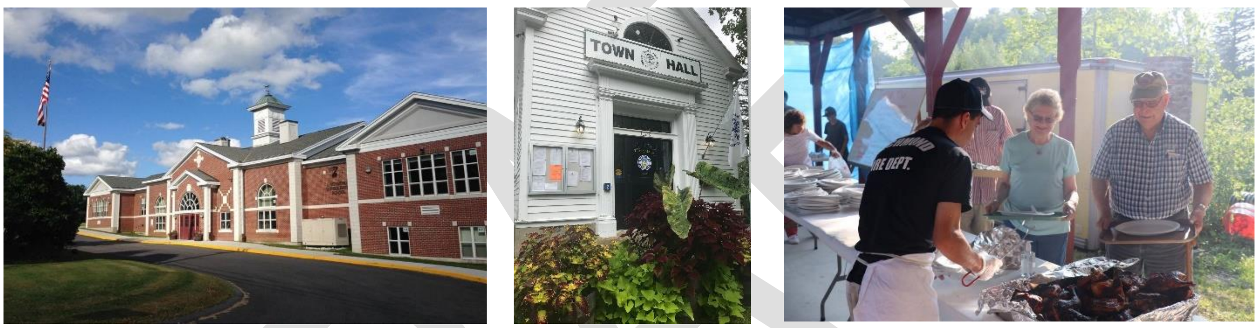


Figure 3-1: Societal features in Richmond. Left to right: Richmond Consolidated School, Town Hall, and Senior Outreach Services (Town of Richmond, 2020)

3.3 Economic Features

As a smaller, residential community, Richmond's primary industries have shifted since its founding from agriculture to tourism and service. These services include farms, wineries, and hospitality. The Town is known as a summer and seasonal destination for both tourists and second-home owners. Many residents of Richmond work in the City of Pittsfield, a bordering City and a major regional employer. The 2010 U.S. Census indicates that 39.1% of employed Richmond residents commute to Pittsfield for employment, while 15.3% remain and work within the Town (BRPC, 2016). The unemployment rate of 4.8% in Richmond is the same as the state average (Table 3.3). Communication between businesses and the Town about hazard mitigation planning efforts and developing emergency protocols will be key to increasing resilience.

Table 3-3: Economic Statistics

	Richmond	Massachusetts
Labor Force	1,290	5,707,254
Unemployment Rate	4.8%	4.8%
Employed in Top Employment Industry – Healthcare and Social Assistance	15.2%	5.6%
Mean Travel Time to Work (minutes)	18.7	31

(United States Census Bureau, 2010, United States Census Bureau, 2019)

3.4 Infrastructure Features

Richmond is located between I-90, US Route 20, and NY State Route 22. In addition to these highways, there are many unpaved dirt roads that frequently erode in some locations and can cause sedimentation of waterbodies. Also, services to the Richmond area could be disrupted if critical roadways and bridges are flooded. An Amtrak and freight rail also run through town. Berkshire Regional Transit Authority is the nearest public transit service with a bus line in Lenox. The Department of Public Works maintains all the Town-owned infrastructure.

The Fire Department has a single station and there is no police station; the Police Chief is seasonal and part-time. The State Police rely on a radio tower located on Lenox Mountain. Emergency services are generally well equipped, and the Town operates and promotes an emergency notification system to residents (CodeRed). The Town is also working to improve response times for both Fire and EMS through a partnership with the West Stockbridge Fire Department and is part of the Berkshire County Mutual Aid Agreement and with surrounding towns in Columbia County, NY.

Most of the Town is supported by private water supply wells, which may be susceptible to future droughts, while a few homes and businesses rely on public well systems (see Appendix B for a list). Most of the Town is also serviced by on-site septic systems, which can be vulnerable to rising groundwater. The neighborhood around Richmond Pond has sewer services, which goes to Pittsfield's Wastewater Treatment Facility. Eversource provides the electricity to the Town. No natural gas provider is designated for the area, but five large natural gas lines run through the Town. Electricity and communication infrastructure is vulnerable to forest fires and power outages due to wind, ice, and tree damage.

There are five small, privately-owned dams, which are not rated under the Massachusetts Office of Dam Safety (ODS) due to their size. There are three dams of concern located outside of Richmond. The Upper and Lower Root Reservoir Dams are owned by the Town of Lenox and are classified as High Hazard by ODS. The privately-owned Richmond Pond Dam is located in Pittsfield and is considered a Significant Hazard by ODS. See Appendix B for details on dams.

Office of Dam Safety Hazard Classifications

- High Hazard: Dams located where failure or mis-operation will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).
- Significant Hazard: Dams located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s), or cause interruption of use or service or relatively important facilities.
- Low Hazard: Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected.
- Non-jurisdictional: Typically, under 6 ft in height and/or under 15 acre-feet in storage and are not assigned a hazard code.

3.4.1 *CRB Workshop Discussion of Existing Infrastructure*

Workshop participants identified key infrastructure features in Richmond that are most vulnerable to, or provide protection against, natural hazards and climate change impacts. As noted below, the majority of the existing infrastructure features were determined to be both a vulnerability and a strength.

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

Vulnerability	Both Vulnerability and Strength	Strength
• Roads experience flooding, and many gravel roads in town get washed out during heavy rain • Railroad and gas lines running through town • Limited publicly accessible Wi-Fi if residents lose power and phone/internet services • Beaver activity creates flooding areas • Town-owned underground storage tanks • Lenox Reservoir Dam	• Emergency Shelter has a generator, but the shelter may be a vulnerability during COVID • Culverts and Bridges contribute to flooding, but there is an assessment forthcoming to identify and update undersized culverts • Most residents have private drinking water wells which rely on power sources • Communications and power infrastructure can be affected by storms, but cell tower is central and has power backup	• Eversource invests time and money into maintaining and improving electrical infrastructure • Wastewater infrastructure around Richmond Pond reduces groundwater contamination and water quality issues • Buildings and facilities have the potential for green infrastructure and shading projects

Figure 3-2: Infrastructural features in Richmond

The Fire Department (left) and road in Richmond (right; Town of Richmond)

3.5 Environmental Features

The majority of Richmond is located within the Housatonic River Watershed. A small portion of Richmond's northwest corner is part of the Hudson River Watershed. Wetlands and water represent almost ten percent of the land area within the Town. Richmond has three main waterways: Lenox Mountain Brook, Furnace Brook, and Cone Brook. These waterways merge south of Richmond in

Stockbridge to form the Williams River, which connects to the Housatonic River. Other water bodies in the Town include Fairfield Brook, Tracy Brook, Scace Brook, Sleepy Hollow Brook, Fairfield Pond, and Quarry Pond, and several other smaller unnamed ponds and brooks. Lenox Reservoir is located just outside the eastern town boundary.

Richmond Pond, located in the northern portion of town and around 233 acres in size, is partially located in the Town of Richmond and partly in Pittsfield. Richmond Pond flows north into the southwest branch of the Housatonic River, located within the City of Pittsfield just north of Richmond. The Pond outlet flows into Royes Brook for a short time before another channel breaks off, forming Ford Brook. The Pond is a major seasonal recreational draw, but also faces water quality challenges.

Richmond is in the Western New England Marble Valley's Ecoregion, which is known for unique rock formations and ecosystems produced by the calcium rich bedrock. Numerous rare and endangered species live here. The vast forest system provides wildlife corridors and connectivity. The Town has two state-owned Natural Heritage Areas (NHAs) and a section of State Forest along Dean Hill Road. Residents in Town have protected their own properties under conservation restrictions, and several pieces of land in Richmond are owned by various land trusts. Several homeowners have also opted to enroll in Chapter 61, a state program that reduces property taxes in exchange for land conservation through forestry, agriculture, or recreation.

Existing recreation opportunities in Richmond include hiking trails on the Yokun Ridge, water-based recreation on Richmond Pond, and cross-country skiing at Hilltop Orchards. Among the wealth of water resources in Richmond, many brooks are classified as cold-water fisheries, including Cone Brook and Furnace Brook. Lenox Water Supply land is classified as Outstanding Resource Waters (ORW) and is mainly located in Lenox, but has a few small areas located in Richmond. Groundwater and surface water protection areas also provide additional protection for environmental resources, although the BioMap2 also identifies Core Habitat and Critical Natural Landscape areas in the Town that are not currently protected. See the Richmond Environmental Resource map in the Appendix for location information.

The Town has one underground storage tank (2017 MA Tier II Facility) at the DPW, an unlined, capped former landfill site, and one chemical building as considerations for potential environmental impact.

In 2016, Richmond completed its Open Space and Recreation Plan to comprehensively examine the Town's open space and recreation needs, identify goals and objectives, and protect the Town's water and natural resources as well as sensitive environmental and wildlife habitat. The goals developed by the community are as follows:

1. Water resources in Richmond are protected.
2. Natural resources in Richmond are protected.
3. Residents and visitors are aware of Richmond's open space and cultural resources and recreational opportunities.
4. The Town's recreation opportunities meet community needs.
5. Funding for conservation and recreation projects meets community needs.
6. Ensure Implementation of the Richmond Open Space and Recreation Plan.

The Town hopes these goals, along with the seven-year plan outlined in the OSRP, will help to balance the competing demands associated with growth and economic development with those for preservation of the natural and historic environment. According to the 2005 land use inventory for Richmond, forests cover 7,655 acres, or 62.89% of all land within the Town. Although in some ways a strength, this vast forest system could also be a concern with future drought conditions if the forest is not managed accordingly.

Figure 3-3: Richmond Pond (Town of Richmond, 2020)

3.5.1 CRB Workshop Discussion of the Environment

Workshop participants identified key environmental features in Richmond that are most vulnerable to, or provide protection against, natural hazards and climate change impacts.

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

Vulnerabilities	Both Vulnerability and Strength
• Leaching from former landfill may have impact on water supplies under flooding conditions • Invasive plant species are present throughout town • Tick problem in the Town needs to be managed, but with consideration of potential side impacts from chemical controls	• Forest system used recreationally and provides heat island mitigation; increase in usage can harm public property. • Problem trees in Town should be evaluated for removal or replacement. • Open space is preserved and accessible for public use. Invasive species on properties need to be continuously maintained. • Diverse wildlife habitat; beavers are an issue for flooding • The ponds draw visitors, but they should be monitored regularly for bacteria • Wetland, streams and river are important to economy and recreational activities, but there are issues with flooding, bacteria, and other contamination. • Plans and bylaws, some may need to be updated to reflect climate change • Local agriculture is important in Richmond and needs to be protected from climate change impacts

3.6 Land Use

Richmond has a total land area of 19 square miles. Sixty-three percent of the land is considered forested, comprised of state-owned and locally owned parcels (MassGIS, 2005). Residential parcels make up most (60%) of the forested lands, but housing only covers 8% of the land area. Wetlands and water represent 12% of the total land area, and agriculture is 14% (Fig. 3-4). Commercial & Industrial use make up 1.4% of Richmond's land use, most of which is in property at Richmond Pond. Residential development is regulated through several mechanisms, including the Berkshire Scenic Mountain Act, zoning, the Wetlands Protection Act, and subdivision controls.

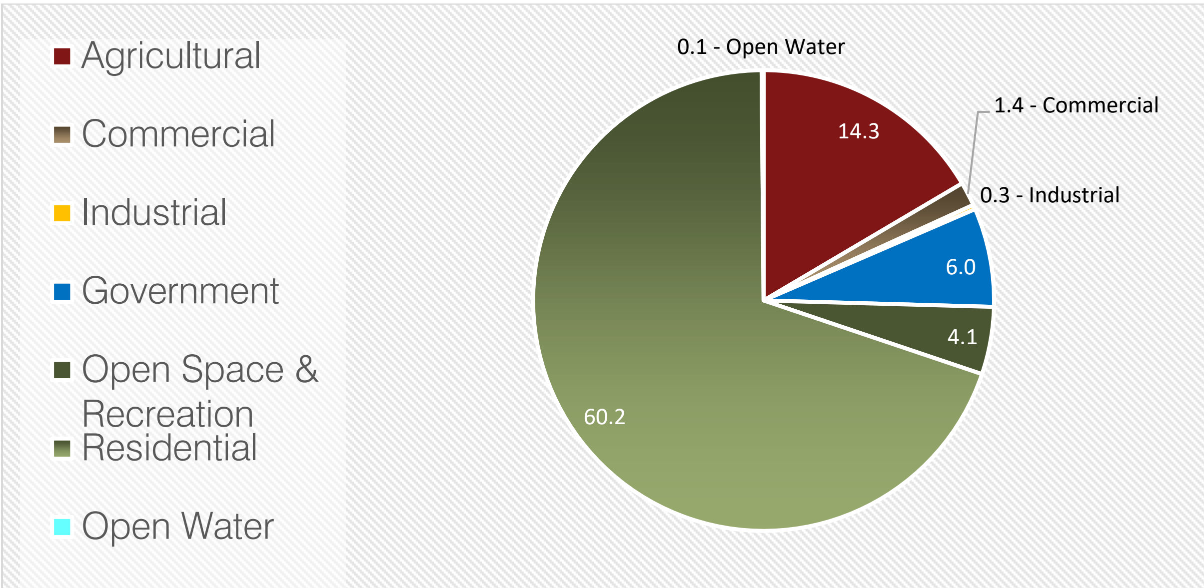


Figure 3-4: Land Use Distribution in Richmond, MA

(MassGIS, 2020a)

3.7 Recent and Potential Development

There are no known major developments, site plans, or subdivisions currently planned in Richmond or that have been completed in the last five years.

4

Hazard Profiles

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 Richmond. Each hazard risk and vulnerability assessment uses previous occurrences and climate projections to identify high risk areas and the likelihood that a hazard will occur. The vulnerability analysis looks at 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 Richmond on potential future development. FEMA's Hazus software was used to model the potential damage of 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 and the 2018 SHMCAP 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 ranges from very low to high. Severity classifications are a range from minor severity 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 overall State. These frequency and severity classifications for the State will provide an idea to the Town in prioritizing mitigation actions for each hazard.

Table 4-1. Massachusetts Hazard Risk Summary

Hazard	Frequency	Severity
	Massachusetts	Massachusetts
Inland Flooding	High (1 flood disaster declaration event every 3 years; 43 floods per year of lesser magnitude)	Serious to Catastrophic

Hazard	Frequency	Severity
	Massachusetts	Massachusetts
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
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

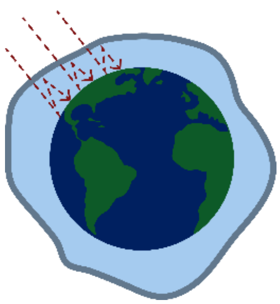
Not all hazards included in the 2018 State Hazard Mitigation and Climate Adaptation Plan or the 2013 Massachusetts State Hazard Mitigation Plan apply to the Town of Richmond. Given Richmond's inland location, coastal hazards and tsunamis are unlikely to affect the Town. Given the type of fires that have occurred in Richmond's history, the Town will focus on brush fires rather than wildfires. It is assumed that the entire Town of Richmond 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 soils 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 Berkshire 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. Fifteen disaster declarations occurred in Berkshire 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 Richmond commonly experiences are projected to worsen 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 (CO^2) 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 likely 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 four top hazards/climate change impacts that Richmond faces. Extensive discussion led to the selection of the following:

- Flooding
- Nor'easters, Ice Storms, and Severe Snowstorms
- Wind, Severe Thunderstorms, and Tornadoes
- Extreme Heat/Drought

The workshop was designed to bring stakeholders together to brainstorm action items that will facilitate a 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 building placements in flood zones, road and building impacts during snowstorms, and discussed possible improvements. Workshop participants also reviewed challenges impacting the school, isolated populations, and available housing. There was extensive discussion about winter storms, wind 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. Richmond has many trees, which can be a great strength to the community, but can also be a challenge when they 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 coordinating tree management with the utility company to eliminate tree hazards over power lines.

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. There was discussion about emergency evacuation procedures for these populations. 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

Flooding events in Richmond 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 5 years or a probability of occurrence greater than 20% per year. 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 of flooding could include injury or death, property damage, and traffic disruption. While Richmond 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 from 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. Residents identified localized erosion occurring near Richmond Pond and the Boys and Girls Club.

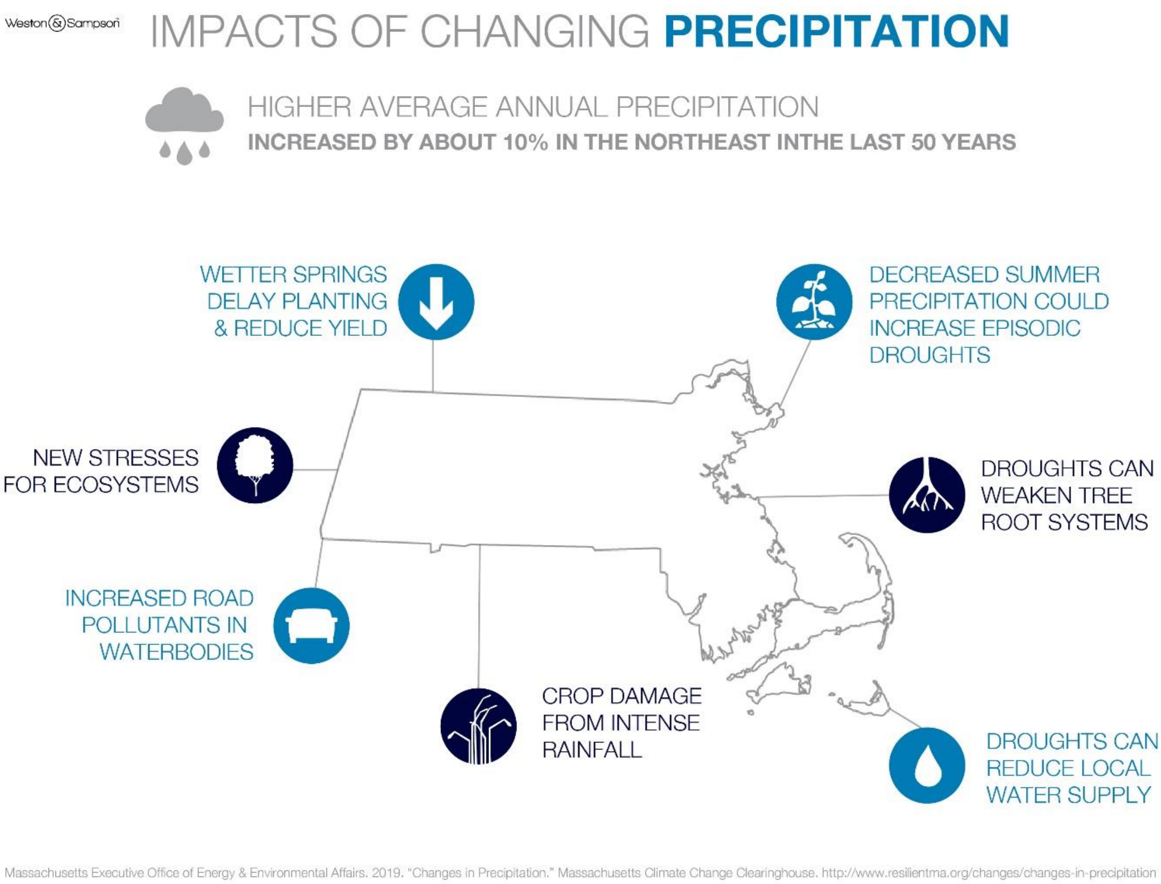


Figure 4-1. Impact of changing precipitation in future on the State of Massachusetts

4.2.1 Areas Vulnerable to Flooding

Areas within the 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 failures. 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 Richmond primarily occurs as riverine flooding along Furnace Brook, Richmond Pond, Bourne Pond, and Quarry Pond. Locally identified areas of flooding have been identified along Lenox Mountain Road, West Road, Town Beach Road, Dublin Road, and Furnace Road (see Table 4-2). This flooding could likely be mitigated with improved stormwater management. Flooded roadways and eroded roads due to precipitation often restricts 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 Richmond (FEMA, 1985) is included in Appendix B. FEMA is currently updating the FIRMs, which many change the current understanding of flood vulnerability. The current ZONE A surrounds most of the water bodies and wetlands areas listed above, including Furnace Brook, Cone Brook, and the headwaters of Richmond Pond (Ford and Royes Brooks). There is no designated Zone X in Richmond.

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, 2019a) 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, 2019b). There are no repetitive loss properties in Richmond (DCR, 2020a). 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 an undersized culvert, 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 Richmond, 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.

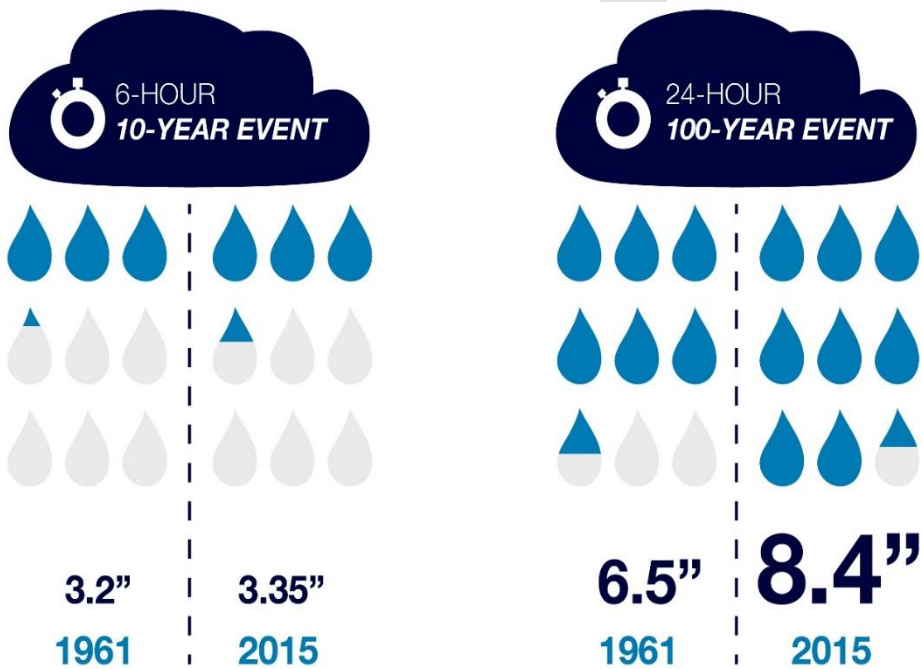


Figure 4-2. Stormwater Design Standards (NOAA TP 40, 1961 and NOAA, 2015)

4.2.1.5 Locally Identified Areas of Flooding

Richmond 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. The Town has recently made some repairs to the stormwater system on Stevens Glen and West Roads, improved drainage, and made several other updates to reduce the impact of flood events. Table 4-2 on the next page identifies the local areas that are prone to flooding.

Table 4-2. Locally Identified Areas of Flooding

Location	Description
Lenox Mountain Road at Cone Brook	In flood zone

Location	Description
West Road at Furnace Brook	In flood zone
Town Beach Road at Richmond Pond	In flood zone
Dublin Road at Fairfield Brook	In flood zone
Sleepy Hollow Brook	Partially in flood zone
Rossiter Rd, right off of Rt 41	Partially in flood zone

4.2.2 Historic Flood Events

4.2.2.1 <u>Flood Events in Richmond</u>

NOAA's National Centers for Environmental Information Storm Events Database (NOAA, 2020b) provides information on previous flood and flash flood events for Berkshire 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)" (NOAA and NWS, 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" (NOAA and NWS, 2018, p.A-20).

Between 2000 and 2020, the Town of Richmond had four floods and flash flood events that are identified below in Table 4-3. Although the event in March 2008 caused $4,000 in property damages, there were no deaths or injuries reported at any of these events.

Table 4-3: Richmond Flooding Events 2000-2020

Event Date	Type of Flooding	Description
3/8/2008	Flood	The combination of heavy rainfall (one to three inches), frozen ground, and snowmelt led to flooding and closure of several secondary roads in Richmond.
7/27/2009	Flash Flood	A warm, humid and unstable airmass was in place as a weakening cold front moved across the area. In addition, a strong upper-level disturbance moved over the region, triggering widespread thunderstorms. Numerous roads were closed due to flash flooding.
7/31/2009	Flash Flood	Slow moving thunderstorms, some producing very heavy downpours, moved across Berkshire County. Generally, 1 1/4 to 1 1/2 inches of rain was reported across the northeast portion of Berkshire County. This, coupled with previous heavy rainfall, created waterlogged ground and exacerbated high river and stream levels. A washout was reported on West Road in Richmond.
6/3/2014	Flash Flood	Slow moving showers and thunderstorms developed with some producing very heavy rain in a short period of time. In addition, strong wind gusts were experienced in some locations, causing damage to trees and power lines. Lenox Road in Richmond was reportedly closed due to flash flooding from heavy rainfall and drainage issues.

(NOAA, 2020b, data downloaded 12/2020)

4.2.2.2 Berkshire County Flooding Events

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

Table 4-4. Previous Federal Disaster Declarations - Flooding

Disaster Name and Date of Event	Disaster Number	Type of FEMA Assistance	Counties Under Declaration
Severe Storms and Flooding October 7-16, 2005	DR-1614	Public Assistance; Individual & Households Program	All 14 Massachusetts Counties
Severe Storms and Flooding April 15 - 25, 2007	DR-1701	Public Assistance	Essex, Suffolk, Norfolk, Bristol, Plymouth, Barnstable, Dukes, Nantucket, Berkshire, Hampshire, Hampden, Franklin, Berkshire
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, 2020c)

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 4-5 below displays critical facilities in Richmond that are located within the 100-year FEMA flood zone.

Table 4-5. Critical Facilities Located within the FEMA Flood Zone

Facility	Address	100-Year Flood Zone
Richmond Free Public Library	2821 State Road	X
Richmond Pond Dam	N/A	X
Richmond Iron Works Dam	N/A	X
Sherrill Pond Dam	N/A	X
Strong Pond Dam	N/A	X

Out of 55 critical facilities in Richmond, five are in the 100-year flood zone (Table 4-5). It is important to protect these facilities from flooding that could threaten public health and cause water quality and flooding issues downstream if flooding were to occur and dam sites were to overflow. Four of these are dams, which are typically found in flood areas. Please see Section 4.2.4 for more information on risk associated with these dams.

During the CRB Workshop, stakeholders discussed concern for residents who may experience social isolation, including elderly residents and children. Twenty-four Census Blocks in Richmond have a higher concentration (>25%) of youth (5) or seniors (19) and are located partially within a FEMA flood zone. Please see the Town's Hazard Map in Appendix B for specific locations of Census Blocks overlapping with the floodplain and a summary of locations of vulnerable populations.

4.2.3.2 Flood Exposure Tables

The Town's existing tax parcel and property value data were used to estimate the number of parcels (developed and undeveloped) and buildings located in identified hazard areas along with their respective assessed values. The parcel data set provides information about the parcel size, land use type, and assessed value among other characteristics. The parcel data was also classified into various land use types based on the Massachusetts Department of Revenue's Property Type Classification Code for Fiscal Year 2019.

To determine the vulnerability of each parcel and building, a GIS overlay analysis was conducted in which flood hazard extent zones were overlaid with the parcel data and existing building footprint data. To calculate the exposure of parcels and buildings to flood hazards, parcels with buildings that are located completely or partially within recognized hazard zones were identified using the ArcGIS overlay analysis (i.e. select by location using the intersect function). The number of parcels and buildings for each land use category was then totaled, along with the value of buildings and real estate properties associated with those parcels. These figures provide a strong indication of current hazard vulnerability, as well as potential future vulnerability as it relates to vacant and potentially developable parcels.

The results of the vulnerability assessment conducted for Richmond'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 4-6 below shows the detailed exposure of buildings in 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 165 parcels with a property value of over 112 million dollars are in the 100-year flood zone (Table 4-6). Overall, almost 18% of Richmond's total property is at risk to flooding.

Table 4-6. Exposure of Parcels in 100 Year Flood Zones by Land Use Type

Land Use Type	Total Number of Parcels	Total Area of Parcels (acres)	Number of Parcels in the Flood Zone	Area of Parcels in the Flood Zone (acres)	Percentage of Parcels in the Flood Zone	Property Value in the Flood Zone
Residential	1063	7215.8	117	700.6	9.71	$96,647,700.00
Commercial	57	1412.1	8	720.1	50.99	$1,045,900.00
Industrial	6	32.9	1	8.4	25.49	$700.00
Institutional	47	706.6	14	409.1	57.89	$13,574,300.00
Agricultural	51	1709.7	14	194.1	11.36	$149,200.00

Land Use Type	Total Number of Parcels	Total Area of Parcels (acres)	Number of Parcels in the Flood Zone	Area of Parcels in the Flood Zone (acres)	Percentage of Parcels in the Flood Zone	Property Value in the Flood Zone
Open Space	18	489.8	11	45.0	9.19	$1,124,000.00
Total	**1242**	**11566.9**	**165**	**2077.3**	**17.96**	**$112,541,800.00**

An analysis of developable vacant parcels has shown that 68 parcels (469 acres) remain undeveloped, with 10 of them, or 4% of the total, located in flood zones. Currently there are no commercial or industrial buildings within the floodplain, and all undeveloped parcels in Richmond are classified as residential. In contrast, there were 19 structures documented in 2016 (BRPC, 2016). Building and parcel data are not comparable and therefore these cannot be used to infer if flood vulnerability has increased since the last plan.

The analysis was conducted utilizing MassGIS data (MassGIS, 2020a) and FEMA flood maps (FEMA, 1985). The result of this analysis identifies future flooding that could occur on these parcels if they were to be developed. The Town does have a floodplain bylaw and flood-prone regulation in the zoning bylaw requiring a special permit for any development or construction in a flood-prone area. Therefore, even without proactive action to mitigate future flood risk, future flood vulnerability in Richmond can only increase slightly with potential development. Furthermore, there is no recent or planned development in Richmond that would affect the Town's flood vulnerability. It is recommended that as the Town anticipates expanding development, additional analysis be conducted on these parcels to reduce future damage from flooding and stop development in flood-prone areas.

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, 2017). There are two types of dam failures that can occur. Catastrophic failure occurs when there is a sudden, rapid, uncontrolled release of impounded failure. The second type is design failure, which occurs as a result of minor overflow events. Dam overtopping occurs when floods exceed 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 rivers and stream banks that are inundated.

Dam failures during flood events are of concern in Massachusetts, given the high density of dams constructed in the 19th century (MEMA and DCR, 2013). As defined by the 2013 Massachusetts State Hazard Mitigation Plan, a very low frequency hazard may occur less frequently than once in 100 years (less than 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). Dam failure is classified as a low frequency event in the Town. According the Massachusetts Department of Conservation and Recreation's (DCR) Office of Dam Safety, there are five non-jurisdictional dams in Richmond (DCR, 2021a). Town staff also raised concern about the Richmond

Pond Dam in Pittsfield (Significant Hazard), the Upper and Lower Root Reservoir Dams in Lenox (High Hazard).

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, 2020b). This plan must be updated annually and submitted to the 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. Richmond may consider requesting the EAP for the dams of interest located in Lenox and Pittsfield.

4.2.5 Flooding and Climate Change

Richmond's average annual precipitation is 47.9 inches (NOAA, 2020b). 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).

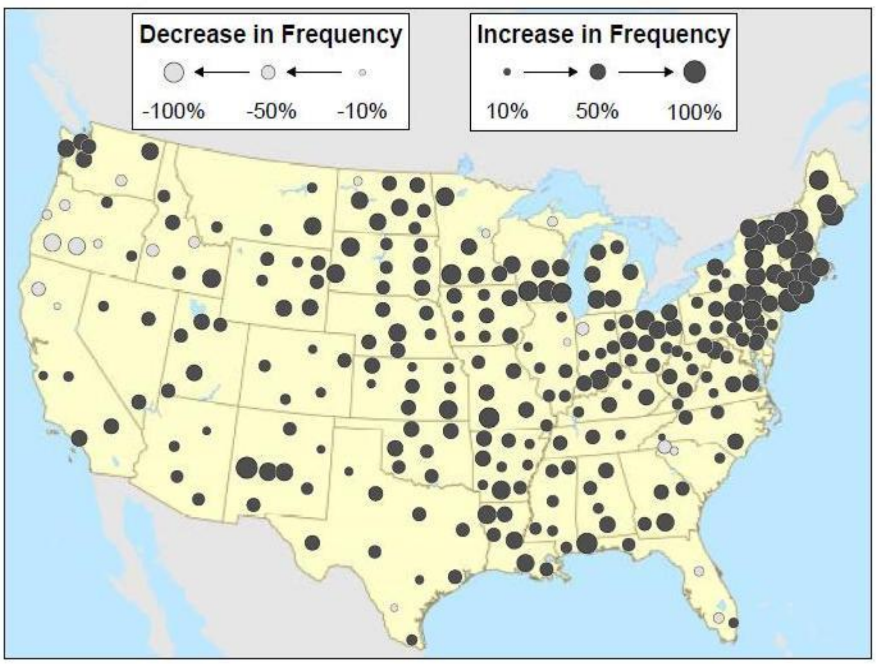


Figure 4-3. Changes in Frequency of Extreme Downpours

(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 the dam infrastructure.

4.3 Wind Related Hazards

High winds can occur during hurricanes, tropical storms, tornadoes, nor'easters, and thunderstorms. The entire Town of Richmond is vulnerable to the impacts of high wind. Wind may down trees and power lines. High wind and storm events can cause property damage and hazardous driving conditions. While Richmond's current 100-year wind speed is 94 mph, climate change will likely increase events and severity (ASCE, 2018).

The planning process identified vulnerabilities related to potential storm damage to power and phone wires from overhanging trees that have not been trimmed by the electric utilities (Eversource) or the phone or cable companies. The utilities' tree maintenance program should be upgraded to reduce the risk associated with tree damage to utility lines. High winds caused significant power line damage in Richmond during Tropical Storm Irene in 2011. Falling trees and branches can also block traffic and emergency routes. This is a regional issue that affects cities and towns beyond Richmond. During Richmond's MVP Workshop in December 2020, attendees discussed the impact of past storms on power systems and service disruption.

Richmond is served by State Police, who have reliable communications towers on the mountain that house equipment for the Police. Other Town departments communicate via radios that connect with a dispatch office. Town officials stated that their communications systems may be at risk during flooding and high wind events. Emergency communication plans for vulnerable populations should be developed, including 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 Berkshire County. Between 2000 and Sept. 2020, 446 wind entries were uploaded into the database and 342 were related to thunderstorms. Other wind events were related to low pressure cells, rains, and other hazard events. During this time period, there were no deaths, no injuries, but $20,000 worth of damages in Richmond. Winds ranged from 39 to 60 miles per hour.

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 Richmond. The entire Town area 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 due to 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 Richmond. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard may occur more frequently than once in 5 years (a greater than 20% chance per year).

NOAA's National Centers for Environmental Information offers thunderstorm and hail data for Berkshire County (NOAA, 2020b). Between 2000 and Sept. 2020, 138 thunderstorm events caused $890,500 in property damages in Berkshire County. Five injuries and no deaths were reported. Out of the 138 events, Richmond was severely affected by 15 storms. Up to $10,000 worth of property damage was reported, but no deaths or injuries occurred. All the major thunderstorm events that affected Richmond caused downed trees and powerlines, leading to roadblocks and power outages in parts of the Town.

Between 2000 and Sept. 2020, there were 4 hail events, but no property damage, deaths or injuries were reported. The size of hail typically ranges from 0.75" up to 2" (NOAA, 2020b).

4.3.2 Hurricanes and Tropical Storms

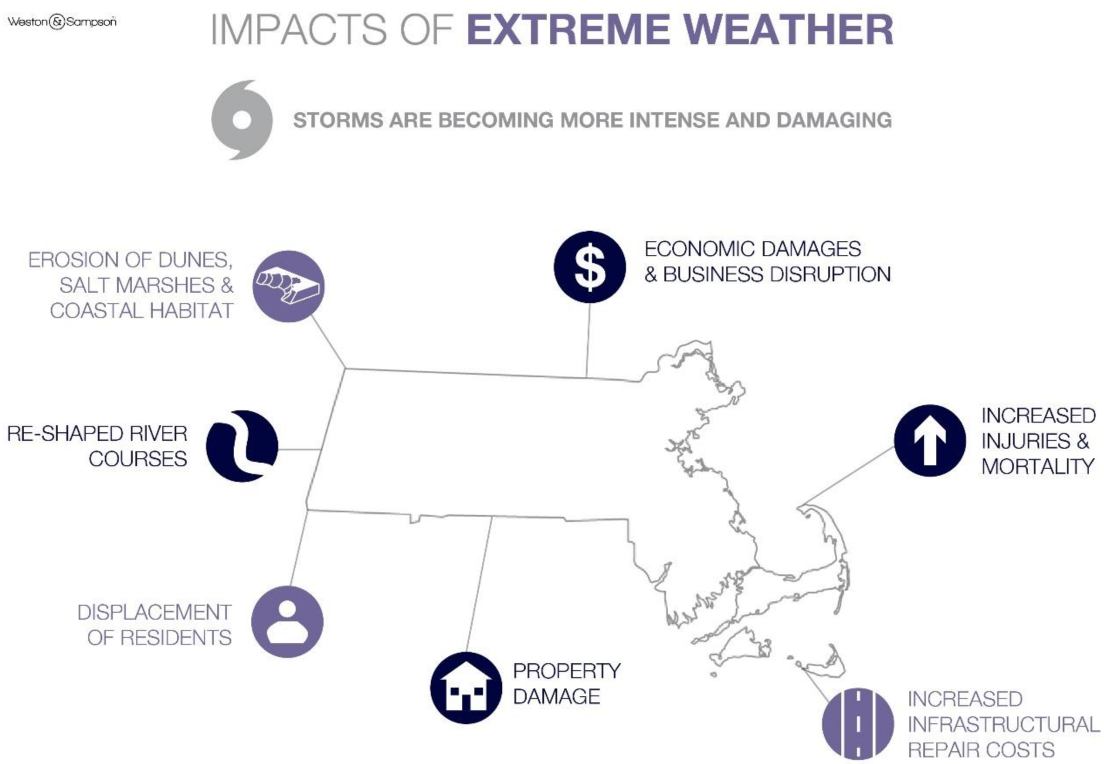
Tropical cyclones (including tropical depressions, tropical storms, and hurricanes) form over the warm waters of the Atlantic, Caribbean, and Gulf of Mexico. A tropical storm is defined as having sustained winds from 39 to 73 mph. If sustained winds exceed 73 mph, it is categorized a hurricane. The Saffir-Simpson 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 winds and cause more severe localized damage (MEMA and DCR, 2013). The Saffir/Simpson scale (Table 4-7) 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 4-7. 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, page 325 (table originally created by NOAA)

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 and future 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 Richmond. 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 Richmond 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).



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). Berkshire County faced one major Tropical Storm, Irene, in the last 10 years. During the August 2011 Tropical Storm, strong winds also occurred across Berkshire 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 (National Oceanic and Atmospheric Administration (NOAA, 2020b).

Potential hurricane damage in Richmond was estimated using a hurricane modeling software. Hazus Multi-Hazard (Hazus) is a GIS model developed by FEMA to estimate losses in a defined area due to a specified natural hazard. 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. For the purpose of this analysis, in order to estimate potential damage, both a Category 2 and a Category 4 hurricane were modeled. Although there have been no recorded Category 4 hurricanes in Massachusetts, the storm was modeled to show the impact that could occur from an extreme scenario. A Category 4 hurricane could potentially occur in the future due to climate change.

In Massachusetts, the return period for a Category 2 hurricane is approximately 0.01 percent, and for a Category 4 hurricane it is approximately 0.005 percent. Hazus models hurricanes based upon their return period. Therefore, a Category 2 was modeled as a 100-year hurricane and a Category 4 was modeled as a 500-year hurricane. To model each of these hurricanes, the study region was defined. The Census Tract is 68 sq mi and 2,420 people (as of 2010), and the Town of Richmond is 19 sq mi and 1,590 people. An estimated 1,000 are located buildings in the tract with $501 million dollars value, and 93% of the buildings are residential.

The Town of Richmond was outlined by the Census Tract that covers 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 Richmond's Census Tract if either a Category 2 or a Category 4 hurricane passed by. Hazus is based on 2010 Census data and 2014 dollars. The table below shows the estimated damage from a Category 2 and a Category 4 hurricane in the Town.

Table 4-8. Estimated Damages in Richmond's Census Tract from Probabilistic Category 2 and Category 4 Hurricanes

	Category 2	Category 4
Building Characteristics		
Estimated total number of buildings	1,488	1,488
Estimated total building replacement value (Year 2014 $) (Millions of Dollars)	$501	$501
Building Damages		
# of buildings sustaining minor damage	0.64	12.28
# of buildings sustaining moderate damage	0.01	0.4
# of buildings sustaining severe damage	0	0.01
# of buildings destroyed	0	0
Population Needs		
# of households displaced	0	0
# of people seeking public shelter	0	0
Debris		
Total debris generated (tons)	1	2,229
Tree debris generated (tons)	0	2,182
# of truckloads to clear building debris (@25 tons/truck)	0	2
Value of Damages (Thousands of dollars)		
Total property damage	$88.03	$842.29
Total losses due to business interruption	$.02	$5.62

In addition to the infrastructural damage, Hazus also calculated the potential societal impact of a Category 2 and Category 4 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 each hurricane category can be found in Appendix B.

4.3.3 Tornados

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 4-9 provides more detailed information on the EF Scale.

Table 4-9. 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, p.416)

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 Berkshire County is considered an at-risk location (EEA and EOPSS, 2018). There have been 3 recorded tornadoes in Berkshire County since 1950 (NOAA, 2020b). In 2014, there was one EF1 tornado that touched down in Berkshire County but it did not cause damage to the surrounding areas. On August 20, 2004, a tornado with maximum winds estimated at 70 mph, caused damage to public and private property in Pittsfield, the neighboring City.

There have been no recorded tornadoes in the Town, but it was mentioned as a concern by CRB workshop participants. If a tornado were to occur in Richmond, damages would depend on the track of the tornado and would be most likely be moderate due to the prevalence of older construction and the low density of development that exists. Structures built before current building codes may be more vulnerable. Evacuation, sheltering, debris clearance, distribution of food and other supplies, search and rescue, and emergency fire and medical services may be required. Critical evacuation and transportation routes may be impassable due to downed trees and debris, and recovery efforts may be complicated by power outages.

Tornado events in Richmond are a very low frequency event and the entire Town area 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). Tornados are difficult to simulate well in climate models because of their small size. However, it is predicted that the frequency of tornados in eastern 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, Richmond is not subject to the coastal hazards often associated with nor'easters. The Town of Richmond 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 2013 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 Richmond are high frequency events. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard may occur more frequently than once in 5 years (a greater than 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. Richmond's hilly topography magnifies winter storms 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 (i.e. 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 issues are 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 Richmond. 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 4-10. Previous Federal Disaster Declarations – Winter Weather

Disaster Name and Date of Event	Disaster Number	Type of Assistance	Counties Under Declaration
Snowstorm March 05, 2001 - March 07, 2001	EM-3165	FEMA Public Assistance	Middlesex, Essex, Norfolk, Berkshire, Hampshire, Franklin, Berkshire
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	Middlesex, Essex, Suffolk, Norfolk, Hampshire, Hampden, Berkshire
Severe Storm and Snowstorm October 29-30, 2011	DR-4051	FEMA Public Assistance	Middlesex, Berkshire, Hampshire, Hampden, Franklin, Berkshire
Severe Winter Storm, Snowstorm, and Flooding February 8-9, 2013	DR-4110	FEMA Public Assistance	All 14 Massachusetts Counties

(FEMA, 2020c)

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 3-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 20ºF. A severe blizzard is categorized as having temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced by snow to near zero (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.

Figure 4-5. Richmond roads after heavy snow. (Source: Town of Richmond)

There have been 87 winter storm entries between 2000 and 2020 totaling $63,000 in storm damage for Berkshire County (NOAA, 2020b). Two of the entries were categorized as a blizzard and five as an ice storm. 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.

The Town provides standard snow plowing operations and clearing snow has not posed any significant challenges. However, Town officials acknowledged that due to steep areas and gravel roads, icing conditions can occur throughout the Town, making travel difficult. The spring thaw, with freezing conditions, is particularly difficult in these hilly areas.

Blizzards are classified as high frequency events in Richmond. As defined by the 2013 Massachusetts State Hazard Mitigation Plan, this hazard can occur more than once in five years (a greater than 20% chance of occurring each year). Lenox Mountain, Reservoir Road and the East Slope are at a higher risk for snowfall than the remaining portions of town (BRPC, 2012).

4.4.2 Ice Storms

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. An ice storm warning, now included in the criterion for a winter storm warning, is for severe icing. This is issued when ½ inch or more of accretion of freezing rain is expected. 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. There were three ice storms in Berkshire County between 2000 and Sept. 2020, during which no property damage was recorded. Up to an inch of ice has accumulated during these storms on exposed surfaces across higher elevations in Berkshire County, causing power outages and downed trees and powerlines (NOAA, 2020b). Cities and towns were without power for days and school were canceled due to power outages.

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

Sleet occurs when raindrops fall into subfreezing air thick enough that the raindrops refreeze into ice before hitting the ground. Sleet differs from hail. Sleet is a wintertime phenomenon, while hail usually falls during thunderstorms in the spring and summer (MEMA and DCR, 2013).

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 vibration, sometimes violent, 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 4-11 summarizes Richter Scale magnitudes and corresponding earthquake effects (MEMA and DCR, 2013).

Table 4-11. 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. Of the over 5,000 earthquakes recorded in the Northeast Earthquake Catalog through 2008, 1,530 occurred within the boundaries of the six New England States, with 366 earthquakes recorded for Massachusetts between 1627 and 2008. 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). A summary of historic earthquakes in Massachusetts is included in Table 4-12 below.

Table 4-12. Historical Earthquakes in Massachusetts and Surrounding Area, 1727-2020

Location	Date	Magnitude
MA - Cape Ann	11/10/1727	5
MA - Cape Ann	12/29/1727	NA
MA - Cape Ann	2/10/1728	NA
MA - Cape Ann	3/30/1729	NA
MA - Cape Ann	12/9/1729	NA
MA - Cape Ann	2/20/1730	NA
MA - Cape Ann	3/9/1730	NA
MA - Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA - Salem	7/1/1744	NA
MA - Off Cape Ann	11/18/1755	6
MA - Off Cape Cod	11/23/1755	NA
MA - Boston	3/12/1761	4.6
MA - Off Cape Cod	2/2/1766	NA
MA - Offshore	1/2/1785	5.4
MA - Wareham/Taunton	12/25/1800	NA
MA - Woburn	10/5/1817	4.3
MA - Marblehead	8/25/1846	4.3
MA - Brewster	8/8/1847	4.2
MA - Boxford	5/12/1880	NA
MA - Newbury	11/7/1907	NA
MA - Wareham	4/25/1924	NA
MA - Cape Ann	1/7/1925	4
MA - Nantucket	10/25/1965	NA
MA - Boston	12/27/1974	2.3
MA - Nantucket	4/12/2012	4.5
MA – Newburyport	2/20/2013	2.3
MA – Freetown	1/9/2014	2.0
MA – Bliss Corner	2/11/2014	2.2
MA – off Northshore	8/18/2014	2.0
MA – Rockport Coast	6/1/2016	2.2
MA – Nantucket	8/18/2018	2.4
MA – Templeton	12/21/2018	2.1
MA – Gardner	12/23/2018	2.2
MA – Rockport	4/27/2019	2.1
MA – North Plymouth	12/3/2019	2.1

(USGS, 2020)

Ground shaking or ground motion is the primary cause of earthquake damage to man-made structures. Ground motion from earthquakes is amplified by soft soils and reduced by hard rock. Ground motion is measured by maximum peak horizontal acceleration expressed as a percentage of gravity (%g). Peak ground acceleration in the State ranges from 10 %g to 20 %g, with a 2% probability of exceedance in 50 years.

A serious earthquake in Massachusetts is possible. Richmond is located in an area with a PGA of 10%g with a 2% probability of exceedance in 50 years (Figure 4-6). 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 Richmond. Thus, Richmond 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.

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 damage such as cracked plaster and chimneys, or broken windows, or major damage resulting in building collapse. 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. People who reside or work in unreinforced masonry buildings are vulnerable to liquefaction (liquefaction is the phenomenon that occurs when the strength and stiffness of a soil is reduced by earthquake). Earthquakes often trigger fires and the water distribution system may be disrupted, thus posing a risk for public health and safety.

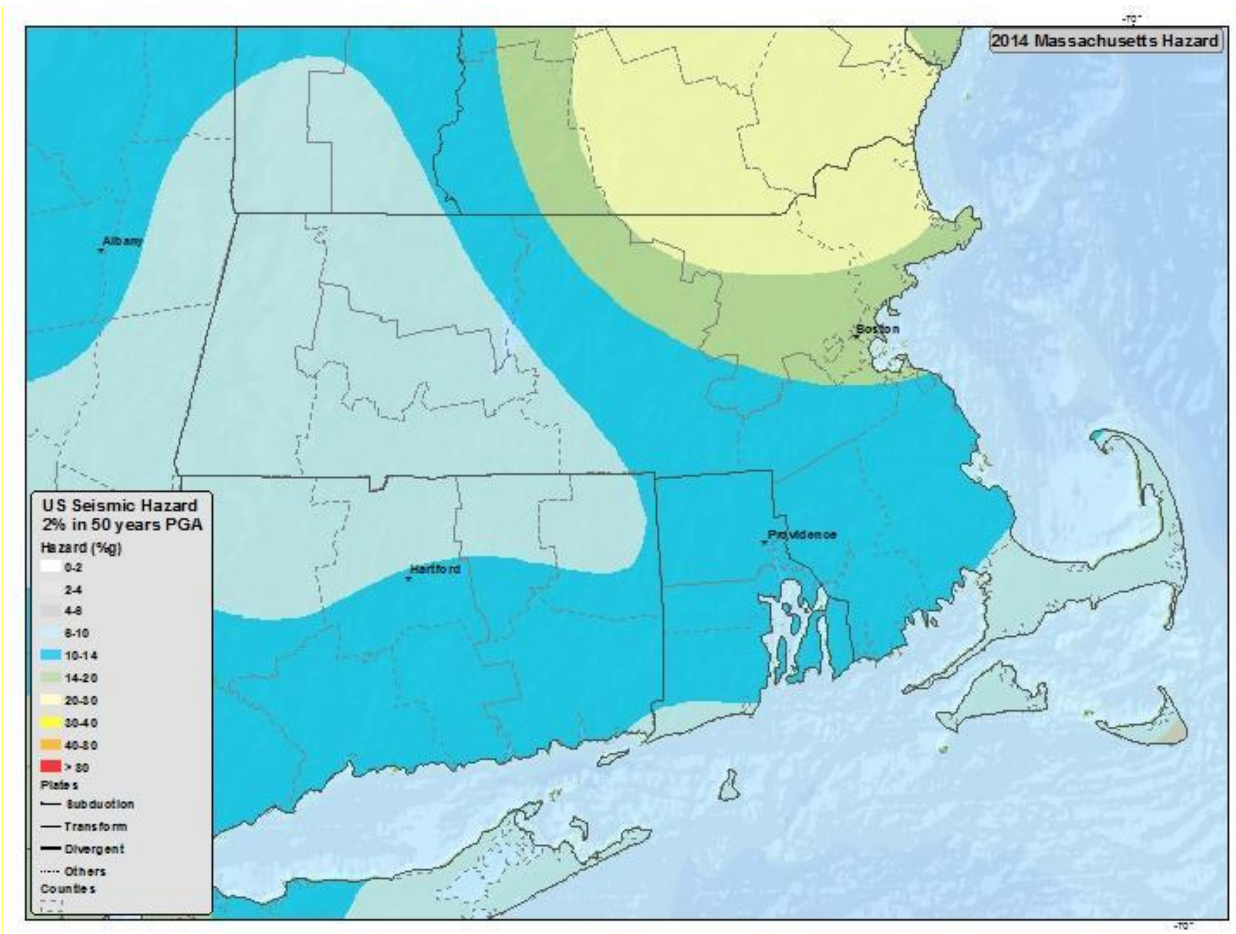


Figure 4-6. 2014 Seismic Hazard Map- Massachusetts

(USGS,2020)

Potential earthquake damage was modeled for the area including Richmond 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, two earthquakes were modeled: a magnitude 5.0 and a magnitude 7.0 earthquake. While large earthquakes are rare in Massachusetts, there was a magnitude 5.0 earthquake recorded in 1963. The tables below show the estimated damage from both a magnitude 5.0 and a magnitude 7.0 earthquake in the municipality. 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.

In a magnitude 5.0 earthquake in the region, approximately 89 % of the buildings (and 85% of the building value) damaged are associated with residential housing. The replacement value of the transportation and utility lifeline systems is estimated to be 544 and 16 (millions of dollars), respectively. Highway bridges and railway segments, and water, wastewater, and natural gas distribution lines would be affected.

In a magnitude 7.0 earthquake in the region, approximately 87 % of the buildings (and 73% of the building value) damaged are associated with residential housing. The replacement value of the transportation and utility lifeline systems is estimated to be 550 and 246 (millions of dollars), respectively. Highway bridges and railway segments and bridges, power facilities, and water, wastewater, and natural gas distribution lines would be affected.

Table 4-13. Estimated Damage to Critical Lifelines from Probabilistic Magnitude 7.0 Earthquake

Facility Type	Moderate Damage	Complete Damage	Functional >50% on day 1
Schools	2	2	0
Emergency Op Centers	6	3	0
Police Stations	2	2	0
Fire Stations	4	2	0

Table 4-14. Estimated Damage in Richmond from Probabilistic Magnitude 5.0 and 7.0 Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	1,488	1,488
Estimated total building replacement value (Year 2014 $) (Millions of dollars)	501	501
Building Damages		
# of buildings sustaining slight damage	320	416
# of buildings sustaining moderate damage	118	509
# of buildings sustaining extensive damage	21	201
# of buildings completely damaged	3	189
Population Needs		
# of households displaced	5	120
# of people seeking public shelter	2	53
# casualties (depends on time of day)	0	Between 3-14
Debris		
Building debris generated (tons)	2,000	39,000
# of truckloads to clear building debris (@25 tons/truck)	80	1,560
Building-Related Economic Loss (Millions of dollars)		
Income Losses	$2.32	$22.59
Direct Building Losses	$22.55	$202.75
Direct repairs (transportation and utility)	$560	$796

Table 4-15. Estimated Infrastructural Damage in Richmond from Magnitude 5 Earthquake

Land Use Type	Total Number of Buildings Damaged	Percent of Buildings Damaged	Total Value of Building Damage[1]
Agricultural	3.6	51%	Not quantified
Residential	411	30%	$17,100,000
Commercial	27	52%	$1,770,000
Industrial	14	53%	$528,000
Others	5	48%	$840,000
TOTAL	**461**	**9%**	**$ 20,000,000**

[1]Includes Slight, Moderate, Extensive, and Complete Damage
[2]Includes Building, Content and Inventory

Table 4-16. Estimated Infrastructural Damage in Richmond from Magnitude 7 Earthquake

Land Use Type	Total Number of Buildings Damaged	Percent of Buildings Damaged	Total Value of Building Damage[1]
Agricultural	7	100%	Not quantified
Residential	1,150	87%	$133,000,000
Commercial	53	99%	$26,400,000
Industrial	27	99%	$7,900,000
Others	11	99%	$12,800,000
TOTAL	**1,248**	**87%**	**$ 180,000,000**

[1]Includes Slight, Moderate, Extensive, and Complete Damage
[2]Includes Building, Content and Inventory

A full Hazus risk response report for each earthquake category can be found in Appendix B.

Earthquakes are classified as a low frequency event in Richmond. As defined by the 2013 State Hazard Mitigation Plan, these events occur from once in 50 years to once in 100 years, or 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).

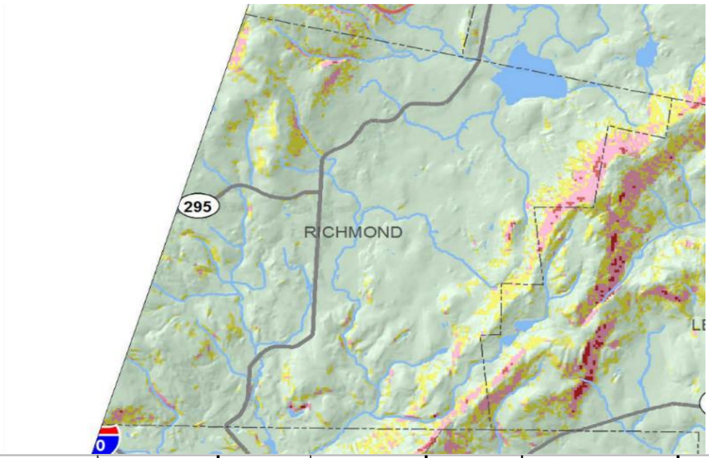
Landslides occur throughout the United States, causing an estimated $1 billion in damages and 25-50 deaths each year. Any area composed of very weak or fractured materials resting on a steep slope will likely experience landslides. Although the physical cause of many landslides cannot be removed, geologic 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 4-17 below.

Table 4-17. 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)

Richmond is classified as stable and therefore having a low risk for landslides, except for a few locations that are unstable in the northeast portion of the Town (Figure 4-7). No significant landslides have been recorded for Richmond or Berkshire County (EEA and EOPSS, 2018). Rather, local officials indicate that there are rarely localized issues of erosion during construction as a result of development, or as a result of clearing vegetation. Landslides are classified as low frequency events in Richmond. According to the 2013 State Hazard Mitigation Plan, these events occur from once in 50 years to once in 100 years, or 1% to 2% per year.



Map Color Code	Predicted Stability Zone	Relative Slide Ranking[1]	Stability Index Range[2]	Factor of Safety (FS)[3]	Probability of Instability[4]	Predicted Stability With Parameter Ranges Used in Analysis	Possible Influence of Stabilizing or Destabilizing Factors[5]
	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
	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
	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
	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 4-7. Slope Stability Map of Massachusetts focusing on Richmond

(Source: The Massachusetts Geological Survey, 2013)

4.6 Fire Related Hazards

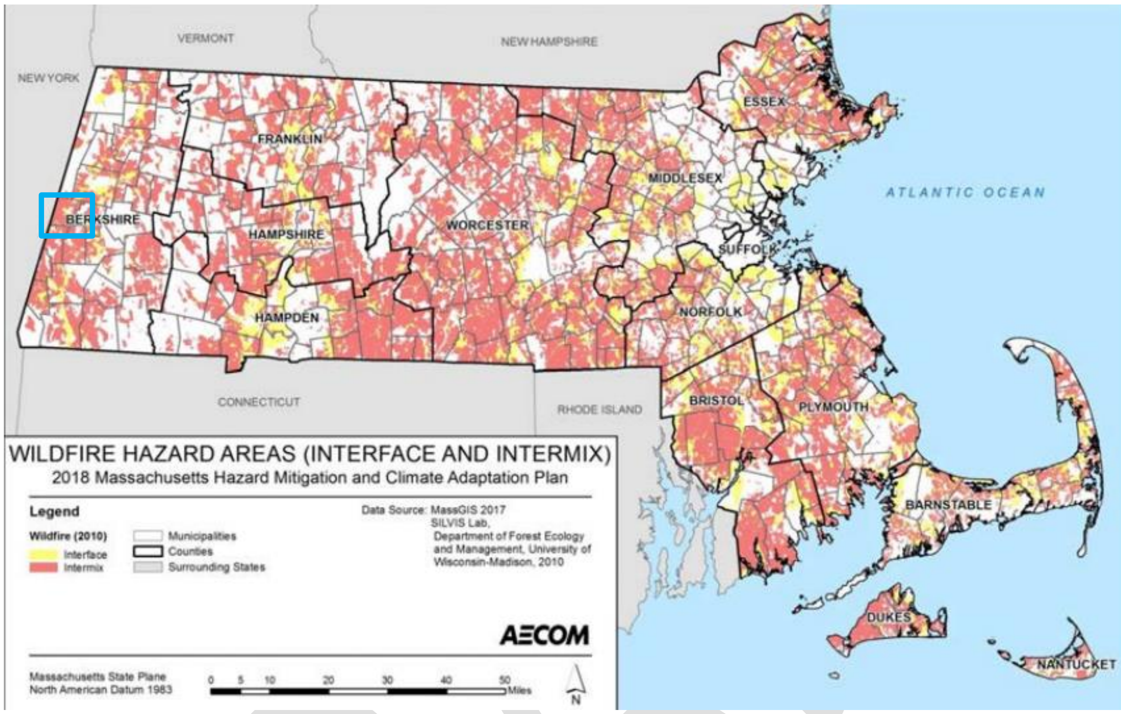
Richmond is more likely to experience a brushfire compared to a wildfire (or a fire with a large impact area). Wildfires and brushfires can occur in the vegetative wildland, including grass, shrub, leaf litter, and forested tree fuels. Fires can be caused by natural events, human activity or in an intentional 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."*

Brush fires are classified as medium frequency events in Richmond 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 Richmond most vulnerable to brush fire are primarily heavily wooded areas and forests directly adjacent to developed areas. INSERT INFORMATION FROM FIRE CHIEF ON FIRE INCIDENTS IN THE LAST YEAR (2020), IMPACT (DAMAGE/INJURIES) AND AREAS OF CONCERN.

Figure 4-8. Wildfire related hazard areas in Massachusetts. Richmond is outlined in light blue.
Source: (EEA and EOPSS, 2018)



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 5, 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 may cause soil erosion and ultimately the chance of flooding. Additionally, subsequent rains can worsen erosion because brush fires burn ground vegetation and ground cover.

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 temperatures also play a role when considering the effect 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. During extreme cold, pipes may freeze and burst in many buildings with unreinforced masonry.

4.7.1 Extreme Cold

Extreme temperatures are considered a Town-wide hazard in Richmond and generally last from an afternoon to a few days. 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 Richmond, 30% of the population is over 65 years old and 8.5% 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.

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 4-9 below provides more information. Between 2000 and Sept. 2020, Berkshire County experienced 20 extreme cold and wind chill events, which caused no deaths, injuries, or property damage. NOAA's National Centers for Environmental Information Storm Events Database provides data for extreme cold events.

Temperature (°F)

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

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

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

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

Effective 11/01/01

Figure 4-9. Windchill Temperature Index and Frostbite Risk
(NOAA, n.d.b)

4.7.2 Extreme Heat

Increased temperatures will impact all locations within Richmond. 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 densely settled urban areas. 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.

July is the hottest month in Richmond and average high temperature is July is around 70°F (NOAA, 2020b). The Town of Richmond 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 Sept. 2020, Berkshire County experienced three extreme heat days, which did not result in 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 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 4-10) is forecast to reach 100-104˚ F for two or more hours (NOAA, n.d.a). 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.

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

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

Figure 4-10. Heat Index Chart

(NOAA, n.d.a)

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.

In Richmond, children under five years old make up 15.3% of the population, and 30% of the population is over 65 years old (US Census Bureau, 2019). 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).

The Massachusetts Department of Public Health Bureau of Environmental Health provides a community profile related to public health metrics (MA DPH, 2019). Richmond's largest concern during heat waves is likely to be older adults (over 65) that make up 31% of the population and are more likely to have pre-existing health conditions. No heat stress emergency visits were recorded in 2017.

4.7.3 Climate Change Impacts: Extreme Temperatures

Between 1961 and 1990, Boston experienced an average of one day per year in excess of 100°F. That could increase to six days per year by 2070, and 24 days per year by 2099. 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 4-11 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 worsen air pollution, which can lead to negative health impacts such as respiratory problems.

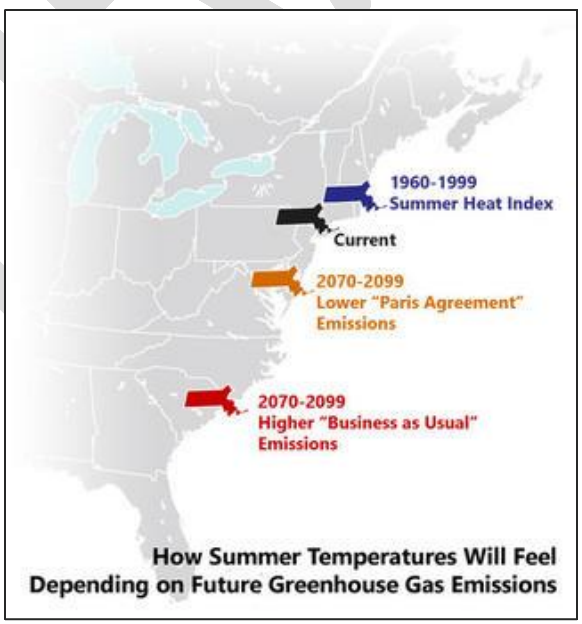


Figure 4-11. Massachusetts Extreme Heat Scenarios.

(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. Richmond is located within the western region (EEA and MEMA, 2019).

According to the updated Drought Management Plan (EEA and MEMA, 2019) there are five levels of drought to characterize drought severity.

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

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

Although the Town of Richmond experienced water supply restrictions in 2015, the Town usually has adequate water supply. The drinking water supply is mostly served by private wells, and there is typically abundant water supply in Richmond. The Town sends water conservation notices to residents as needed.

The Drought Management Plan specifies agency response and interagency coordination and communication based on various drought levels. During normal conditions, data are routinely collected and distributed. 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 use of emergency supplies become necessary, or in which the Governor may exercise his 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 Trask 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 six 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, 2019).

Berkshire County did not experience any recorded drought periods from 2000 to Sept. 2020, according to the National Center for Environmental Information Storm Events Database. Figure 4-12 illustrates statewide drought levels in Massachusetts from 1850 to 2012, using the Standardized Precipitation Index (SPI). Table 4-18 below summarizes a history of Massachusetts droughts between 1879 and 2020.

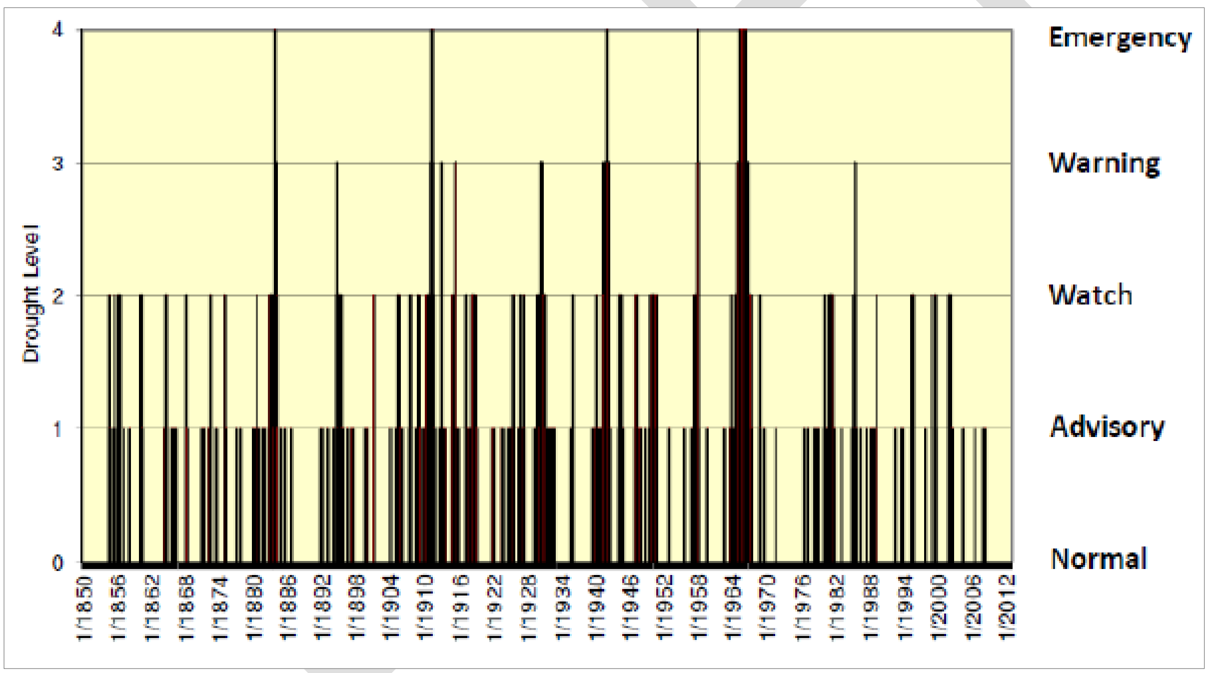


Figure 4-12 Statewide Drought Levels Using SPI Thresholds, 1850 to 2012.

Source: EEA and MEMA, 2013, page 37.

Table 4-18: Droughts in Massachusetts Based on Instrumental Records

Date	Area Affected	Recurrence Interval (years)	Remarks
1879 to 1883	–	–	–
1908 to 1912	–	–	–

Date	Area Affected	Recurrence Interval (years)	Remarks
1929 to 1932	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.
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, 2021b)

Drought Watches not associated with higher levels of drought generally would have occurred three to four times per decade between 1850 and 1950. The Drought Emergency declarations dominated the 1960s. There were no Drought Watches, or more severe drought conditions, in the 1970s. In the 1980s, there was a lengthy Drought Watch level of precipitation between 1980 and 1981, followed by a Drought Warning in 1985. A frequency of Drought Watches at a rate of three years per decade resumed in the 1990s (1995, 1998, 1999). 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 4-13 presents an example of drought conditions in the six drought regions.

Drought is a potential Town-wide hazard in Richmond. 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: 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 Richmond's core team meeting in December 2021, Town staff discussed the connections between multiple hazards and their potential impact on the Town. One example given was the potential for a severe drought to increase the risk of brush fires.

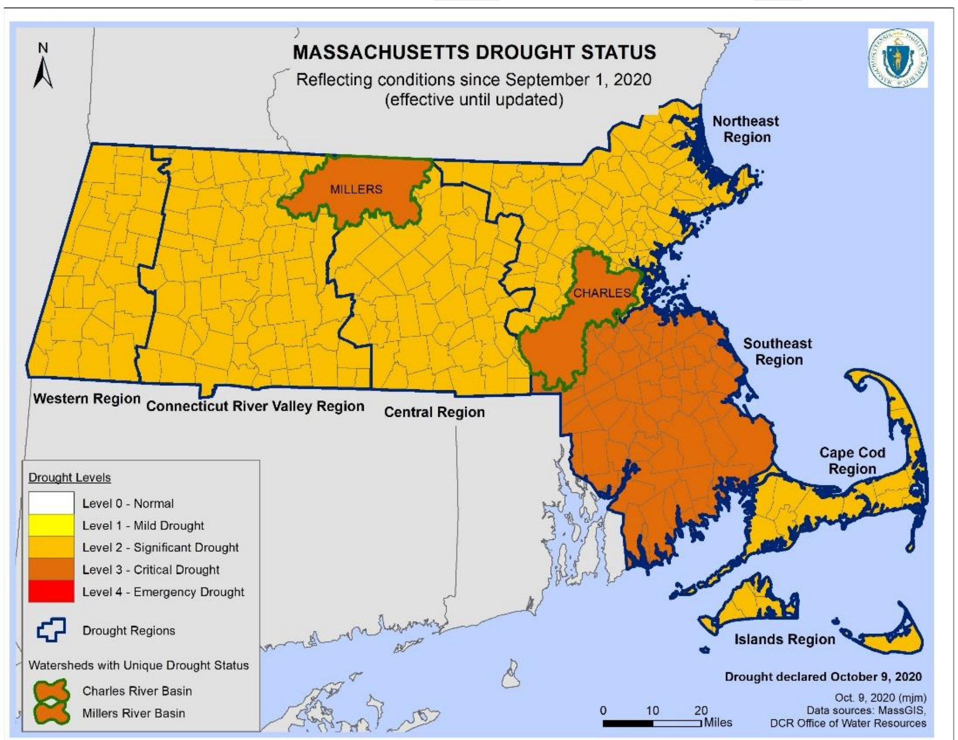


Figure 4-13. Massachusetts Drought Status, September 2020

(DCR, 2021b)

A long-term drought could impact Richmond's wetlands and streams, Richmond Pond, private wells, and drinking water reservoirs. Commercial, municipal, and residential water conservation is important during times of drought or low water levels. To better plan for a drought emergency affecting the water supply, a vulnerability assessment on Richmond's water supply and infrastructure could be conducted to identify potential areas that might be affected and economic impacts of water use restrictions.

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 dry days by the end of the century (EEA and EOPSS, 2018). 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

Existing Mitigation Measures

5.0 EXISTING MITIGATION MEASURES

The Town of Richmond is already undertaking measures to mitigate local hazards. Chapter 5 documents the Town's current operations and discusses potential improvements. FEMA's *Local Mitigation Planning Handbook* categorizes hazard mitigation measures into four types, as displayed in Table 5-1 below (FEMA, 2013). As this chapter will demonstrate, Richmond 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.	• 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	• Acquisitions and elevations of structures in flood prone areas • Utility undergrounding

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

Measure	Action	Examples
	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.	• Structural retrofits • Floodwalls and retaining walls • Detention and retention structures • Culverts
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 risk among local officials, stakeholders, and the public is more likely to lead to direct actions.	• 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. • 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
Natural Systems Protection	These are actions that minimize damage and losses and preserve or restore the functions of natural systems.	• Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements • Wetland restoration and preservation

(*FEMA*, *2013*)

There are numerous existing natural hazard mitigation measures already in place in Richmond. 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. The Town is also involved in sustainability measures that offer public co-benefits that include improved resilience and energy efficiency for municipal buildings.

5.1 Existing Multi-Hazard Mitigation Measures

Central Berkshire Regional Emergency Planning Committee – Under the Emergency Planning and Community Right to Know Act of 1986, communities are required to establish Emergency Planning Committees to develop a response plan for chemical emergencies. Richmond is a part of a regional emergency response committee, which includes Pittsfield, Lenox, Dalton, Lanesborough, Lee, Hinsdale, Washington. In accordance with

Recommended Improvements

Continue to update materials and communicate with regional partners to complete Hazardous Materials Response Plans.

this legislation, the Town of Richmond has identified locations where hazardous materials are stored, used, and transported. Richmond Fire Department is the lead department, but other representatives are invited to attend such as the Board of Health, Town Administrator, and Department of Public Works.	
Comprehensive Emergency Management Plan (CEMP) Richmond has a CEMP that was last updated in 2019. The plan could be updated with new contact information and moved online. Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. 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.	Make CEMP available to staff and neighboring communities.
List of Critical Facilities – The list of critical facilities was updated during this planning process.	None at this time.
Regional Support from Surrounding Communities – Richmond has provided and received additional support from surrounding communities, including police support and a regional fire response partnership with the West Stockbridge Fire Department. Richmond is also part of the Berkshire County Mutual Aid Agreement and with surrounding towns in Columbia County, NY	Formalize or document support systems to retain institutional knowledge and increase transparency in case of an emergency when additional support from other departments and municipalities may be needed.
FEMA Deployment – FEMA can deploy vehicles in the case of an emergency.	None at this time.
Pittsfield 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 mobile kitchen truck, as part of the Salvation Army Disaster Services.	None at this time.
Certified Emergency Response Team (CERT) – A team of trained volunteers organized by the Fire Department who can be called upon to assist and respond during emergencies.	Expand the number of volunteers.
Elder Services of Berkshire County Meals on Wheels – A non-profit organization providing food services to homebound individuals.	None at this time.

Berkshire Medical Reserve Corp – A non-profit organization providing medical care, counseling, and emergency response in Berkshire County.	None at this time.
Emergency Management Training – Fire Department staff have received hazard and emergency management training.	Expand training for more municipal staff.
CodeRED – The Town of Richmond has the CodeRED system, which provides Town officials the ability to deliver messages to targeted areas or the entire Town quickly through a reverse calling system. Residents may update their CodeRED information through the Town website.	Expand outreach to increase the number of residents receiving alerts.
Emergency Shelters – The Richmond Consolidated School is the Town's designated FEMA shelter, and Hancock Shaker Village in Pittsfield serves as a secondary shelter. Once built, the new Town Hall could be used as a shelter. The Richmond Library may also be used as a warming and cooling facility.	Develop a shelter plan for pandemic situation.
Backup Generators – The school, Fire Department, highway department and pump houses have backup generators. Town Hall does not have a backup emergency generator.	None at this time.
Buried Utilities – New developments are required to install underground utilities. The Department of Public Works and the Town's utility providers, Eversource and Magna5, would lead any changes related to burying utility lines.	None at this time.
Permits for Construction – Permits are required from the Building Inspector to ensure the building code is followed, and an online permit system allows for notification of departments with relevant jurisdiction. The Board of Health reviews septic systems. Public Works reviews permits for driveways and road openings. The Fire Department inspects certain aspects of all new construction for fire prevention safety and adherence to the fire code. Conservation Commission reviews permits in their jurisdiction to ensure stormwater regulations are met.	Develop methods to increase cross departmental coordination, improve enforcement, and set easier to understand expectations for permittees.
Multi-Department Review of Developments – Depending upon the type of development, extent of construction, and location, multiple departments, including the Planning Board, Building Inspector, Board of Health, Department of Public Works, Conservation Commission, the Fire Department, and Zoning Board of Appeals may review site plans prior to approval. Enforcement and fines are authorized in a recently adopted town bylaw.	Streamline the system and increase coordination between departments.

Massachusetts State Building Code – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing, and snow loads.	None at this time.
Open Space and Recreation Plan (OSRP) 2016-2022 –The Town has a wealth of environmentally-significant natural areas, and some of these have been protected for conservation, recreation, and to provide flood storage, among other climate resilient co-benefits. The OSRP aims to maintain, promote use, and increase the number of these spaces.	Update the OSRP in a few years with climate resilience, hazard mitigation, and to reflect new floodplain maps.
Zoning Bylaw – Chapter 9 of the Town Bylaws, Zoning regulates the land use of new and redeveloped parcels. Zoning allows, regulates, or guides landscaping, the siting of small energy systems, environmental performance, and safety standards for various land use types. Zoning can be used as a tool to promote affordable housing, proper communication facilities, and smart development.	Evaluate changes needed to account for climate change.
Rules and Regulations for Special Permits, Subdivision, & Site Plan Review – Procedures and guidelines set forth by the Planning Board corresponding to the Subdivision Control Law and Section 6.3 Special Permits of the Zoning Ordinance. Special permits are required for construction of large residential, commercial, institutional, municipal, and industrial developments or expansions.	Consider incorporating climate resilience into the site plan and subdivision review process through the completion of a climate resilience design guideline or scoring system and/or updating controls to account for climate change-induced flooding.
Invasive Species Management – The Town's Conservation Commission and local partners work to identify and address invasive species threats and encourage the use of native plant species.	Develop an invasive species management regulation and permitting process.

5.2 Existing Town-Wide Mitigation for Flood Related Hazards

Richmond 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.

	Recommended Improvements
Participation in the NFIP – Richmond 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.	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.

Richmond participates in the NFIP with 11 policies in force as of February 10, 2021 (DCR, 2020a). 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 October 2020, Richmond is not currently participating in the CRS Program (FEMA, 2020d).

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 Richmond 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 also include wetlands. Richmond's FEMA FIRMs were last updated in 1985. A more recent update has been initiated and was still in progress at the time of report writing.

Once the new FEMA FIRMs are finished, update regulations referencing the old map as needed and identify/prioritize mitigation projects. Consider requiring regulatory controls to account for climate change.

Road Upgrades – The Department of Public Works is responsible for maintaining paved and gravel roads. Gravel roads are regularly maintained to prevent washouts from flooding, and the Town spends significant resources to maintain and clear the roads.

Improve drainage for gravel roads and/or upgrade gravel roads to paved.

Stormwater System Maintenance– The Department of Public Works regularly clears debris from its storm drains, catch basins, and culverts across the Town. Catch basins that regularly have more debris and manage more stormwater (like at the bottom of hills) are prioritized. The Town has replaced and repaired several culverts in the last few years to reduce flooding. Road salt can cause erosion of catch basins. The Town has submitted a bundled Notice of Intent for culvert maintenance, non-jurisdictional culvert replacement, and swale maintenance to the Conservation Commission.

Upcoming map and inventory culverts and outfalls from stream crossing assessment will identify priority repair and replacement projects. Continue to repair and replace stormwater system elements using climate projections and green infrastructure where possible.

Public Education – The Conservation Commission educates the public on the benefits of stormwater systems and responsibilities of owners to keep the system clear.

Include information about green infrastructure measures

Maintenance of Public Waterbodies – The Department of Public Works and community groups help clear debris and keep the waterways clean. The Department of Public Works complies with the Army Corps of Engineers Soil Erosion and Sediment Control Guidelines in flood protection areas. Known erosion areas near Richmond Pond are causing water quality degradation.	Mitigate erosion in known problem area near Richmond Pond.
NPDES Phase II Stormwater Program –The Town has an MS4 area adjacent to Richmond Pond and may be eligible for a waiver.	Pursue waiver for small MS4 area.
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 local 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. Consider implementing a local stormwater bylaw.
Scenic Mountain Regulations– Under the Berkshire Scenic Mountain Act (M.G.L. Ch. 131, Sec. 39A), the Town developed regulations for any land and vegetation clearing or alteration to protect watershed and scenic qualities enhancing federal/state laws. The Scenic Mountain Regulations are enforced by the Conservation Commission and regulated by Board of Appeals.	None at this time.
Massachusetts Wetlands Protection Act and Local Wetlands Protection – The Commonwealths' 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 buffer around wetlands, and a 200-foot buffer around riverfront areas. The Wetlands Protection Act is locally enforced by the Conservation Commission and Department of Community Development. The Town further regulates wetlands through the local Wetlands Bylaw (Ch.12).	The local Wetlands Bylaw could consider the incorporation of climate change adaptation measures.
Wastewater System – The Town installed a sewer system in the Richmond Pond area that goes to Pittsfield's Wastewater Treatment Facility and is maintained by the Town's sewer operator.	Continue assessing the wastewater system for potential vulnerabilities.
Beaver Management – The Town installs "beaver diverters" and water control devices to mitigate flooding caused by beaver dams. When necessary, beavers are removed from the site.	None at this time.
Grants – Several grants have been obtained by the Town to improve flooding and the stormwater system, including MassDEP	Continue to apply for grants to support the implementation of this plan.

319 Grants, Green Communities Grants, and FEMA Flood Mitigation Grants.	

5.3 Existing Dam Mitigation Measures

Existing Dam Mitigation Measures	Recommended Improvements
Dam Rehabilitation and Removal – Richmond's plan is to work with dam owners to assess and implement rehabilitations as needed for the two dams affecting the Town: Richmond Pond Dam and Lenox Reservoir Dam.	Work with City of Pittsfield and Richmond Pond Dam owner to improve condition.
DCR Dam Safety Regulations and Inspections (2017) – All jurisdictional dams are subject to the Division of Conservation and Recreation's dam safety regulations (302 CMR 10.00). The dams must be inspected regularly, and reports filed with the DCR Office of Dam Safety.	None at this time.
Permits Required for Construction – State law requires a permit for the construction of any dam.	None at this time.
Emergency Action Plans (2017) – DCR requires that all dams classified or reclassified as high hazard potential and significant hazard potential have an Emergency Action Plan.	Obtain Emergency Action Plan from Town of Lenox.

5.4 Existing Town-Wide Mitigation for Wind-Related Hazards

Existing Town-Wide Mitigation for Wind-Related Hazards	Recommended Improvements
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. The code's provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence. If a tornado were to occur, damages would depend on the track of the tornado and would most likely be high due to the prevalence of older construction and the density of development.	None at this time.
Tree Maintenance – The Department of Public Works, Tree Warden, and Eversource maintain trees to reduce the risk of power outages and damage to powerlines during high wind events. Eversource has increased maintenance, and information is shared between the Town and Eversource regularly and during wind hazard events.	Establish regular maintenance program.

5.5 Existing Town-Wide Mitigation for Winter-Related Hazards

Existing Town-Wide Mitigation for Winter-Related Hazards	Recommended Improvements
Snow Removal Guidelines in the Bylaws – Chapter 8, Section 10 prohibits private property owners or tenants from clearing snow in a way that impedes public ways.	None at this time.

Snow Plowing and De-icing Operations – The Department of Public Works provides standard snow plowing operations on main arterials, including salting, and has adopted plowing guidelines. Certain roads in the Town are subject to ice build-up and require additional attention during cold weather, regardless of snowfall. The Town may scrape ice off the pavement with a grader and keep the area treated with salt. Snow clearing is done by Town--blacktops first then move to gravel in emergency coordination with police, fire and utilities.	Need continued monitoring and improvements to salt and sand options. Conduct outreach to residents about safe driving practices
Winter Parking Ban – The Town restricts parking during the winter to avoid roadway hazards during snow emergencies.	None at this time.
Fuel Assistance – Available to renters and homeowners meeting income guidelines through the New England Farm Workers' Council.	Expand programs to assist low-income households by providing fuel assistance.

5.6 Existing Town-Wide Mitigation for Drought-Related Hazards	Recommended Improvements
Land Acquisitions for Water Supply Protection – The Town has an ongoing program of land acquisition and conservation partnerships that help protect groundwater supplies.	Continue to purchase land and preserve natural resources through conservation restrictions and partnerships.
Water Conservation – The Town has done outreach about water conservation on their website to encourage residents to use well water efficiently. The groundwater supply in the area is adequate for the foreseeable future.	Add water conservation incentives or giveaways to encourage residents to follow water conservation guidelines.

5.7 Existing Town-Wide Mitigation for Fire-Related Hazards	Recommended Improvements
Open Burning Permits Required – The Town allows controlled open burning of agricultural products (not construction or building materials) in accordance with state regulations from January 15 to May 1st. The Town requires a permit, available online through the County permit website.	None at this time.
Review of Construction – The Fire Department and Building Inspector review buildings for proper fire protection systems, alarms, and sprinklers.	None at this time.
Fire Department Services – There is a combination Fire/Ambulance and Emergency Management Department housed in the Richmond Firehouse. It is a call-volunteer fire department, and a paid-per-call EMT service. Additionally, the Town has two (2)	None at this time.

pumper trucks, dry hydrants, and water pumps that are available for firefighting.	
Statewide Fire Mobilization Plan (Massachusetts Fire and EMS Mobilization Plan, 2018)– The state has a fire mobilization plan for brushfires, as well as a separate plan for Richmond's Fire District. Richmond is prepared to respond to brushfires smaller than five acres.	None at this time.
Fire Safety Education – Richmond has conducted fire safety education at the school.	Resume fire safety programming and seek grants for outreach to vulnerable populations.
Brush Clearing - Brush clearing to provide access to Emergency Service vehicles.	None at this time.

5.8 Existing Town-Wide Mitigation for Extreme Temperature-Related Hazards	Recommended Improvements
Heating and Cooling Shelter – The Richmond Consolidated School can be used as a heating or cooling facility.	Explore other ways to provide refuge to the heat, such as shade features at private properties.

5.9 Existing Town-Wide Mitigation for Geologic Hazards	Recommended Improvements
Massachusetts State Building Code – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is "to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake". This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be "prudent and economically justified" for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, 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 a 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,	None at this time.

emergency rooms, power-generating facilities, and communications facilities.

5.10 Existing Town-Wide Sustainability Measures

Green Communities Program – Richmond is a member of the Green Communities program. Richmond has received funding for energy conservation measures in municipal buildings.

Recommended Improvements
Consider Green Communities as a possible funding source for future improvements.

5.11 Mitigation Capabilities and Local Capacity for Implementation

Under the Massachusetts system of "Home Rule," the Town of Richmond 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 Ordinance, Subdivision and Site Plan Review Regulations, and Wetlands Ordinance. Local ordinances 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 Richmond 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 can expand on and improve the existing policies and programs listed above.

6

Status of 2012 Mitigation Plan

6.0 STATUS OF MITIGATION MEASURES FROM THE 2012 PLAN

6.1 Implementation Progress on the Previous Plan

The Town of Richmond has taken steps to implement the 2012 Berkshire County Hazard Mitigation Plan by integrating the findings into the following programmatic areas and plans: implementing projects addressing problematic culverts and trees, incorporating a flood hazard analysis in the 2016 Open Space and Recreation Plan, and sharing educational material with residents on managing stormwater runoff and preventing stormwater system backups.

The 2012 Berkshire County Hazard Mitigation Plan listed several priority actions items specific to the Town of Richmond. Richmond staff and Core Team members reviewed these previous mitigation measures for completion and to determine if the measures were still a priority if they were not completed. Table 6-1 summarizes the status of the mitigation measures and their priority. The Town completed several mitigation measures from the 2012 plan. Some of the measures have been deleted because they are continuous operation and maintenance procedures and were added into the Town's existing capabilities list in Chapter 5. Some actions were deferred because the Town lacked funding or staff capacity to complete the project. The deferred measures were evaluated based on the Core Team and Richmond staffs' assessment of the continued relevance or effectiveness. Projects that remain a priority will be included in priority projects for this plan and presented in Chapter 7.

Table 6-1. Status of Mitigation Measures from the 2012 HMP

Description of Action	Implementation Responsibility	Status
Replace culverts along Steven's Glen Road, Dean Hill Road and West Roads with larger culverts to reduce risk of flooding	Public Works	Completed.
Work with Conservation Commission to establish procedures for streamlined and expedited permitting for stormwater control features	Public Works, Conservation Commission	Completed. Added to Ch 5-Existing Capabilities
Get easements for undeveloped areas which have or need stormwater swales	Public Works, Town Administrator	Completed.
Create and implement a stormwater control bylaw to reduce flooding potential due to new development	Planning Board or Conservation Commission	Incomplete. Amend to assess whether a new bylaw is needed or if the existing wetland bylaw should be improved and add to list of priorities in Ch. 7.
Work with Planning Board to be more involved in building process and implementation of stormwater systems	Conservation Commission, Planning Board, Public Works	Incomplete. Amend to add the development of a stormwater management plan and add to list of priorities in Ch. 7.
Work with the Town of Pittsfield and the Richmond Pond Dam owner to improve	Town Administrator, Town of Pittsfield,	Incomplete. Add to list of priorities in Ch. 7.

Table 6-1. Status of Mitigation Measures from the 2012 HMP

Description of Action	Implementation Responsibility	Status
the condition of the Richmond Pond Dam	Private Dam Owner	
Work with utility companies to better improve proactive tree trimming and emergency response	Public Works, Utility Companies	Completed. Added to Ch 5- Existing Capabilities.
Work with Tree Warden and DPW to identify and prioritize problem trees	Public Works, Tree Warden	Completed. Added to Ch 5- Existing Capabilities
Work with private landowners to remove woody debris from higher risk fire areas	Fire Department	Incomplete. Add to list of priorities in Ch. 7.
Educate the public on the benefits of stormwater systems and responsibilities of owners to keep system clear	Conservation Commission	Completed. Added to Ch 5- Existing Capabilities
Identify historic structures, businesses, and critical facilities located in hazard-prone areas, including floodplains and dam failure inundation areas.	Building and Zoning, Public Works, Lenox and Pittsfield	Completed the assessment within the floodplain as a part of this plan update. Add assessment of dam failure inundation areas to list of priorities in Ch. 7.

7

Hazard Mitigation & Climate Adaptation Strategy

Photos from the Town of Richmond and Fire Department Facebook pages

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 are available in Appendix C.

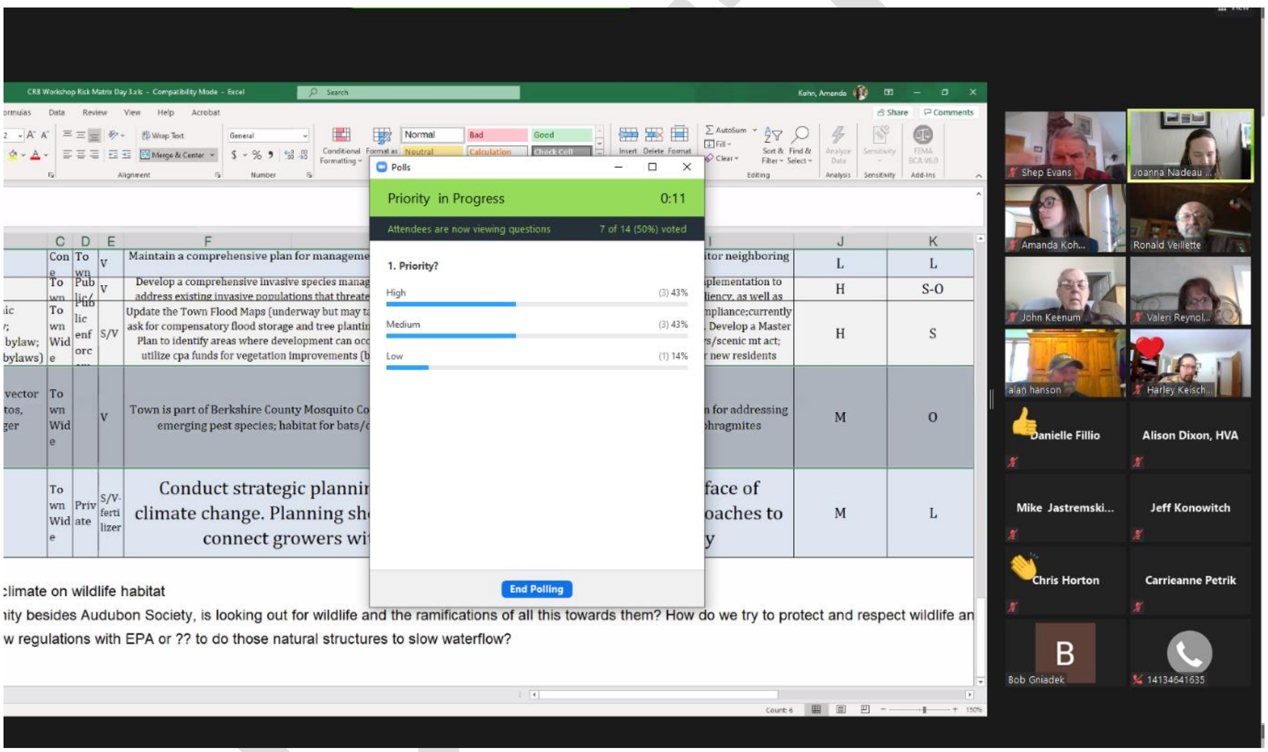


Figure 7-1. Environmental priority action items were presented during Richmond's Community Resilience Building Webinar

Hazard mitigation strategies often provide protection against more than one natural or climatic hazard. Each mitigation measure is described with its estimated cost, timeframe, and implementation responsibility. These considerations also informed the prioritization of the 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 adaption measure with details, such a specific location, strategy, or technique to be used to work towards fulfilling the general objective. Items brought forward from 2012 HMP are noted.

Prioritization Categories Used

Implementation Responsibility

Most hazard mitigation and climate adaptation measures will require a multi-department approach among Town departments that share responsibility. The governing body of the community ultimately decides responsibility. In addition, some action items require extensive involvement with the Commonwealth of Massachusetts departments 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 planned to initiate. 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 breakdown 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

Sources of funding are identified in Table 7-1 and further summarized in Table 7-2. The “Potential Funding Sources” column in Table 7-1 focuses on projects that would be competitive for each funding source. While 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 Drainage	Design and construct culvert rehabilitations and replacements to Dublin Road and Sleepy Hollow Road, anticipating future expected storm events, and other priority projects based on HVA Road Stream Crossing Management Plans (a culvert and bridge assessment)	• Department of Public Works	1-3	$$$$	H	Municipal Small Bridge, MVP, PDM, TA
	Enforce zoning requirements for building permits to ensure Conservation Commission and Planning Board involved in permitting process for stormwater/floodplain management *(Continued from 2012 HMP)*	• Conservation Commission • Planning Board	1-3	$	M	General Fund, Land Use Planning Assistance
	Develop a stormwater management plan (i.e. a list of opportunities for nature-based flood storage and stormwater infiltration using a model that incorporates future climate conditions)	• Department of Public Works	1-3	$ - study $$ - implementation	L	MVP, PDM, TA
Emergency Communications	Increase sign-up for phone alerts to cell phones and part time residents or renters through the Richmond Record and Facebook	• Fire Department • Town Administrator	1-3/3-5	$	H	PDM, General Fund

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**
Forests and Watershed	Work with the City of Pittsfield and the Richmond Pond Dam owner to improve the condition of the Richmond Pond dam *(Continued from 2012 HMP)*	• Town Administrator • City of Pittsfield • Private Dam Owner	3-5	$$-$$$	H	MVP, PDM
	Request dam emergency plan from Town of Lenox to identify structures and critical facilities located in the reservoir dam failure inundation areas. *(Continued from 2012 HMP)*	• Building and Zoning Department • Department of Public Works • Town of Lenox	3-5	$	H	PDM, General Fund
	Provide residents resources on climate-resilient plant species and watershed protection measures	• Conservation Commission	1-3	$	M	General Fund
	Obtain and implement erosion control plan for problem erosion area at Branch Farm Road and Boys and Girls Club	• Conservation Commission	1-3	$$	M	TA
	Evaluate the opportunities to adopt new environmental regulations, such as forest protection zones	• Planning Board • Conservation Commission	3-5	$	L	Land Use Planning Assistance, General Fund
	Conduct outreach to private landowners about removing woody debris near homes and structures in higher risk fire areas *(Continued from 2012 HMP)*	• Fire Department	3-5	$	L	PDM, General Fund

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**
Development Regulations and Planning	Update the FEMA FIRMs and evaluate vulnerability and risks within new flood hazard areas to develop additional flood mitigation projects, with specific attention to critical facilities.	• FEMA • Department of Public Works	1-3	$ - study $$$ - implementation	H	MVP, PDM, TA
	Review Floodplain Overlay District and other bylaws to ensure compliance with the NFIP policies.	• Conservation Commission • Planning Board • DCR	1-3	$	H	General Fund
	Evaluate and update current Wetlands Bylaw for climate resilience and reducing flooding risk, especially in comparison to MACC's recommendations (e.g. riparian buffers/riverfront resource areas, erosion protections, green infrastructure, and/or resilient design specifications for re/development)	• Conservation Commission • Planning Board	1-3	$	M	General Fund, Land Use Planning Assistance, MVP
	Explore options for updating community's plan for managing future development (e.g. Master Plan)	• Planning Board • Long Range Sustainability Committee	1-3	$$	L	Land Use Planning Assistance, General Fund
Invasive Species	Develop an invasive species management regulation and permitting process	• Conservation Commission	3-5	$	M	General Fund
Municipal Buildings and Services	Incorporate hazard mitigation and climate adaption considerations	• Municipal Building Committee	1-3	$$$	H	Green Communities, MVP, PDM, TA

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**
	in the new Town Hall construction, such as solar power and battery backup power, public wifi, shading, public gathering room, fiber cable					
	Evaluate opportunities for resiliency improvements at municipal facilities, especially emergency backup power and feasibility of green power and battery storage for the DPW Garage and Fire Department.	• Department of Public Works	3-5/5-10	$ - study $$-$$$ implementation	L	Green Communities, MVP, PDM
Parks and Open Spaces	Coordinate and update the Open Space Plan with a resilience assessment of the climate change impact on flora and fauna unique to Richmond	• Conservation Commission	3-5	$$	L	LAND, Land use Planning Assistance
Resident Outreach	Seek grant funding for fire safety programs through the fire department, including Senior SAFE.	• Fire Department • Town Administrator	3-5	$	L	Senior SAFE
Shelters	Disseminate emergency shelter plan to inform and consult with all EOC positions on staffing, protocols, training support needed, and supplies updates	• Fire Department • Town Administrator	1-3/3-5	$	M	General Fund
Trees, Electricity and Communication Infrastructure	Develop a comprehensive tree and forest management program to identify trees at risk of causing power outages for removal, replacement,	• Eversource • Magna 5 • Tree Warden	3-5	$$ - planning $$$ - implementation	M	MVP, PDM, TA

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
	or trimming; increase tree canopy near buildings for shade; actively manage forest underbrush; and manage invasive species.					

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. Most of the state lands in Richmond are maintained by DCR and the Division of Fisheries and Wildlife, and several dams are owned by or managed in cooperation with neighboring municipalities of Lenox and Pittsfield. The Town will strive to share and obtain vulnerability data in coordination with these agencies. 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.

Richmond also has strong working relationships with the Berkshire Natural Resources Council (BNRC) and the Berkshire Regional Planning Commission (BRPC), which have 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 Richmond, 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: https://www.mass.gov/lists/community-grant-finder#community-development-. 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 Richmond 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
Chapter 90 Program	Reimbursable grants on approved projects	Public Works and Transportation	None
Community Forest Grant Program	Funding to establish community forests	Environment	None
Community Transit Grant Program	Funding to meet the transportation and mobility needs of seniors and people with disabilities	Public Works and Transportation	Depends on project type
Complete Streets Funding Program	Technical assistance and construction funding	Public Works and Transportation	Eligible communities must pass a Complete Streets Policy and develop a Prioritization Plan
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
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
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

Table 7-2: Potential Funding Sources

Grant	Description	Category	Limitations & Stipulations
			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
MassTrails Program	Trail protection, construction, and stewardship projects	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
MS4 Grant Program	Meeting the requirements of the 2016 MS4 permit and reduce stormwater pollution through partnerships	Environment	Two or more municipalities subject to the 2016 Small MS4 General Permit must apply together
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

Table 7-2: Potential Funding Sources

Grant	Description	Category	Limitations & Stipulations
Natural Resource Damages Program	Funding for restoration projects. Funding comes from settlements, so it is 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
Surface Transportation Block Grant Program (STBG)	Includes funding for bridge projects on any public road and facilities for nonmotorized transportation	Transportation	None
Transportation Alternatives (TA)	Funding for smaller-scale transportation projects such as pedestrian and bicycle facilities, recreational trails, safe routes to school projects, community improvements such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity	Transportation	None

8

Plan Adoption and Maintenance

8.0 PLAN ADOPTION AND MAINTENANCE

8.1 Plan Adoption

The Town of Richmond'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, and funding mechanisms in Table 7.1 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 Town Administrator's Office, 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 other interested local stakeholders. The questions in the survey will reference the tables of existing and proposed action items listed in the MVP-HMP. The survey will assist in determining any necessary changes or revisions to the plan. 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 an update and/or addendum 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 Richmond'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 Berkshire Regional 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 Richmond'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.

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Appendix A

Core Team Materials

Town of Richmond
Hazard Mitigation and Municipal Vulnerability Preparedness (HM-MVP) Plan

Core Team Meeting
Thursday, November 5, 2020 | 10:00 am – 11:00 am

1. Introductions

2. Core Team Role

3. Climate Change in Richmond

4. Project Overview
   - Scope and Schedule
   - Core Team Input
   - Data Sources
   - Community Lifelines and Critical Facilities

5. Goal Setting & Endorsement

6. Community Resilience Building (CRB) Webinars' Materials
   - Tentative Dates:
   - Pre-select features
   - Pre-select hazards

7. Webinar Participants

8. Wrap Up and Next Steps

Action Items	W&S	Town

Weston & Sampson

Town of Richmond
Hazard Mitigation and Municipal Vulnerability Preparedness (HM-MVP) Plan

Core Team Meeting
Thursday, November 5, 2020 | 10:00 am – 11:00 am

1. Introductions
   Attending:
   - Town of Richmond
     - Danielle Fillio, Town Administrator
     - Pete Beckwith, Highway Superintendent
     - John Hanson, Planning Board Chair
     - Steve Traver, Fire Chief
   - Weston & Sampson
     - Steve Roy, Principal
     - Amanda Kohn, Project Manager
     - Joanna Nadeau, Planner

2. Core Team Role
   - Develop/approve list of stakeholders
   - Be Active participants in the Community Resilience Building webinars
   - Promote the public listening session/attend listening session
   - Inform community priorities/determine how decisions from the webinars will be used

3. Project Overview
   Amanda Kohn, Weston & Sampson Project Manager used a PowerPoint presentation to describe the project to the Core Team. The overview included the following:
   - MVP Planning Process
   - Hazard Mitigation Plan Integration
   - MVP Action Grants Funding: When you go for funding via PARC, MVP, etc., action items in the OSRP and the HMP-MVP will be compelling for funders.
   - Scope and Schedule
     i. Town's building project is ongoing – preferred to have separate meetings at this time. Building project is planning to meet twice a month in the evening and some Saturdays. Dec. 12, Jan. 11, Jan 23, Feb 9, Feb 17, Mar 11.
     ii. End of January is when budget season starts. Departments will be busy in January prepping. Danielle will be more busy in February.
     iii. Listening sessions typically held in the evening. Could also do it at a Planning Board meeting or Selectboard. Planning Board would be good because they want to be involved, maybe for February. PB meets 2nd Monday of the month (2/8).

   - Data Sources
     i. MEMA required CEMP plan

   - Community Lifelines and Critical Facilities
     i. Had two fuel leaks – at 53 firehouse they put a generator and a compressor in with monitoring wells and pumped wells to push fuel out; clean and tested

negative. At 40 firehouse, dug up and monitored, came out clean. One monitoring well in the ground.

ii. DF will investigate whether Pittsfield has more than one wastewater facility.

iii. Peirson Place campground water supply. Public means it serves 25 or fewer individuals. Cleared and illegal tent site, rents out on Airbnb. No water being served to visitors.

iv. Other edits were made directly to critical facilities list.

v. Will send out an updated list for final review within the next week.

4. Goal Setting & Endorsement
   - W&S looked at nearby towns and proposed updates to the goals in the old Hazard Mitigation Plan. FEMA requires goals endorsed by core team.
   - Question from John: Long term plans vs short term hazards that they have right now. Lots of dead trees along the highways causes Eversource to repair power constantly. How can we get these addressed soon? Relevant to goal #1, d. Improve reliability of utilities to do maintenance of dead trees. And goal 4 – note Eversource as an entity to coordinate with.
     - The goals are overarching statements; we will talk about smaller actions that we will implement to achieve the goals in the next phase of the plan.
   - We set a goal for getting feedback on these materials within the next week.

5. Climate Change in Richmond
   - People from cities may move inland, as ripple effect from sea level rise or hurricanes
   - We have county and watershed level data
   - Local impacts: In summer drought, no residents lost wells that we heard about. Town sent out reminders in summer newsletter to check wells and be careful with water.
     - When people lose power, they lose water.

6. Community Resilience Building (CRB) Webinars' Materials
   - Tentative Dates: December 15-17, T through Thu; 9-11am
   - Shared the CRB Risk Matrix – Electric utility lines, Eversource, vulnerability -winter storms and high winds -> lose power from falling trees. Action item: develop tree maintenance plan, work with Eversource, prioritizing areas over time, corridor where this happens frequently.
   - To focus the CRB meeting, we can fill out the hazards and the features in advance.
   - Pre-selected hazards
     i. Flooding, wind events, winter weather/extreme cold, extreme heat/drought/fire
   - Pre-select features
     i. Societal: Examples would be schools; vulnerable residents; assets: shelters; issues; economic; historic district
     ii. Infrastructural: This is more of the built environment
     iii. W&S will share the CRB workbook and an example from a neighboring town.

7. Webinar Participants
   - Want the invite list settled by 11/12, so we can send invites a month in advance.

8. Wrap Up and Next Steps

Action Items	W&S	Town
Sending notes and follow up items	X	
Send input on stakeholder list, critical facilities, goals, and features list by 11/13		X
Share CEMP		X

TOWN OF RICHMOND

Core Team Meeting

November 05, 2020

Photo: Town of Richmond Facebook Page

WELCOME CORE TEAM

ROLE – *MORE ON THIS LATER*

- Confirm framework for process
- Provide data and local expertise
- Participate and promote in the CRB webinars
- Finalize priority actions for the final report

TODAY'S OBJECTIVES

- Review Process
- Endorse Goals
- Prepare for CRB Webinars

MA CLIMATE PROJECTIONS

By end of century:

Changes in precipitation

- 18% increase in consecutive dry days
- 57% increase in days with > 1 in. rainfall
- 7.3 inches additional annual rainfall
- Increase in flooding

Rising temperatures

- 10.8°F increase in average annual temperature
- 42% decrease in days/year with min. temperatures < 32* F
- 1,280% increase in 90-degree days/year

Winter weather

- Overall a decrease in annual snowfall
- Likely to have fewer events with a lot of snow
- Freeze –thaw cycle to change

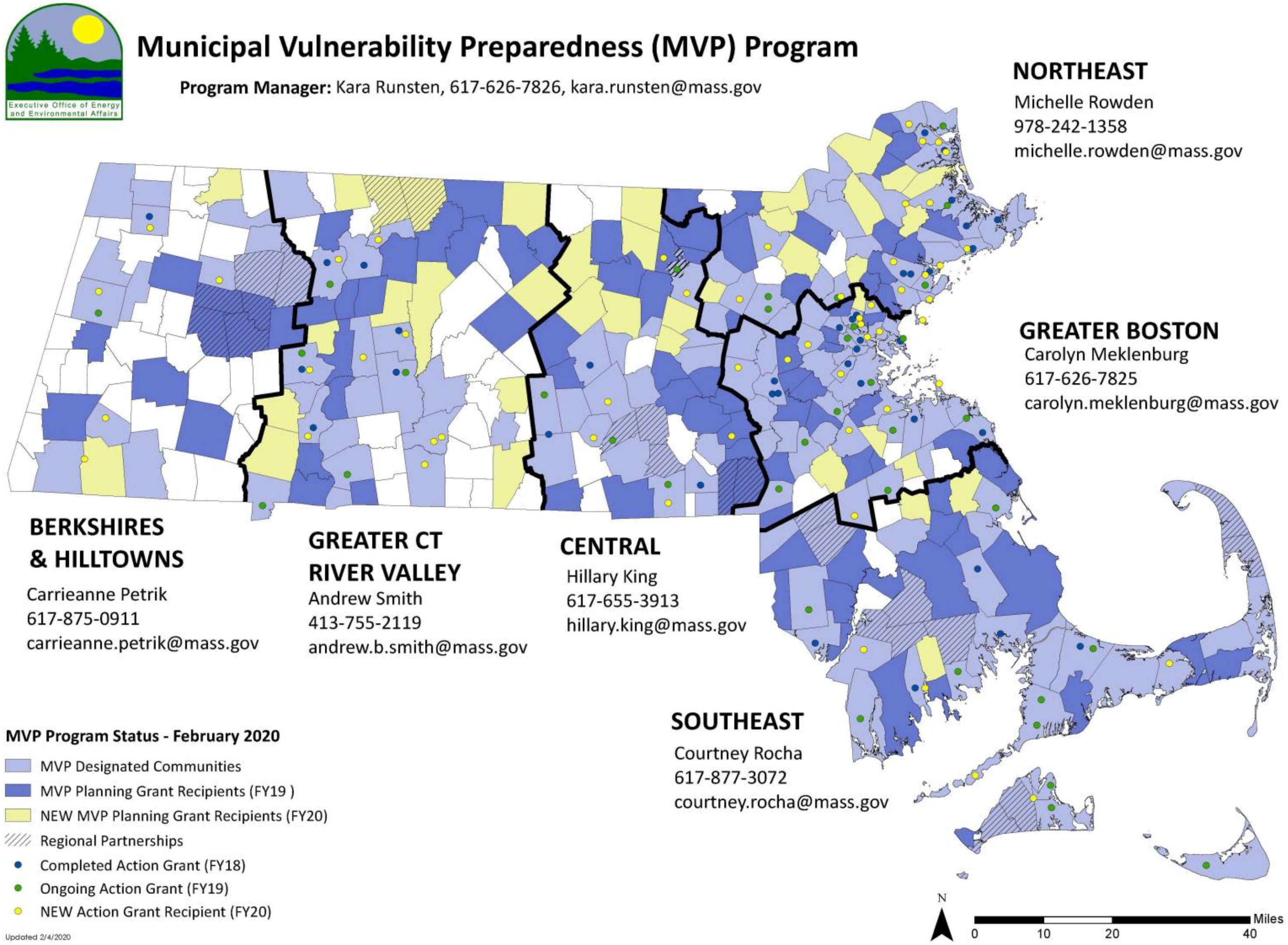
Regional changes

- Increase in frequency and magnitude of hurricanes and nor'easters
- 4-10.5 feet of sea level rise

Source: State Hazard Mitigation and Climate Adaptation Plan, September 2018 / resilientma.org / Northeast Climate Adaptation Science Center

MUNICIPAL VULNERABILITY PREPAREDNESS (MVP) PROGRAM

- Improved resilience and preparedness
- Collaboration with stakeholders
- Increased education, planning, and implementation
- Funding for resilience-related actions



MVP PROGRAM

1. MVP Planning Grant

- Define climate hazards
- Identify community vulnerabilities and strengths
- Develop and prioritize adaptation actions
- Receive MVP designation

** We're also updating Richmond's Hazard Mitigation Plan!*

2. MVP Action Grant

- Implement priority adaptation actions identified during the planning process

What Can the MVP Action Grant Fund?

Assessments

Outreach & Education

Management Measures

Redesign & Retrofit

Nature-Based Solutions

Ecological Restoration

Water Quality & Infiltration

Flood Protection

Extreme Heat Mitigation

Drought Mitigation

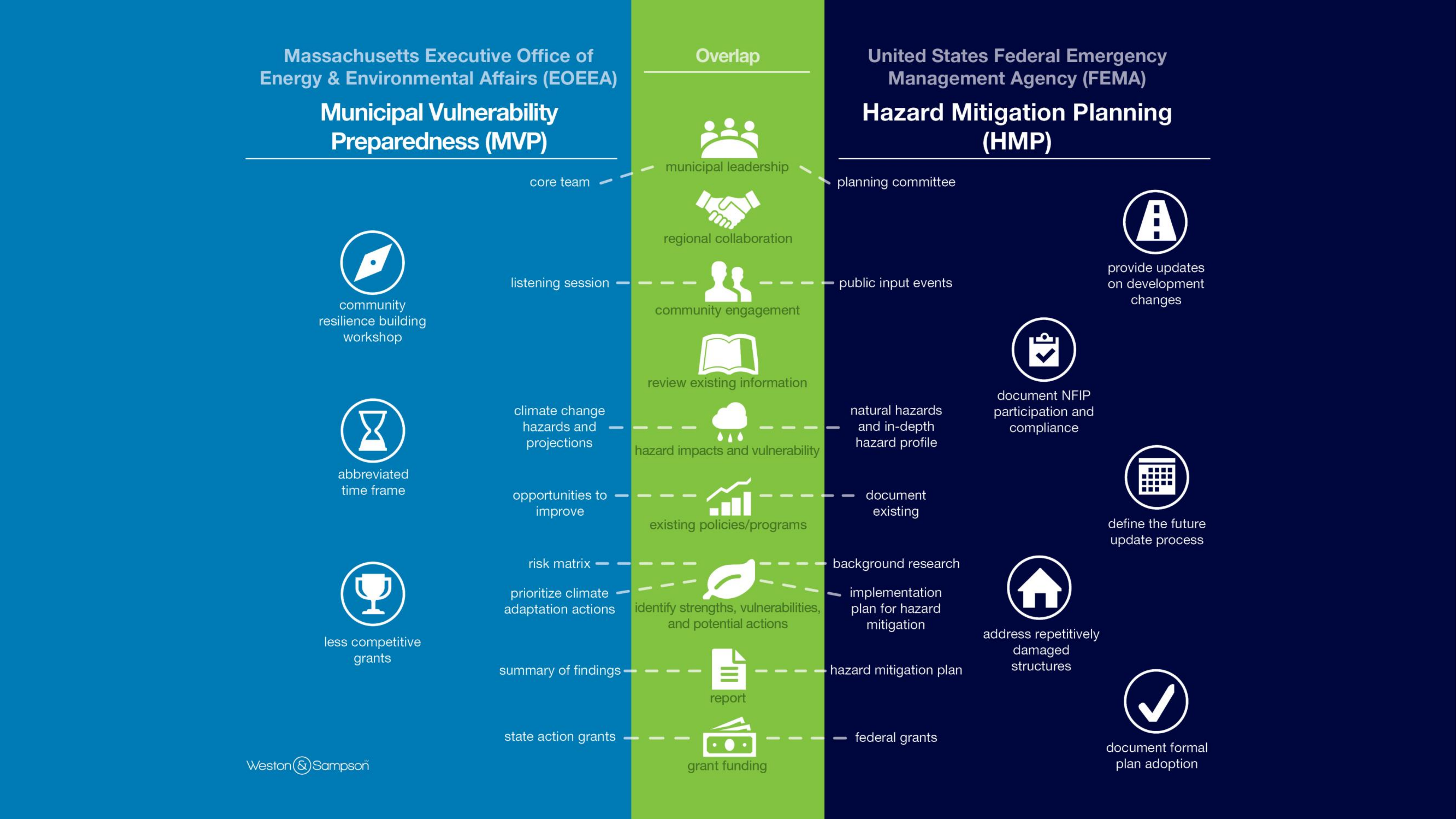
Energy Resilience

Chemical Safety

Land Acquisition

Housing

Mosquito Control


Massachusetts Executive Office of Energy & Environmental Affairs (EOEEA)
Municipal Vulnerability Preparedness (MVP)
Overlap
United States Federal Emergency Management Agency (FEMA)
Hazard Mitigation Planning (HMP)
core team
municipal leadership
planning committee
regional collaboration
community resilience building workshop
listening session
community engagement
public input events
provide updates on development changes
review existing information
document NFIP participation and compliance
abbreviated time frame
climate change hazards and projections
hazard impacts and vulnerability
natural hazards and in-depth hazard profile
opportunities to improve
existing policies/programs
document existing
define the future update process
risk matrix
background research
prioritize climate adaptation actions
identify strengths, vulnerabilities, and potential actions
implementation plan for hazard mitigation
less competitive grants
address repetitively damaged structures
summary of findings
report
hazard mitigation plan
state action grants
grant funding
federal grants
document formal plan adoption
Weston & Sampson

MILESTONE SCHEDULE

OCTOBER 2020	NOVEMBER 2020	DECEMBER 2020	FEBRUARY 2021	APRIL 2021	JUNE 2021
Core Team Kickoff	Listening Session #1 (video and survey)	CRB Webinars	Listening Session #2	Action Grant	MVP-HMP Plan

Flexible, date preference?

CORE TEAM INVOLVEMENT

Virtual engagement options include webinars, videos, surveys, social media campaigns, and more!

1. Core Team Kickoff | *Thanks for coming!*
2. Existing Plans | *Seeking input today*
3. Critical Facilities List and Hazard Map | *Seeking input today*
4. Endorse Goals | *Seeking input today*
5. Community Resilience Building Webinars | *December 1-3*
6. Finalize Priorities
7. Public Listening Session and Input
8. Report | *Due June 2021*

CLIMATE DATA

- Massachusetts Integrated State Hazard Mitigation and Climate Adaptation Plan (2018)
- Massachusetts Climate Change Projections (NECSC, 2018 on resilientma.org)
- Massachusetts Climate Change Adaptation Report (MA EEA, 2011)

APPLICABLE PLANS

- Berkshire County Hazard Mitigation Plan (2012)
- Town of Richmond Community Development Plan (2003)
- Town of Richmond Annual Report (2018, 2019)
- Town of Richmond Bylaws (2019)
- Richmond Cultural Council Community Input Survey
- Open Space and Recreation Plan (2016-2022)

LIFELINES & CRITICAL FACILITIES

Feature Type	Name	Address
SAFETY AND SECURITY		
Emergency Operations Center	Richmond Fire Station	35 Firehouse Lane
Public Works	Department of Public Works	53 Firehouse Lane
Alternate Emergency Operations Center	Richmond Consolidated School	1831 State Road
Fire	Richmond Fire Station	35 Firehouse Lane
Town Offices/ Police	Richmond Town Hall and Police Department	1529 State Road
FOOD, WATER, SHELTER		
Agriculture	Hilltop Orchards and Furnace Brook Winery	508 Canaan Road
	Berkshire Horse Works	101 Patton Road
Shelters	Richmond Consolidated School	Rte 41, 1831 State Road
Food and Agriculture	Bartlett Apple Orchard and Farmer's Market	575 Swamp Rd
Food and Fuel Assistance	Berkshire Community Action Council	
Food Assistance	Elder Services of Berkshire County Meals on Wheels	
Water supply	See separate table below	
Wastewater	Private Septic Systems	Town-wide except near Richmond Pond

See attachment –
Draft Critical Facilities List

Rebranding by FEMA to Community Lifelines

RICHMOND'S CLIMATE ADAPTATION & HAZARD MITIGATION GOALS

Weston & Sampson

WEBINAR OUTLINE

WEBINAR OBJECTIVES:

- Identify vulnerabilities and strengths
- Brainstorm projects or action items
- Prioritize projects or action items

TODAY'S DISCUSSION:

- Pre-Select Features
- Pre-Select Hazards
- Stakeholder List

Photos: Town of Richmond Facebook

Recommended webinar topic areas include:

INFRASTRUCTURE

NATURAL RESOURCES

COMMUNITY

RISK MATRIX

Pre-fill today?
Survey with Core Team?
Survey with Participants?

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

CLIMATE HAZARDS IN RICHMOND

Pick 4 for the CRB Webinars

Flooding

Extreme Temperatures

Drought

Winter weather (Nor’easters, ice storms, snowstorms, blizzards)

Wind events (thunderstorms, hurricanes, tornadoes)

Brushfires/Wildfires

STAKEHOLDER LIST

See attachment –

Draft Stakeholder List (Excel)

Board/Committee/Town Staff			Agricultural Commission		413-553-7793
Board/Committee/Town Staff	William E. Martin	Chair	Board of Appeals		413-553-7793
Board/Committee/Town Staff	Ronald Veillette	Chair	Conservation Commission	ronsan@berkshire.rr.com	
Board/Committee/Town Staff			Cable Advisory Commission		413-553-7793
Board/Committee/Town Staff			Municipal Building Committee		413-553-7794
Board/Committee/Town Staff			Sewer Advisory Committee		413-553-7793
Board/Committee/Town Staff	Cathy Gamberoni	Chairperson	Cultural Commission	richmondmaculturalcouncil@gmail.c	413-553-7793
Board/Committee/Town Staff	William Bullett	Police Chief	Police Department	police@richmondma.org	413-442-3693
Board/Committee/Town Staff	John Olander	Health Agent	Board of Health	boh@richmondma.org	413-230-4941
Board/Committee/Town Staff	Andrew Fisher	Chairperson	Board of Health		
Board/Committee/Town Staff	Adam Weinberg	Warden	Tree Warden		
Board/Committee/Town Staff	Roger Manzolini	Elected Board Member, Chairman	Board of Selectmen		413-553-7803
Board/Committee/Town Staff	Neal Pilson	Elected Board Member, Vice-Chairman	Board of Selectmen		
Board/Committee/Town Staff	Phyllis LeBeau	Director	Council on Aging		
Board/Committee/Town Staff	Peter Cohen	Chairperson	Council on Aging	coa@richmondma.org	413-553-7793
Board/Committee/Town Staff	Gloria Morse	Chairperson	Historical District Commission		413-553-7793
Board/Committee/Town Staff	Jeff Konowitch	Chairperson	Recreation Committee		413-553-7794
Board/Committee/Town Staff	Robert Gniadek	Chairperson	Finance Committee		413-553-7795
Board/Committee/Town Staff	Kristin Smith	Librarian	Library	k.smith@richmondma.org	413-553-7795
Board/Committee/Town Staff	John Herrera	Veteran's Agent	Veterans Affairs	jherrera@cityofpittsfield.org	(413) 499-9433
Board/Committee/Town Staff	Dewey Wyatt	Chairperson	School Committee	dmwyatt9@gmail.com	413-822-3882
Local Leaders/Organization Reps	Ken Kelly	President	Richmond Pond Association	kkelly@utica.edu	(413) 329-9678
Local Leaders/Organization Reps	John Keenum	President	Richmond Land Trust	president@richmondlandtrust.net	(413) 698-3898
Local Leaders/Organization Reps					
Local Leaders/Organization Reps					

THANKS FOR COMING

Next Steps:

- Send feedback and input to W&S
- Listening Session Promotion
- CRB Webinar Series

Photo: Town of Richmond Facebook Page

Town of Richmond

Hazard Mitigation and Municipal Vulnerability Preparedness (HM-MVP) Plan

Core Team Meeting

Thursday, February 18, 2020 | 11:00 am – 12:00 pm

- Status Update
- Action Prioritization
- Implementation Plan Review
- Wrap Up and Next Steps
    a. Listening Session Dates
    b. Report Chapter reviews

Weston & Sampson

APPENDIX B

Critical Facilities and Community Lifelines

Critical facilities and community lifelines are extremely essential components to the Town's function, viability, and protection. 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.
4. Services that support the day to day needs of a community

Critical facilities and community lifelines in the Town of Richmond have been identified with help from knowledgeable Town staff, the Core Team, MassGIS data, and existing Town and regional plans, including the Berkshire County Hazard Mitigation Plan (BRPC, 2012).

Table A-1. Emergency Response Facilities

Feature Type	Name	Address
SAFETY AND SECURITY		
Emergency Operations Center	Richmond Fire Station	35 Firehouse Lane
Public Works	Department of Public Works	53 Firehouse Lane
Fire	Richmond Fire Station	35 Firehouse Lane
Town Offices	Richmond Town Hall	1529 State Road
FOOD, WATER, SHELTER		
Agricultural Resources	Hilltop Orchards and Furnace Brook Winery	508 Canaan Road
	Berkshire Horse Works	101 Patton Road
	Bartlett Apple Orchard and Farmer's Market	575 Swamp Rd
Shelter	Richmond Consolidated School	Rte. 41, 1831 State Road
Water supply	See separate table below	
Wastewater	Private Septic Systems	Town-wide except near Richmond Pond
HEALTH AND MEDICAL		
End of Life Facilities	Center Cemetery	1188 State Road
	Cone Hill Cemetery	Cone Hill Road
Health Services	Visiting Nurse	1831 State Rd
ENERGY		
Electrical Transmission	Eversource (critical infrastructure)	See attached map
Natural Gas Lines	3 Tennessee; 2 Berkshire gas	TN line runs E to W; BG line runs N-S
COMMUNICATIONS		
Radio Receivers	Emergency radio tower for DCR, State Police	Lenox Mountain near Yokun Road
Post Office	Richmond Post Office	2089 State Road
TRANSPORTATION		

Evacuation Routes	See MEMA CEMP Plan	
Rail	Amtrak/Freight Rail	See attached map
HAZARDOUS MATERIAL		
Solid Waste Facility	Former Cone Road Landfill Site (uncapped)	Cone Hill Road
Underground Storage Tank (2017 MA Tier II Facility)	Department of Public Works	53 Firehouse Lane
Chemical Building	Boys Club Property/Camp Russell	341 Boys Club Rd
Pump stations with backup power		Elm Road and Town Beach Road
COMMUNITY AND CULTURAL FACILITIES		
Religious Centers	Richmond Congregational Church	1515 State Road
	Berkshire Community Church	45 Cemetery Road
Library	Richmond Free Public Library	2821 State Road
School	Richmond Consolidated School	Rt 41, 1831 State Road
National Historic Sites	Northeast School	981 Summit Road
	Nichols – Sterner House	428 Swamp Road
	Goodwood	311 Summit Road
	Kenmore Estate	1385 State Road
	Shaker Farm	Dublin Road (Approx. 1380 Dublin Rd, between Lenox and Sleepy Hollow Rds.)
	Richmond Furnace Historical and Archaeological District	Cone Hill, Furnace Rd and 41 – near W. Stockbridge line, near Pilgrim street
Local and State Historic Resources	Over 100 Sites	See Richmond Open Space and Recreation Plan
NATURAL RESOURCE ASSETS		
BioMap2 Areas		See attached map
Groundwater Protection Areas		See attached map
Surface Water Protection Areas		See attached map
Parks and Open Space		See attached map
Waterbodies		See attached map
Dams	See table below	See attached map
REGIONAL FACILITIES		
Waste Management	Canaan Transfer Station	7 Flints Crossing Rd, Canaan, NY 12029
	Southern Berkshire Regional Household Hazardous Waste Collection Program	Various drop off locations
Cell Tower	West Stockbridge	
School	Pittsfield High School	300 East St, Pittsfield
	Monument Mountain Regional High School	600 Stockbridge Rd, Great Barrington

	Taconic High School	96 Valentine Rd, Pittsfield
Food and Fuel Assistance	Berkshire Community Action Council	292 West St, Pittsfield, MA
	Elder Services of Berkshire County- Meals on Wheels	877 South St #4e, Pittsfield, MA 01201
Wastewater Treatment	Richmond Pond area serviced by public centralized sewer sent to the Pittsfield Wastewater Treatment Facility Majority of Richmond uses private septic systems	901 Homes Road, Pittsfield, MA
Transit	Berkshire Regional Transit Authority	Nearest bus service is in Lenox

Table A-2. Public Drinking Water Wells

Source_ID	Site Name	Latitude	Longitude	Type
1249011-01G	Bartletts Orchard LLC	42.401085	-73.311696	TNC
1249010-01G	Branch Farm Condo Assn	42.410777	-73.322671	TNC
1249005-01G	Camp Marion White	42.415093	-73.316445	TNC
1249012-01G	Camp Russell	42.409888	-73.324616	TNC
1249012-02G	Camp Russell	42.411304	-73.326029	TNC
1249009-01G	Heirloom Fire Catering	42.374639	-73.367387	TNC
1249013-01G	Hilltop Orchard and Furnace Brook Winery	42.395887	-73.387182	TNC
1249006-01G	Peirson Place	42.398796	-73.369812	TNC
1249000-01G	Richmond Congregational Church	42.390644	-73.367012	TNC
1249004-02G	Richmond Consolidated School	42.383491	-73.364954	NTNC
1249008-01G	Well #1	42.394119	-73.315994	GW

(MassGIS Public Water Supplies, 2014 with input from Core Team)

- Peirson Place may not serve water to guests.
- Town Hall shares well with Richmond Congregational Church
- GW= Community Groundwater Well, serves multiple homeowners (quasi-public)
- TNC= Transient Non-Community Well, serves fewer than 25 people daily, such as a camp or restaurant
- NTNC=Non-Transient Non-Community Well, regularly serves more than 25 people daily for more than 6 months of the year

Table A-3. Dam Information

Name	Ownership	Location	Hazard Class
Sherrill Pond Dam	Private	Richmond	Non-jurisdictional
Browne Pond Dam	Private	Richmond	Non-jurisdictional
Rose Pond Dam	Private	Richmond	Non-jurisdictional
Strong Pond Dam	Private	Richmond	Non-jurisdictional
Richmond Iron Works Dam	Private	Richmond	Non-jurisdictional
Richmond Pond Dam	Private	Pittsfield	Significant
Lower Root Reservoir Dam	Town of Lenox	Lenox	High
Upper Root Reservoir Dam	Town of Lenox	Lenox	High

(US Army Corps of Engineers, 2019)

Hazard Classifications

- High: Dams located where failure or mis-operation will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).
- Significant: Dams located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s), or cause interruption of use or service or relatively important facilities.
- Low: Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected.

Appendix B

Additional Hazard Data

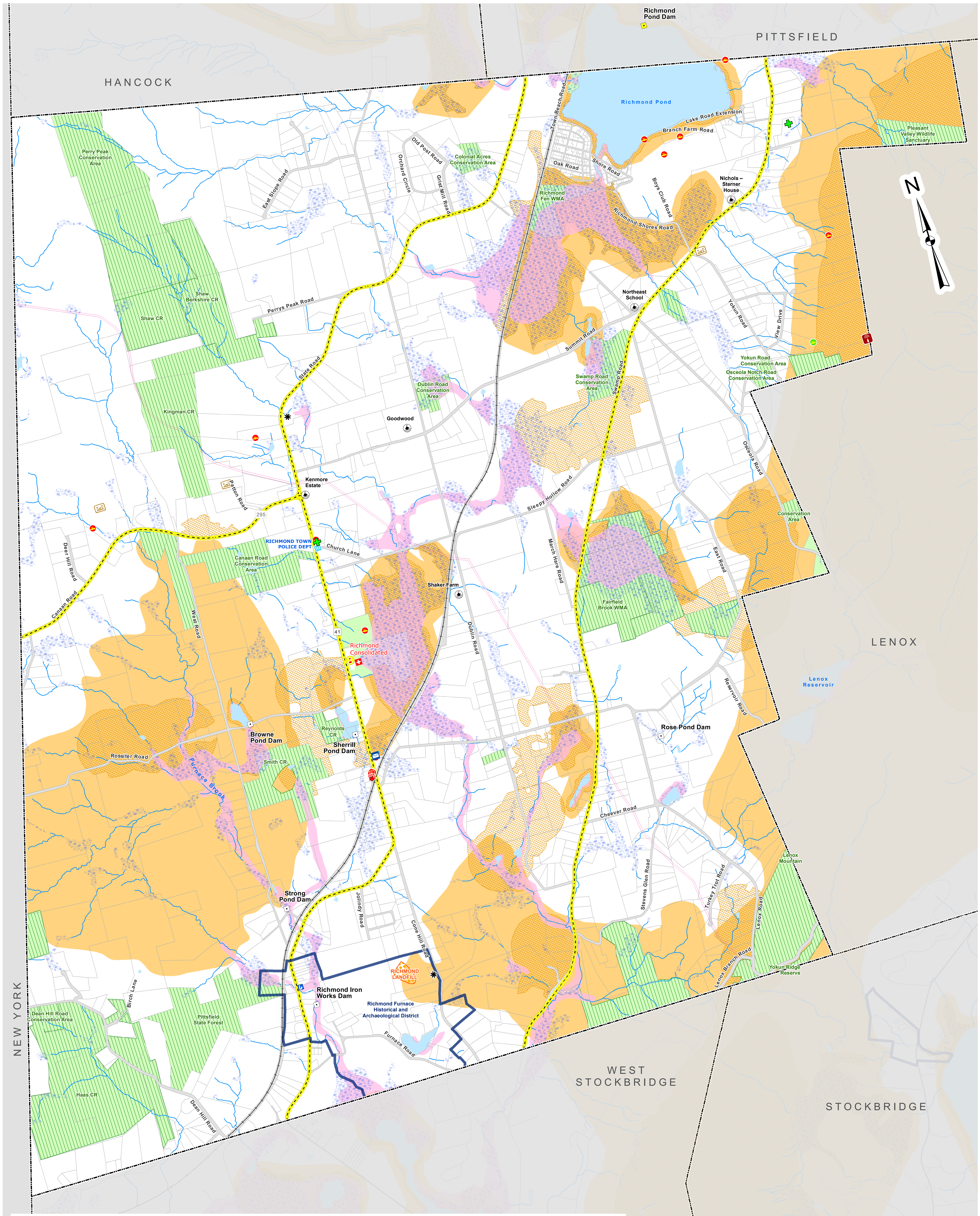
FIGURE 1

TOWN OF RICHMOND, MASSACHUSETTS

MUNICIPAL VULNERABILITY PREPAREDNESS
CRITICAL FACILITIES MAP

DECEMBER 2020 SCALE: NOTED

Weston & Sampson



Legend

- Agricultural Resources
- Cemeteries
- Health Services
- Library
- National Historic Sites
- Post Office
- Public Works
- Radio Receiver
- Religious Centers
- Richmond Fire Station/Emergency Operations Center
- Shelter
- Underground Storage Tank
- Town Hall
- School
- Police Department
- Solid Waste Facility
- Conservation/Protected Land
- Open Space
- Amtrak/Freight Rail
- Electrical Transmission
- Evacuation Route

Public Water Systems

- Community Groundwater Source
- Non-Community Groundwater Source

Dams

- Significant Hazard
- N/A

MassHistoric Commission Inventory (Areas)

- National Register of Historic Places

Flood Zone Designations

- 1% Annual Chance of Flooding (Zones A, AE, AH, AO)

Waterways

- Rivers, Streams, and Brooks
- Marsh/Bog/Wooded Marsh
- Lakes, Ponds, Reservoirs

BioMap2 Core Habitat

- BioMap2 Core Habitat
- BioMap2 Critical Natural Landscape

1,200 0 1,200
Scale In Feet

FIGURE 2

TOWN OF RICHMOND, MASSACHUSETTS

MUNICIPAL VULNERABILITY PREPAREDNESS HAZARD AND ENVIRONMENTAL FEATURES MAP

DECEMBER 2020 SCALE: NOTED

Weston & Sampson

Hazus: Hurricane Global Risk Report

Region Name: Richmond

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Friday, October 9, 2020

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 68.22 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 2,420 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 501 million dollars (2014 dollars). Approximately 93% of the buildings (and 92% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,488 buildings in the region which have an aggregate total replacement value of 501 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

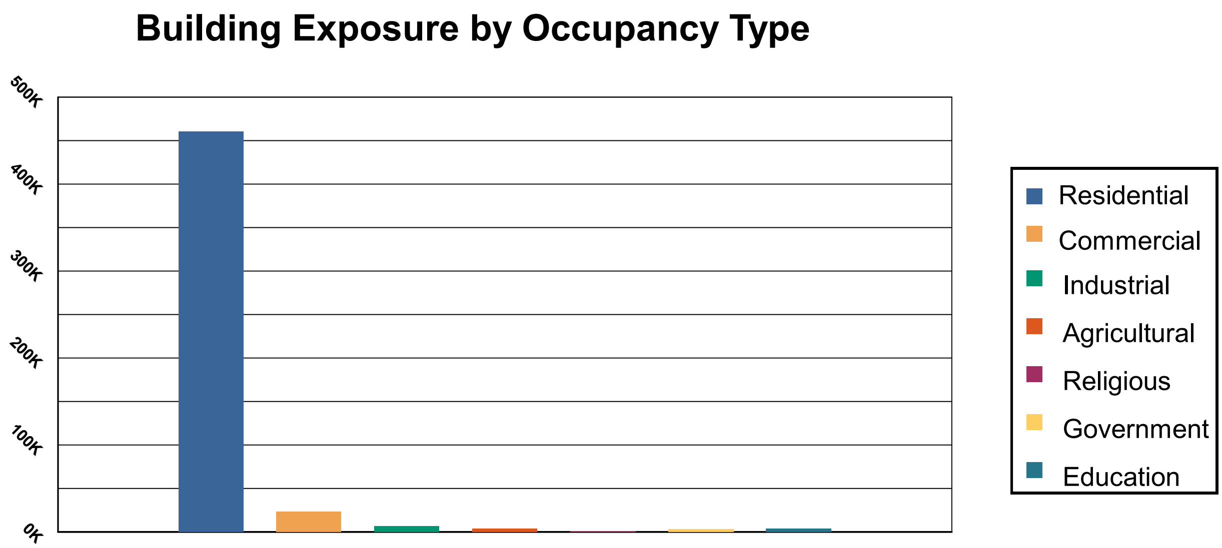


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	460,306	91.79 %
Commercial	23,056	4.60%
Industrial	6,589	1.31%
Agricultural	3,621	0.72%
Religious	849	0.17%
Government	3,386	0.68%
Education	3,660	0.73%
Total	**501,467**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 4 fire stations, 2 police stations and 6 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

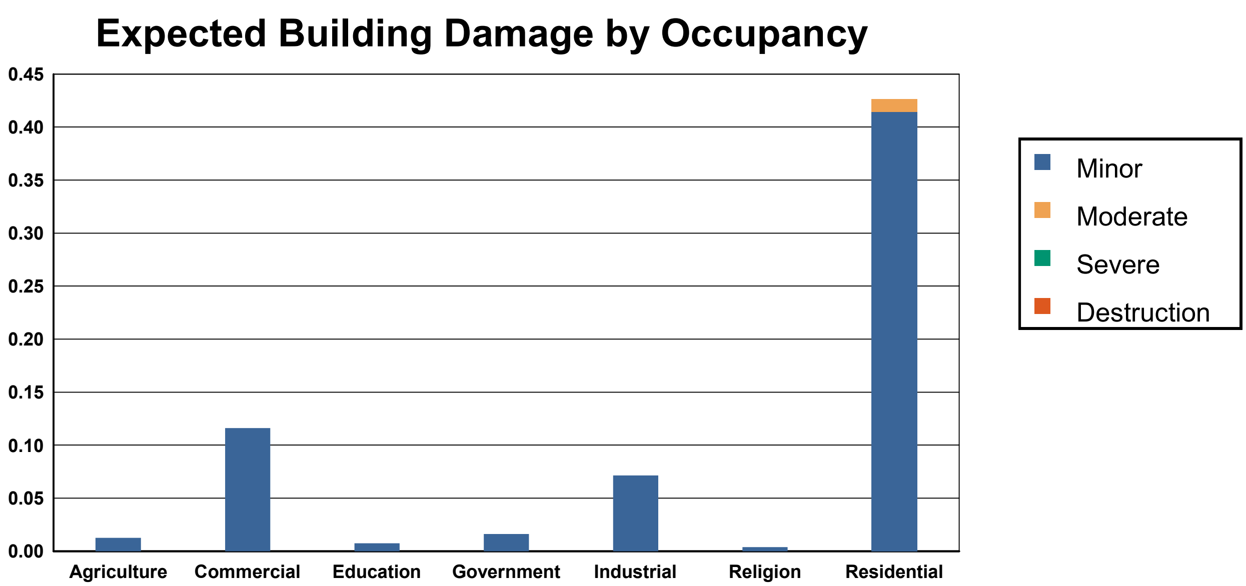


Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	6.99	99.82	0.01	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	52.88	99.78	0.12	0.22	0.00	0.00	0.00	0.00	0.00	0.00
Education	2.99	99.75	0.01	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Government	5.98	99.73	0.02	0.27	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	26.93	99.74	0.07	0.26	0.00	0.00	0.00	0.00	0.00	0.00
Religion	2.00	99.81	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00
Residential	1,389.57	99.97	0.42	0.03	0.01	0.00	0.00	0.00	0.00	0.00
Total	**1,487.35**		**0.64**		**0.01**		**0.00**		**0.00**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	12	99.67	0	0.33	0	0.00	0	0.00	0	0.00
Masonry	97	99.72	0	0.27	0	0.01	0	0.00	0	0.00
MH	8	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	51	99.74	0	0.26	0	0.00	0	0.00	0	0.00
Wood	1,321	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

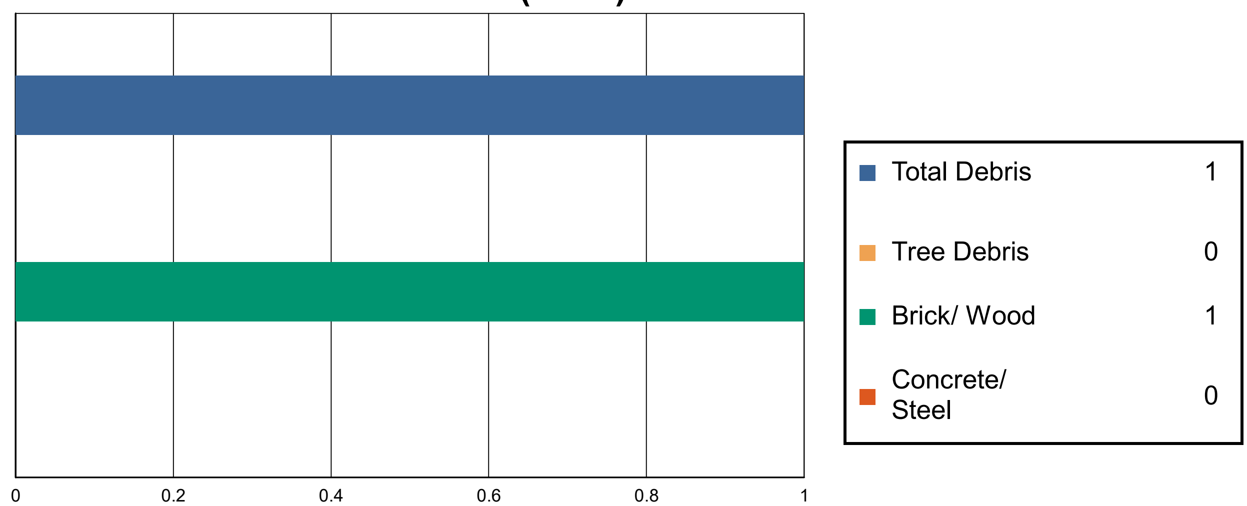
Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	6	0	0	6
Fire Stations	4	0	0	4
Police Stations	2	0	0	2
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

Estimated Debris (Tons)

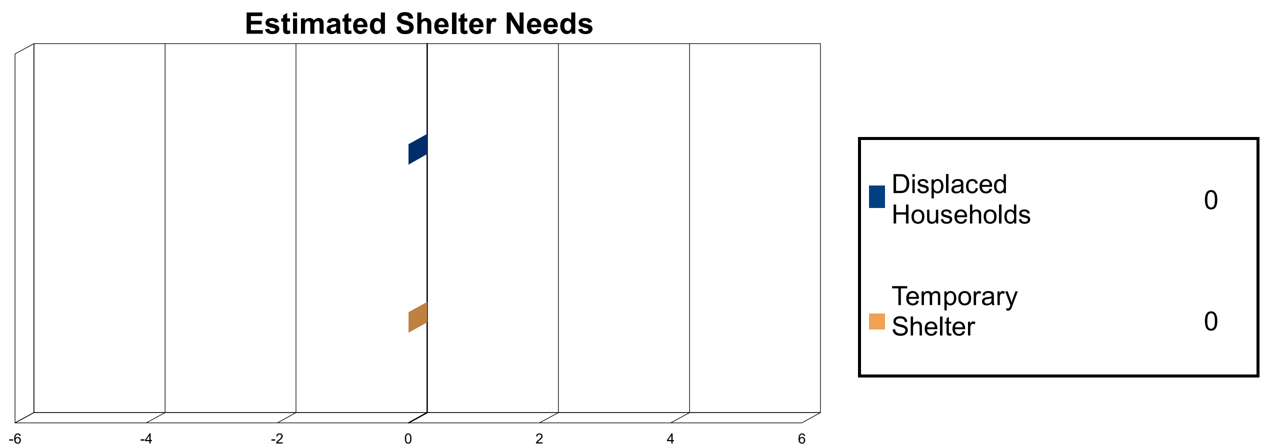


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 1 tons, Brick/Wood comprises 100% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 2,420) will seek temporary shelter in public shelters.

Economic Loss

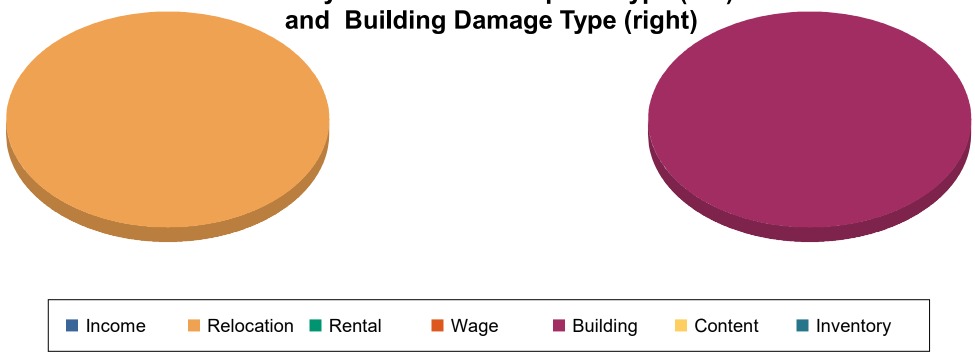
The total economic loss estimated for the hurricane is 0.1 million dollars, which represents 0.02 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

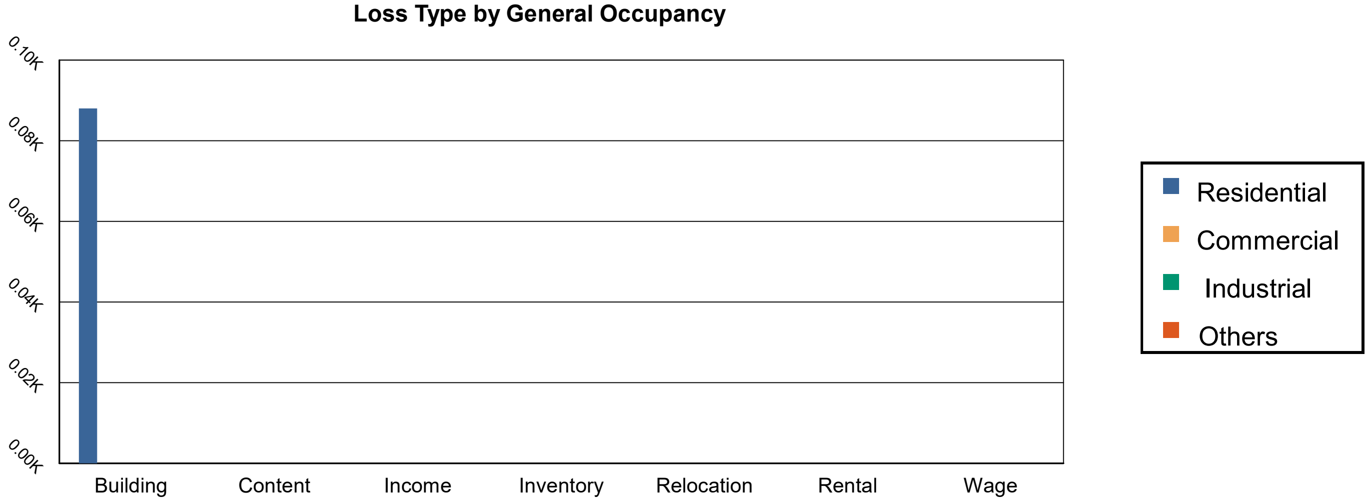


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	88.03	0.00	0.00	0.00	88.03
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**88.03**	**0.00**	**0.00**	**0.00**	**88.03**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.02	0.00	0.00	0.00	0.02
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.02**	**0.00**	**0.00**	**0.00**	**0.02**

Total

Total	**88.05**	**0.00**	**0.00**	**0.00**	**88.05**

Appendix A: County Listing for the Region

Massachusetts
- Berkshire

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Massachusetts				
Berkshire	2,420	460,306	41,161	501,467
Total	**2,420**	**460,306**	**41,161**	**501,467**
Study Region Total	**2,420**	**460,306**	**41,161**	**501,467**

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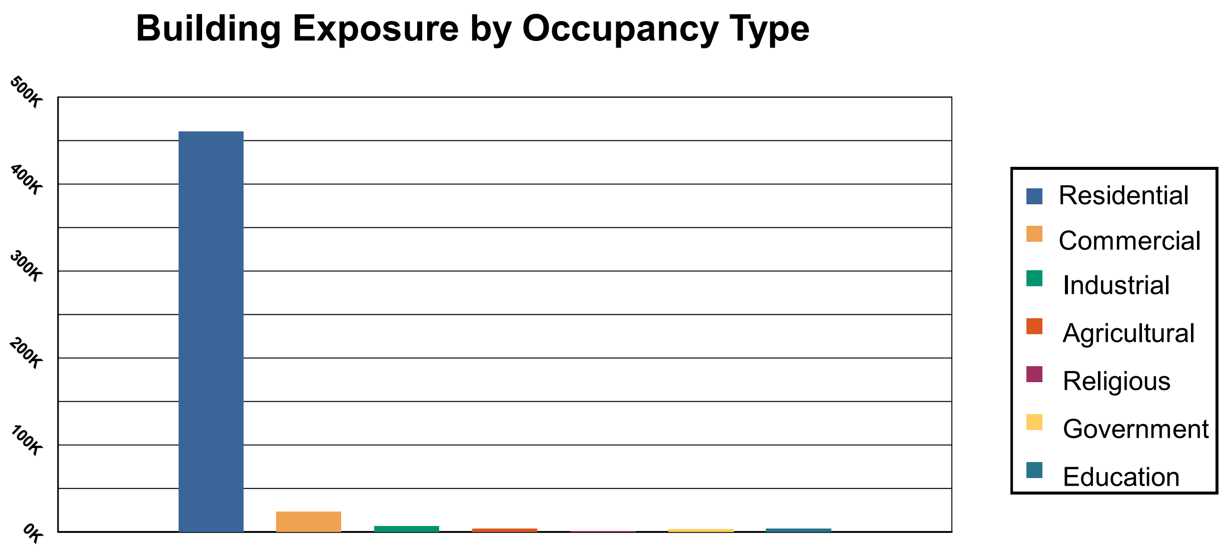

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General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

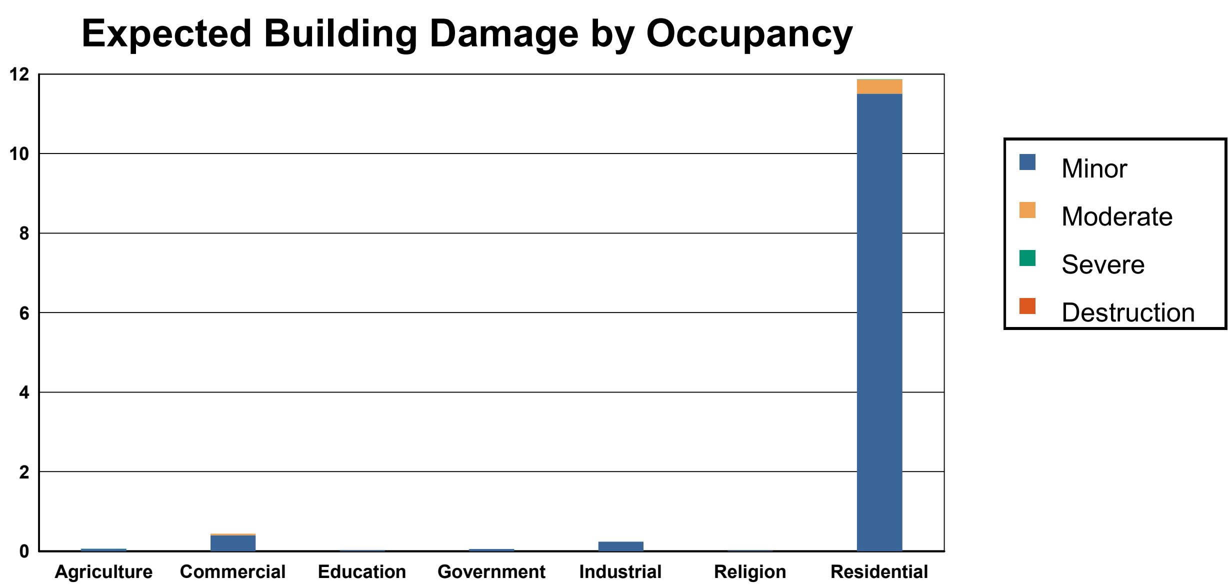


Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	6.94	99.17	0.05	0.78	0.00	0.04	0.00	0.01	0.00	0.00
Commercial	52.56	99.17	0.40	0.75	0.04	0.08	0.00	0.00	0.00	0.00
Education	2.98	99.18	0.02	0.81	0.00	0.01	0.00	0.00	0.00	0.00
Government	5.95	99.14	0.05	0.85	0.00	0.01	0.00	0.00	0.00	0.00
Industrial	26.76	99.11	0.24	0.87	0.00	0.02	0.00	0.00	0.00	0.00
Religion	1.99	99.34	0.01	0.65	0.00	0.01	0.00	0.00	0.00	0.00
Residential	1,378.13	99.15	11.51	0.83	0.35	0.03	0.01	0.00	0.00	0.00
Total	**1,475.30**		**12.28**		**0.40**		**0.01**		**0.00**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	12	98.91	0	1.08	0	0.01	0	0.00	0	0.00
Masonry	95	98.45	1	1.36	0	0.18	0	0.01	0	0.00
MH	8	99.98	0	0.01	0	0.01	0	0.00	0	0.00
Steel	51	99.09	0	0.83	0	0.07	0	0.00	0	0.00
Wood	1,311	99.23	10	0.76	0	0.01	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

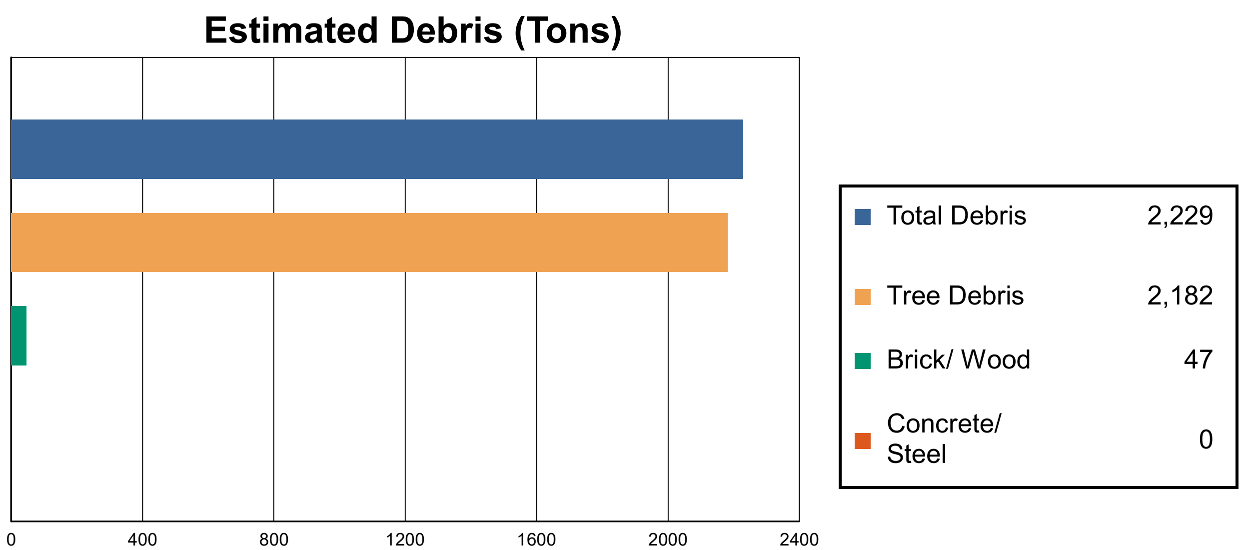
Thematic Map of Essential Facilities with greater than 50% moderate

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	6	0	0	6
Fire Stations	4	0	0	4
Police Stations	2	0	0	2
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

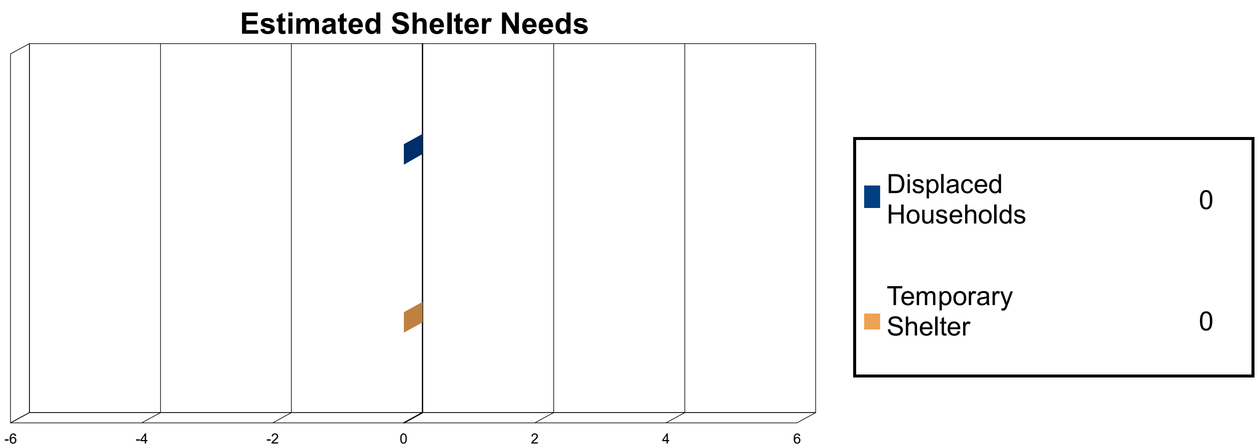


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2,229 tons of debris will be generated. Of the total amount, 2,080 tons (93%) is Other Tree Debris. Of the remaining 149 tons, Brick/Wood comprises 31% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 102 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 2,420) will seek temporary shelter in public shelters.

Economic Loss

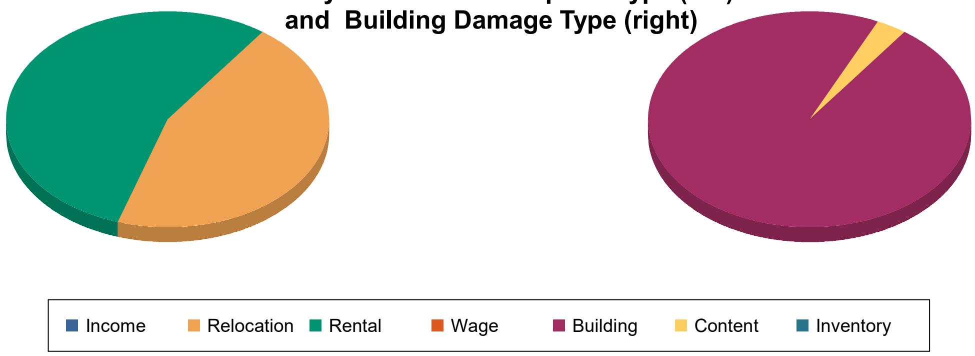
The total economic loss estimated for the hurricane is 0.8 million dollars, which represents 0.17 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 99% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

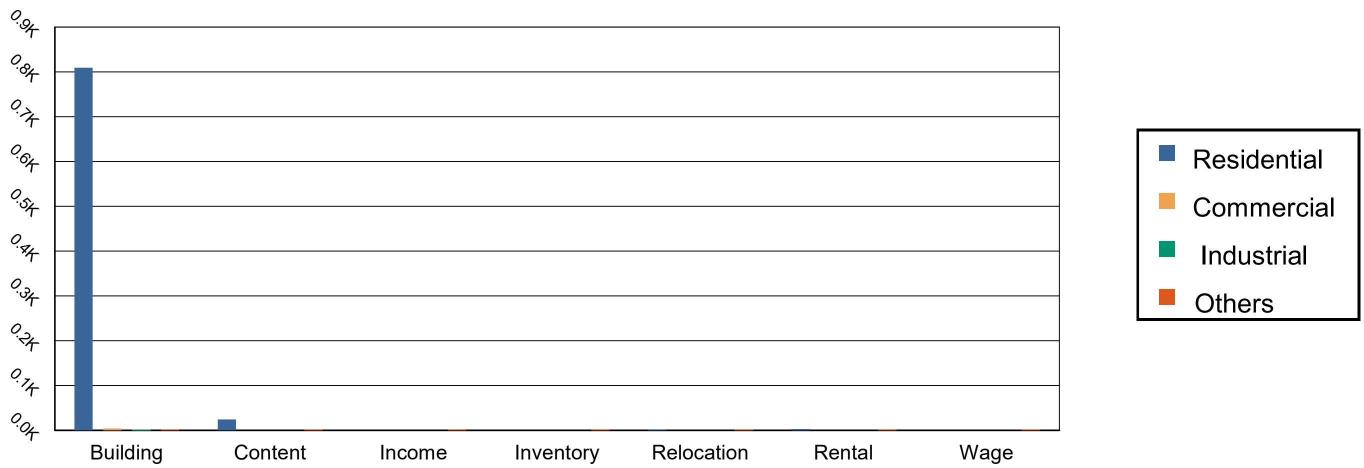


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	809.33	4.61	1.32	2.30	817.56
	Content	24.73	0.00	0.00	0.00	24.73
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**834.06**	**4.61**	**1.32**	**2.30**	**842.29**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	2.37	0.15	0.01	0.02	2.54
	Rental	3.09	0.00	0.00	0.00	3.09
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**5.45**	**0.15**	**0.01**	**0.02**	**5.62**

Total

Total	**839.51**	**4.76**	**1.32**	**2.32**	**847.91**

Appendix A: County Listing for the Region

Massachusetts
- Berkshire

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Massachusetts				
Berkshire	2,420	460,306	41,161	501,467
Total	**2,420**	**460,306**	**41,161**	**501,467**
Study Region Total	**2,420**	**460,306**	**41,161**	**501,467**

Hazus: Earthquake Global Risk Report

Region Name Richmond

Earthquake Scenario: Magnitude 5 Earthquake

Print Date: October 09, 2020

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 68.21 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 2,420 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 501 (millions of dollars). Approximately 93.00 % of the buildings (and 92.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 544 and 16 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 501 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 89% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 1 schools, 2 fire stations, 0 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 560.00 (millions of dollars). This inventory includes over 68.97 miles of highways, 13 bridges, 503.31 miles of pipes.

Table 1: Transportation System Lifeline Inventory

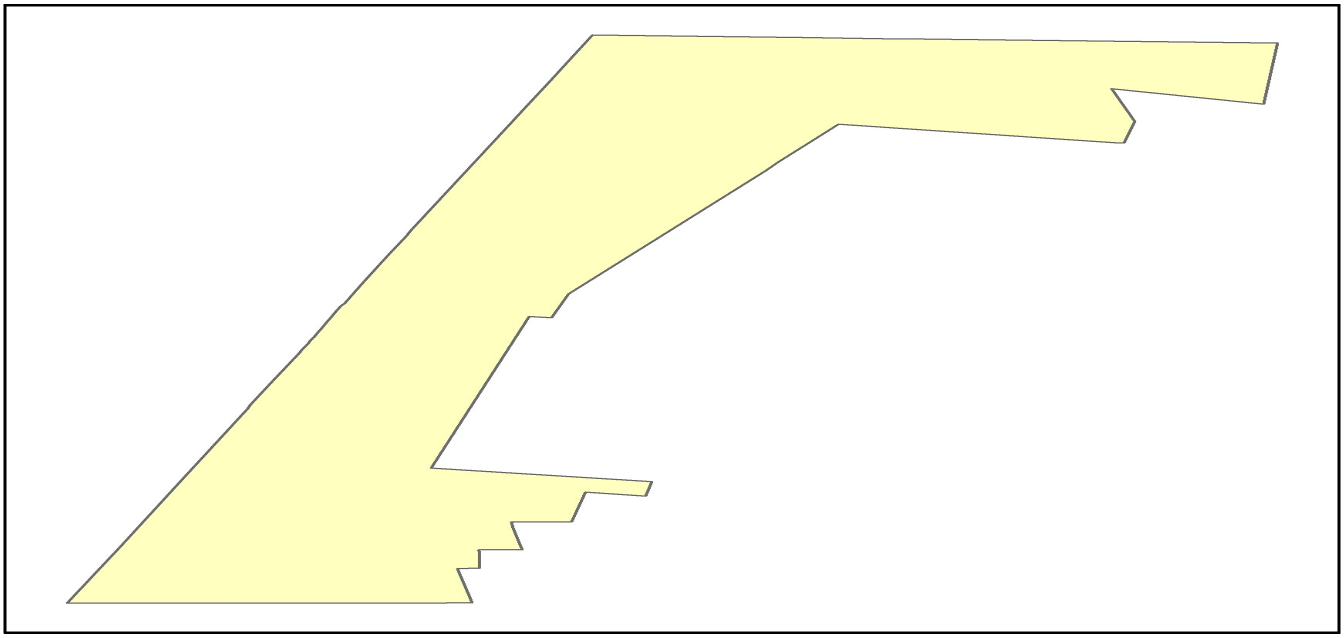
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	13	45.5647
	Segments	24	482.7185
	Tunnels	0	0.0000
		Subtotal	**528.2832**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	4	16.5740
	Tunnels	0	0.0000
		Subtotal	**16.5740**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	0	0.0000
	Runways	0	0.0000
		Subtotal	**0.0000**
		Total	**544.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.1027
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**8.1027**
Waste Water	Distribution Lines	NA	4.8616
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.8616**
Natural Gas	Distribution Lines	NA	3.2411
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**3.2411**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	0	0.0000
		Subtotal	**0.0000**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**16.20**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



Scenario Name	Magnitude 5 Earthquake
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-73.36
Latitude of Epicenter	42.38
Earthquake Magnitude	5.00
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 141 buildings will be at least moderately damaged. This is over 9.00 % of the buildings in the region. There are an estimated 3 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

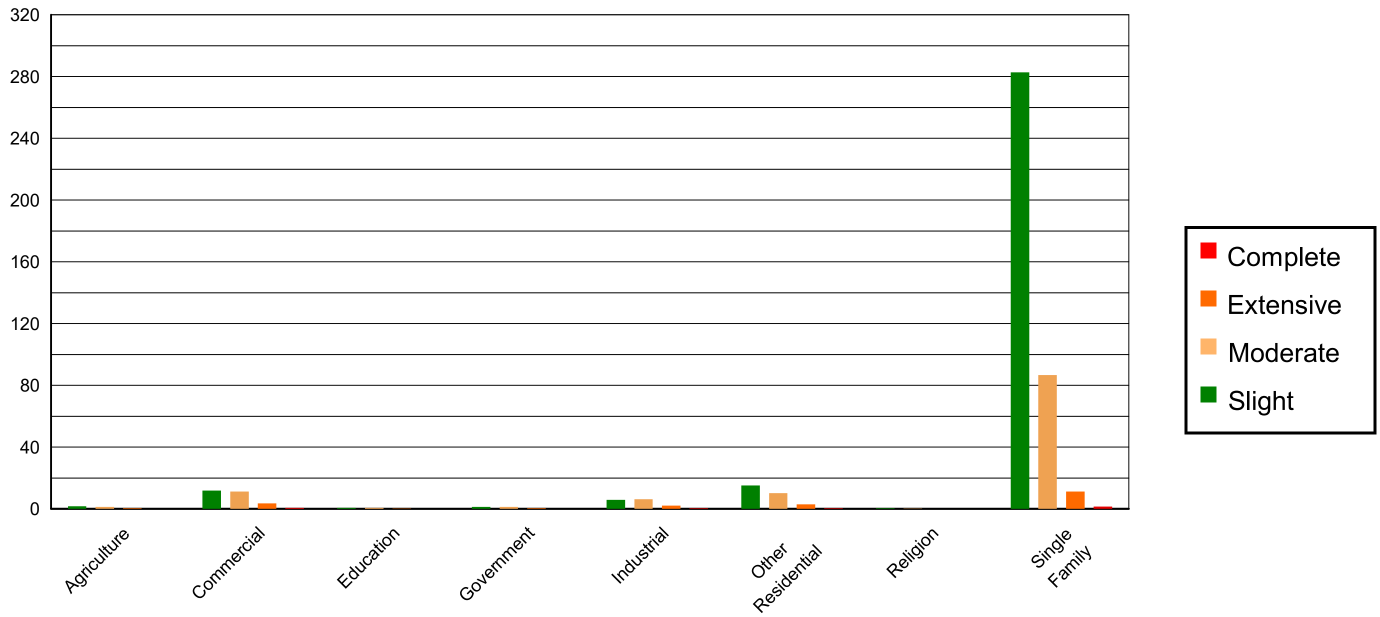


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	3.42	0.33	1.75	0.55	1.35	1.14	0.42	1.97	0.07	2.22
Commercial	25.59	2.49	11.81	3.70	11.29	9.58	3.66	17.37	0.66	21.05
Education	1.51	0.15	0.65	0.20	0.62	0.53	0.18	0.87	0.03	1.10
Government	2.86	0.28	1.27	0.40	1.36	1.15	0.44	2.08	0.08	2.45
Industrial	12.69	1.24	5.73	1.79	6.15	5.22	2.07	9.83	0.36	11.46
Other Residential	43.26	4.21	15.15	4.74	10.09	8.57	3.00	14.24	0.50	15.92
Religion	1.15	0.11	0.42	0.13	0.31	0.26	0.10	0.48	0.02	0.61
Single Family	935.94	91.18	282.80	88.49	86.66	73.55	11.19	53.17	1.41	45.19
Total	**1,026**		**320**		**118**		**21**		**3**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	948.24	92.38	284.14	88.91	80.99	68.74	7.70	36.56	0.41	13.26
Steel	22.31	2.17	10.25	3.21	12.56	10.66	4.21	19.99	0.75	23.95
Concrete	4.02	0.39	1.85	0.58	2.46	2.09	0.75	3.56	0.12	3.84
Precast	1.53	0.15	0.56	0.17	0.85	0.72	0.45	2.13	0.04	1.17
RM	7.64	0.74	1.83	0.57	2.26	1.91	0.91	4.33	0.03	0.96
URM	40.56	3.95	19.41	6.07	16.36	13.89	6.17	29.30	1.65	52.92
MH	2.13	0.21	1.55	0.48	2.34	1.98	0.87	4.12	0.12	3.89
Total	**1,026**		**320**		**118**		**21**		**3**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	1	1	0	0
EOCs	0	0	0	0
PoliceStations	0	0	0	0
FireStations	2	1	0	1

Transportation Lifeline Damage

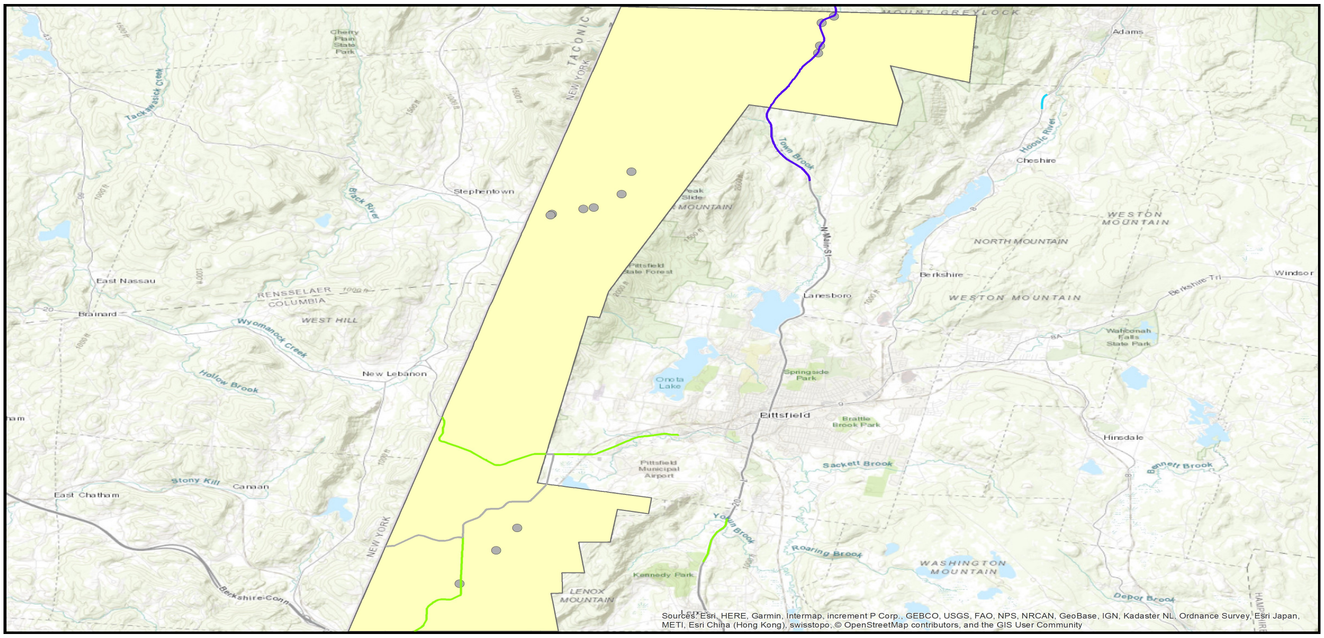


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	24	0	0	24	24
	Bridges	13	0	0	13	13
	Tunnels	0	0	0	0	0
Railways	Segments	4	0	0	4	4
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	252	27	7
Waste Water	151	14	3
Natural Gas	101	5	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	1,051	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

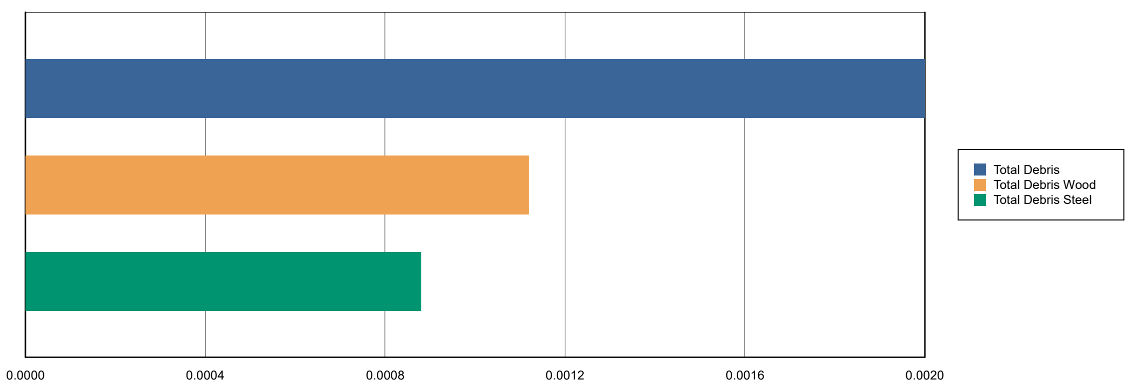
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 56.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 80 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



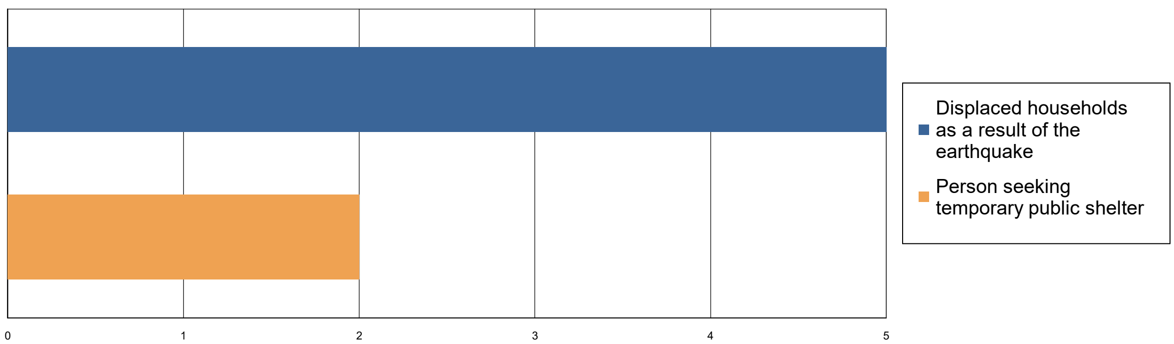
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	80 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 5 households to be displaced due to the earthquake. Of these, 2 people (out of a total population of 2,420) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
5	2

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.06	0.01	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.05	0.01	0.00	0.00
	Other-Residential	0.45	0.09	0.01	0.02
	Single Family	1.07	0.15	0.01	0.03
	Total	**2**	**0**	**0**	**0**
2 PM	Commercial	3.29	0.66	0.08	0.15
	Commuting	0.00	0.00	0.00	0.00
	Educational	1.01	0.21	0.03	0.05
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.33	0.07	0.01	0.02
	Other-Residential	0.10	0.02	0.00	0.00
	Single Family	0.24	0.03	0.00	0.01
	Total	**5**	**1**	**0**	**0**
5 PM	Commercial	2.28	0.46	0.05	0.10
	Commuting	0.00	0.01	0.01	0.00
	Educational	0.09	0.02	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.21	0.04	0.00	0.01
	Other-Residential	0.18	0.04	0.00	0.01
	Single Family	0.42	0.06	0.01	0.01
	Total	**3**	**1**	**0**	**0**

Economic Loss

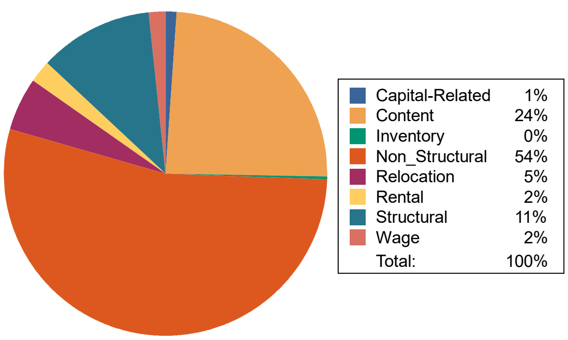
The total economic loss estimated for the earthquake is 23.05 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 22.55 (millions of dollars); 10 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 81 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

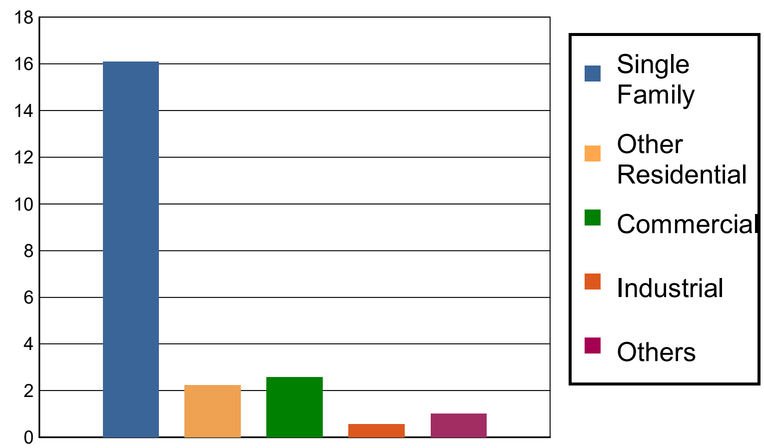


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0666	0.2573	0.0135	0.0521	0.3895
	Capital-Related	0.0000	0.0284	0.1918	0.0076	0.0057	0.2335
	Rental	0.1962	0.1772	0.1432	0.0035	0.0192	0.5393
	Relocation	0.6918	0.1031	0.2252	0.0307	0.1110	1.1618
	Subtotal	**0.8880**	**0.3753**	**0.8175**	**0.0553**	**0.1880**	**2.3241**
Capital Stock Losses							
	Structural	1.6184	0.2109	0.4115	0.0825	0.2050	2.5283
	Non_Structural	9.4177	1.2645	0.8434	0.2645	0.3895	12.1796
	Content	4.1885	0.3877	0.4923	0.1534	0.2402	5.4621
	Inventory	0.0000	0.0000	0.0222	0.0280	0.0095	0.0597
	Subtotal	**15.2246**	**1.8631**	**1.7694**	**0.5284**	**0.8442**	**20.2297**
	Total	**16.11**	**2.24**	**2.59**	**0.58**	**1.03**	**22.55**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	482.7185	0.0000	0.00
	Bridges	45.5647	0.2935	0.64
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**528.2832**	**0.2935**	
Railways	Segments	16.5740	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**16.5740**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**544.86**	**0.29**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	8.1027	0.1228	1.52
	Subtotal	**8.1027**	**0.1228**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	4.8616	0.0617	1.27
	Subtotal	**4.8616**	**0.0617**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	3.2411	0.0211	0.65
	Subtotal	**3.2411**	**0.0211**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**16.21**	**0.21**	

Appendix A: County Listing for the Region

Berkshire,MA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Massachusetts					
	Berkshire	2,420	460	41	501
Total Region		**2,420**	**460**	**41**	**501**

Hazus: Earthquake Global Risk Report

Region Name Richmond

Earthquake Scenario: Magnitude 7 Earthquake

Print Date: October 09, 2020

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General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 68.21 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 2,420 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 501 (millions of dollars). Approximately 93.00 % of the buildings (and 92.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 550 and 245 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 501 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 89% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 2 schools, 4 fire stations, 2 police stations and 6 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 795.00 (millions of dollars). This inventory includes over 68.97 miles of highways, 12 bridges, 439.31 miles of pipes.

Table 1: Transportation System Lifeline Inventory

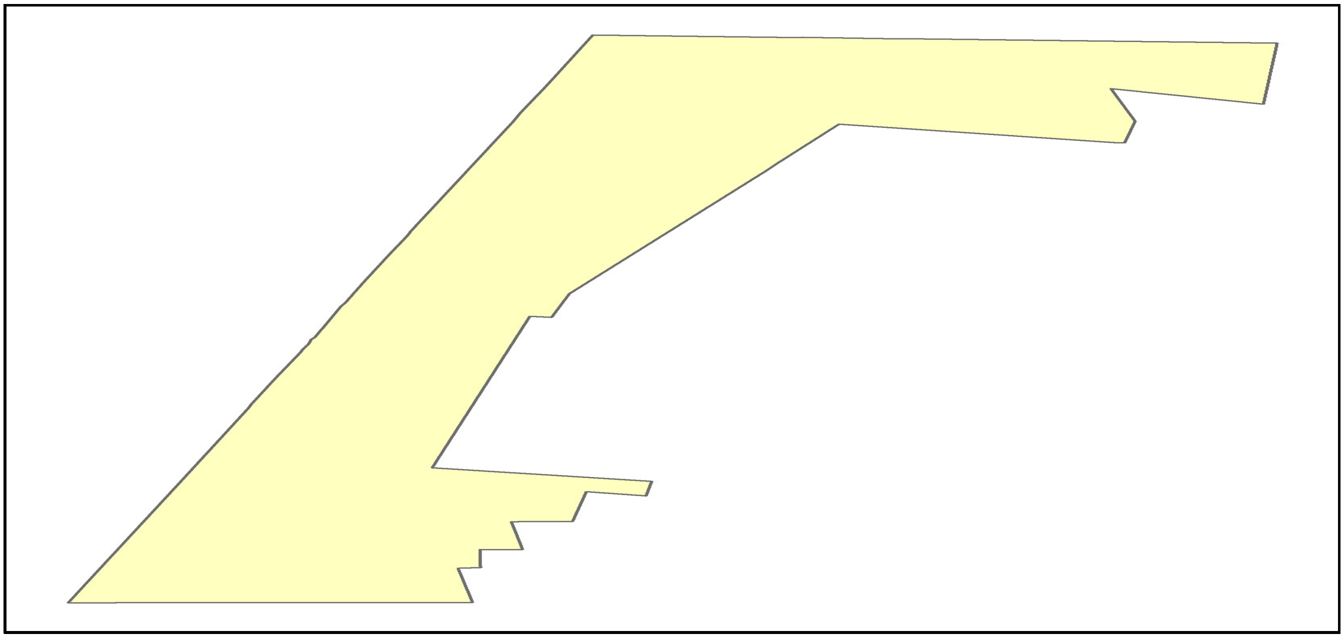
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	12	9.9569
	Segments	24	482.7185
	Tunnels	0	0.0000
		Subtotal	**492.6754**
Railways	Bridges	5	26.8035
	Facilities	0	0.0000
	Segments	5	30.8883
	Tunnels	0	0.0000
		Subtotal	**57.6918**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	0	0.0000
	Runways	0	0.0000
		Subtotal	**0.0000**
		Total	**550.40**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.1027
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**8.1027**
Waste Water	Distribution Lines	NA	4.8616
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.8616**
Natural Gas	Distribution Lines	NA	3.2411
	Facilities	0	0.0000
	Pipelines	4	43.1414
		Subtotal	**46.3825**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	1	186.5528
		Subtotal	**186.5528**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**245.90**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



Scenario Name	Magnitude 7 Earthquake
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-73.37
Latitude of Epicenter	42.37
Earthquake Magnitude	7.00
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 899 buildings will be at least moderately damaged. This is over 60.00 % of the buildings in the region. There are an estimated 189 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

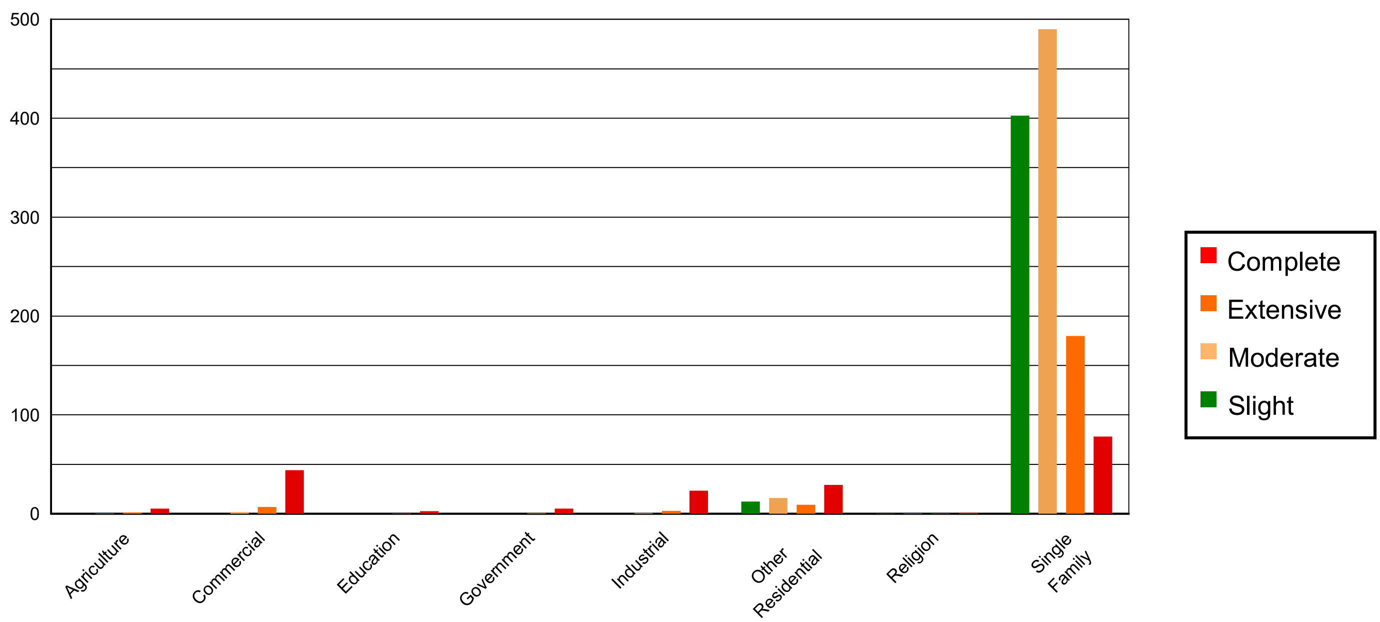


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0.00	0.00	0.03	0.01	0.34	0.07	1.25	0.62	5.37	2.84
Commercial	0.04	0.02	0.16	0.04	1.72	0.34	6.92	3.44	44.17	23.36
Education	0.00	0.00	0.01	0.00	0.09	0.02	0.38	0.19	2.51	1.33
Government	0.00	0.00	0.01	0.00	0.14	0.03	0.64	0.32	5.21	2.75
Industrial	0.02	0.01	0.06	0.01	0.63	0.12	2.97	1.48	23.33	12.34
Other Residential	5.18	2.99	12.49	3.01	16.04	3.15	9.03	4.48	29.27	15.48
Religion	0.10	0.06	0.23	0.06	0.32	0.06	0.24	0.12	1.11	0.59
Single Family	167.56	96.91	402.55	96.87	489.93	96.22	179.87	89.35	78.09	41.30
Total	**173**		**416**		**509**		**201**		**189**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	172.78	99.93	414.94	99.85	504.29	99.04	183.33	91.07	46.14	24.40
Steel	0.02	0.01	0.04	0.01	0.50	0.10	4.40	2.19	45.12	23.87
Concrete	0.00	0.00	0.01	0.00	0.11	0.02	0.75	0.37	8.32	4.40
Precast	0.00	0.00	0.00	0.00	0.06	0.01	0.19	0.10	3.17	1.68
RM	0.02	0.01	0.04	0.01	0.44	0.09	1.26	0.63	10.90	5.77
URM	0.06	0.04	0.50	0.12	3.65	0.72	10.59	5.26	69.34	36.68
MH	0.00	0.00	0.01	0.00	0.15	0.03	0.77	0.38	6.07	3.21
Total	**173**		**416**		**509**		**201**		**189**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	2	2	2	0
EOCs	6	6	3	0
PoliceStations	2	2	2	0
FireStations	4	4	2	0

Transportation Lifeline Damage

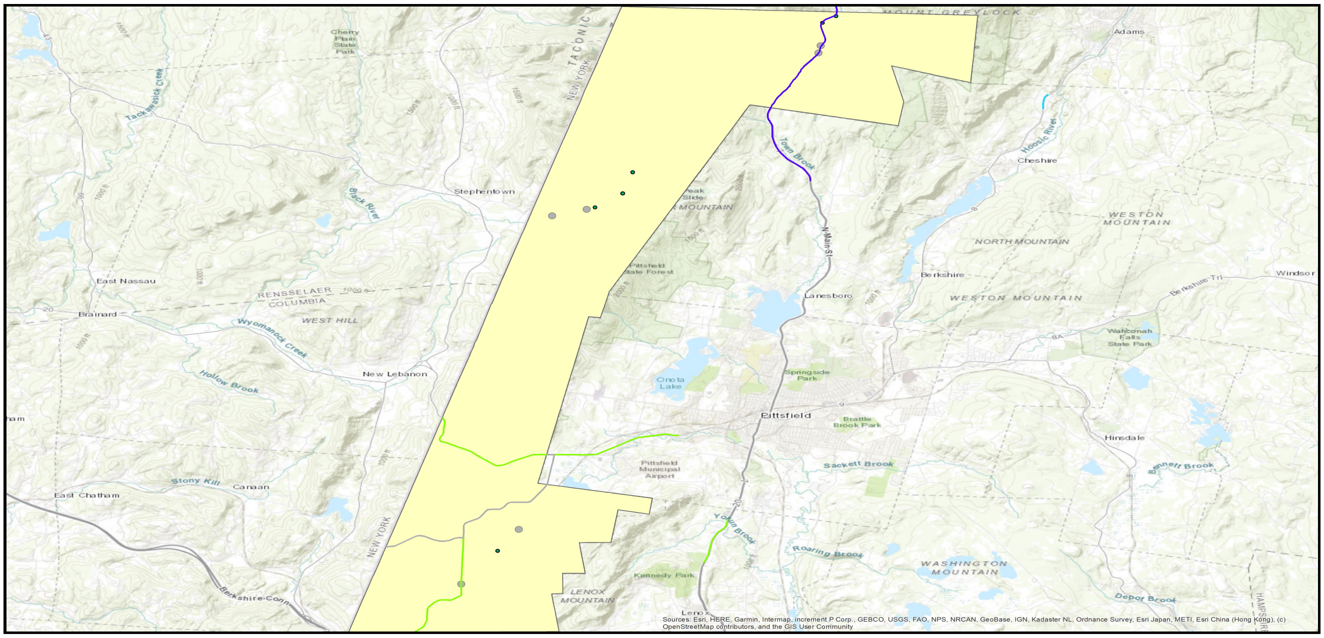


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	24	0	0	24	24
	Bridges	12	3	2	9	10
	Tunnels	0	0	0	0	0
Railways	Segments	5	0	0	5	5
	Bridges	5	5	4	0	1
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	1	0	0	1
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	252	710	177
Waste Water	151	356	89
Natural Gas	37	16	4
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	1,051	988	906	1	0	0
Electric Power		972	794	477	131	1

Induced Earthquake Damage

Fire Following Earthquake

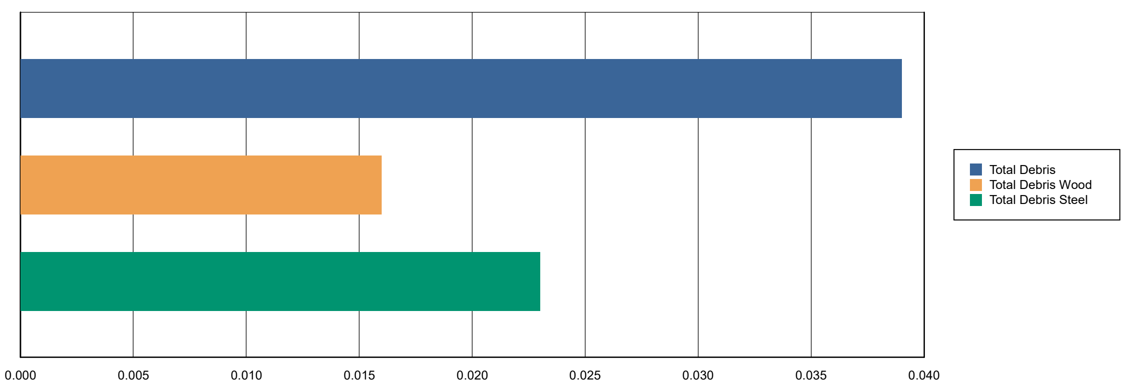
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 39,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 41.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 1,560 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



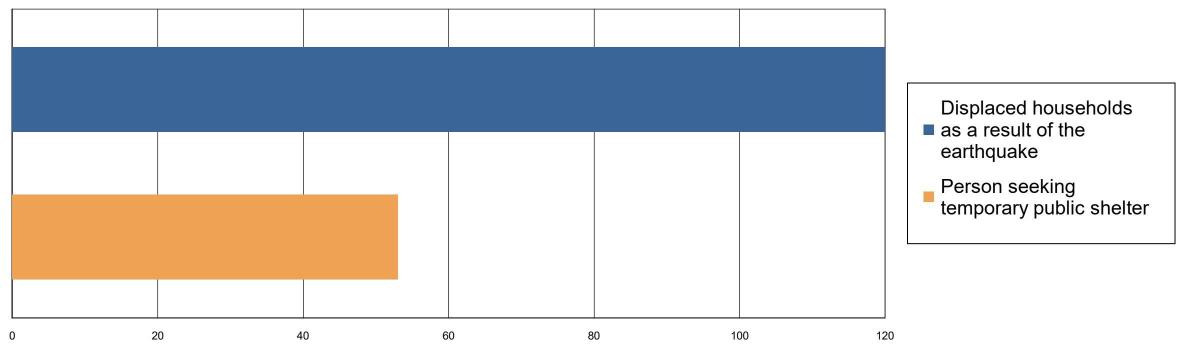
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.02	0.02	0.04	1,560 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 120 households to be displaced due to the earthquake. Of these, 53 people (out of a total population of 2,420) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
120	53

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	1.67	0.53	0.08	0.16
	Commuting	0.00	0.01	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	1.29	0.41	0.07	0.13
	Other-Residential	11.57	3.69	0.60	1.19
	Single Family	18.10	4.52	0.57	1.11
	Total	**33**	**9**	**1**	**3**
2 PM	Commercial	96.69	30.54	4.84	9.46
	Commuting	0.01	0.05	0.04	0.01
	Educational	31.20	10.14	1.70	3.31
	Hotels	0.00	0.00	0.00	0.00
	Industrial	9.55	3.07	0.50	0.98
	Other-Residential	2.61	0.84	0.14	0.27
	Single Family	4.12	1.06	0.14	0.26
	Total	**144**	**46**	**7**	**14**
5 PM	Commercial	67.55	21.35	3.42	6.57
	Commuting	0.22	1.06	0.87	0.21
	Educational	2.92	0.95	0.16	0.31
	Hotels	0.00	0.00	0.00	0.00
	Industrial	5.97	1.92	0.31	0.61
	Other-Residential	4.60	1.48	0.25	0.47
	Single Family	7.26	1.86	0.25	0.46
	Total	**89**	**29**	**5**	**9**

Economic Loss

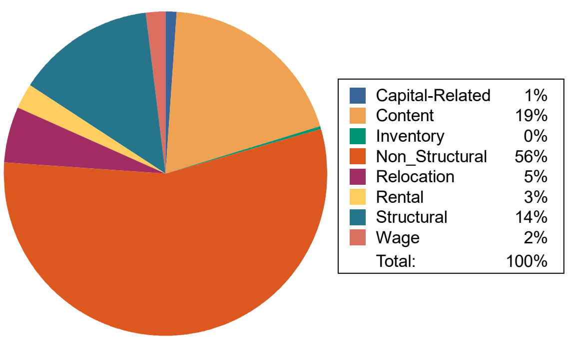
The total economic loss estimated for the earthquake is 279.81 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 202.75 (millions of dollars); 11 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 72 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

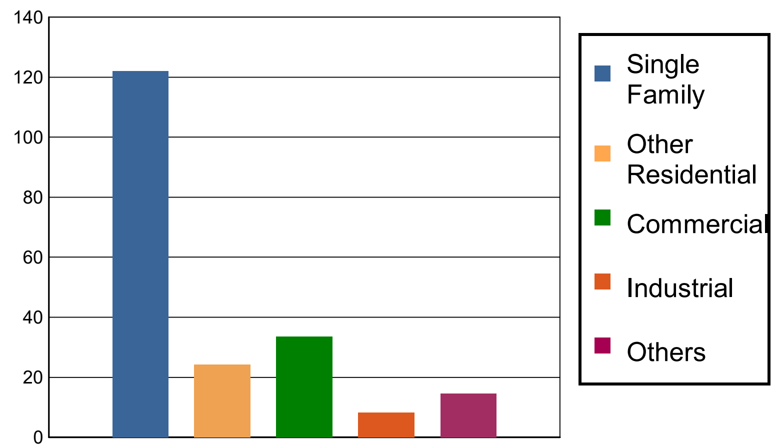


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.7081	2.4514	0.1614	0.4730	3.7939
	Capital-Related	0.0000	0.3024	1.9403	0.0902	0.0840	2.4169
	Rental	2.1162	1.8327	1.1377	0.0294	0.1674	5.2834
	Relocation	7.4276	0.9087	1.6292	0.1849	0.9466	11.0970
	Subtotal	**9.5438**	**3.7519**	**7.1586**	**0.4659**	**1.6710**	**22.5912**
Capital Stock Losses							
	Structural	16.8694	2.4331	5.0888	0.9532	2.7116	28.0561
	Non_Structural	73.0342	14.7339	13.9804	4.3064	6.5662	112.6211
	Content	22.5842	3.3769	7.0155	2.2445	3.3948	38.6159
	Inventory	0.0000	0.0000	0.3221	0.4117	0.1350	0.8688
	Subtotal	**112.4878**	**20.5439**	**26.4068**	**7.9158**	**12.8076**	**180.1619**
	Total	**122.03**	**24.30**	**33.57**	**8.38**	**14.48**	**202.75**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	482.7185	0.0000	0.00
	Bridges	9.9569	2.8220	28.34
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**492.6754**	**2.8220**	
Railways	Segments	30.8883	0.0000	0.00
	Bridges	26.8035	14.5638	54.34
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**57.6918**	**14.5638**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**550.37**	**17.39**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	8.1027	3.1933	39.41
	Subtotal	**8.1027**	**3.1933**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	4.8616	1.6041	33.00
	Subtotal	**4.8616**	**1.6041**	
Natural Gas	Pipelines	43.1414	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	3.2411	0.5495	16.95
	Subtotal	**46.3825**	**0.5495**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	186.5528	54.3251	29.12
	Subtotal	**186.5528**	**54.3251**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**245.90**	**59.67**	

Appendix A: County Listing for the Region

Berkshire,MA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Massachusetts					
	Berkshire	2,420	460	41	501
Total Region		**2,420**	**460**	**41**	**501**

Census Block Number	Vulnerable Populations	Percent in 100 Year Flood Plain	Total Area (acres)	Area in 100 Year Flood Plain (acres)
250039351004044	Elderly	63.7	14.32	9.12
250039351004007	Elderly	19.1	131.51	25.07
250039351003014	Elderly	15.0	400.08	60.17
250039351003023	Elderly	11.0	483.16	53.21
250039351004022	Elderly	10.9	309.54	33.62
250039351004039	Elderly	10.6	10.12	1.08
250039351003057	Elderly	9.8	15.57	1.52
250039351004008	Elderly	9.6	167.87	16.15
250039351003033	Elderly	9.4	22.02	2.08
250039351003044	Elderly	9.0	79.73	7.20
250039351003043	Elderly	8.4	82.78	6.98
250039351004036	Elderly	4.5	305.85	13.61
250039351004026	Elderly	1.5	799.15	11.81
250039351003003	Elderly	1.2	23.92	0.29
250039351003061	Elderly	0.9	3.19	0.03
250039351003050	Elderly	0.8	541.42	4.54
250039351003030	Elderly	0.4	230.55	0.97
250039351004014	Elderly	0.2	131.06	0.24
250039351004029	Elderly	0.1	61.31	0.07
250039351004024	Minor	37.3	45.85	17.12
250039351003017	Minor	15.3	254.51	38.91
250039351003009	Minor	12.1	5.58	0.67
250039351004028	Minor	4.2	247.47	10.29
250039351003000	Minor	1.5	611.93	9.04

Appendix C

Workshop Materials

Stakeholders Invited to Attend Richmond's Community Resilience Building Workshop

Attended	Name	Title	Affiliation
Core Team			
X	Danielle Fillio	Town Administrator	Administration
X	Peter Beckwith	Superintendent	Highway Department
X	John Hanson	Chair	Planning Board
X	Steve Traver	Fire Chief	Fire Department
X	Shepley Evans	Conservation Agent	Conservation Commission
Local			
X	Alan Hanson	Selectboard Chair	Agricultural Commission
	William E. Martin	Chair	Board of Appeals
X	Ronald Veillette	Chair	Conservation Commission
X	Pat Seckler	Member	Conservation Commission
	Bob Dahlen	Member	Conservation Commission
X	Harley Keisch	Member	Conservation Commission
	Ed Fechner	Co-Chair	Cable Advisory Commission
	Pat Callahan	Chair	Municipal Building Committee
	Cathy Gamberoni	Chairperson	Cultural Commission
	William Bullett	Police Chief	Police Department
	John Olander	Health Agent	Board of Health
	Tony Segal	Chairperson	Board of Health
	Adam Weinberg	Warden	Tree Warden
	Roger Manzolini	Elected Board Member	Board of Selectmen
X	Neal Pilson	Elected Board Member	Board of Selectmen
	Phyllis LeBeau	Director	Council on Aging
	Peter Cohen	Chairperson	Council on Aging
	Gloria Morse	Chairperson	Historical District Commission
X	Jeff Konowitch	Chairperson	Recreation Committee
X	Robert Gniadek	Chairperson	Finance Committee
	Kristin Smith	Librarian	Library
	John Herrera	Veteran's Agent	Veterans Affairs
X	Dewey Wyatt	Chairperson	School Committee
X	Ken Kelly	President	Richmond Pond Association
X	Sue Benner	Officer	Richmond Pond Association
X	John Keenum	President	Richmond Land Trust
	Peter Dillion	Superintendent of Schools	Richmond Consolidated
	Jill Pompi	Principal	Richmond Consolidated
	George Rudd	Property Manager	Lakeside Christian Camp
	Jim McGrath	Park, Open Space Natural Resource Program Coordinator	City of Pittsfield
X	Carl Foote	Officer	Richmond Pond Association
X	Doreen Donovan	Officer	Richmond Pond Association
X	Valeri Reynolds	Resident	Richmond Pond Association

State and Regional			
X	Adam Hinds	State Senator	Massachusetts Senate
	Alfred Enchill	Sen. Hinds Staff	Massachusetts Senate
X	Chris Horton	Superintendent	Berkshire County Mosquito Control
X	Michael Jastremski	Watershed Conservation Director	Housatonic Valley Association
X	Alison Dixon	Manager	Housatonic Valley Association
	Smitty Pignatelli	State Representative (4th Berkshire)	Massachusetts House of Representatives
	Ed Markey	Senator	Federal Representatives
	Elizabeth Warren	Senator	Federal Representatives
	Richard Neal	Congressperson, 1st District	U.S. House of Representatives
	Charlie Baker	Governor	Office of the Governor
	Karyn Polito	Lt. Governor	Office of the Governor
	Joseph Ferreira	Governor's Councilor	MA Governor's Council
X	Carrieanne Petrik	MVP Regional Coordinator	EEA
	Jeff Zukowski	Hazard Mitigation Plan Contact	MEMA
	Mark Stinson	General Wetlands	MassDEP
	Lt. David Buell	State Police Lieutenant	State Police - Lee Barracks
			DCR
X	Francesca Hemming	District 1	MassDOT
			U.S. Environmental Protection Agency
			Army Corps of Engineers
			MassWildlife
	Jenny Hansell	President	Berkshire Natural Resources Council
	Thomas Matuszko	Executive Director	Berkshire Regional Planning Commission
	Rick Prew	Field & Operation Manager	Mass Audubon
X	Becky Cushing	Director	Mass Audubon (West)
	Kate Buttolph		Mass Audubon
	Diane Cote	Program Devt & Walks Coordinator	Upper Housatonic Valley National Heritage Area
			New England Farm Workers' Council
Neighboring Communities			
	Chris Ketchen	Chief Administrative Officer	Lenox, MA
X	John Herrera	Veterans' Services Officer/Director	Pittsfield, MA

	Linda Tyer	Mayor	Pittsfield, MA
	Marie Ryan	Town Administrator	West Stockbridge, MA
	Michael Canales	Town Administrator	Stockbridge, MA
	Sherman Derby	Chairman BOS	Hancock, MA
	Robert Lagonia	Town Supervisor	Austerlitz, NY
	Brenda Adams	Town Supervisor	Canaan, NY
X	Steve Powers	Chair, New Lebanon Climate Smart Communities Task Force	New Lebanon, NY

TOWN OF RICHMOND
Hazard Mitigation and Municipal Vulnerability Preparedness (HM-MVP) Plan

Community Resilience Building (CRB) Workshop Series
9:00 -11:00AM

Dec 15th | Infrastructure Assets
Dec 16th | Community Resilience
Dec 17th | Natural Resources

The workshop series will be held through the online meeting platform Zoom. We are encouraging all participants to join the workshop series through your internet browser. Alternatively, you may opt to call in via phone for audio and use an internet browser for visuals. We do not recommend using only your phone for audio. By joining online, you will be able to view the risk matrix that we will be creating as a group in real-time.

We will join the meeting fifteen minutes early to try to help resolve any technology issues. Please email Joanna Nadeau, nadeau.joanna@wseinc.com, if you have barriers to participation or concerns. We have step by step instructions on the following page on how to join a Zoom meeting.

AGENDA

Welcome and Introductions	10 minutes
MVP Program Overview	10 minutes
Overview of Hazards and Climate Change Data	15 minutes
Risk Matrix Confirmation	15 minutes
Climate Adaptation Strategies	10 minutes
Action Items	40 minutes
Prioritization	15 minutes
Wrap Up and Next Steps	5 minutes

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ZOOM INSTRUCTIONS

Option 1 – Join with Direct Link

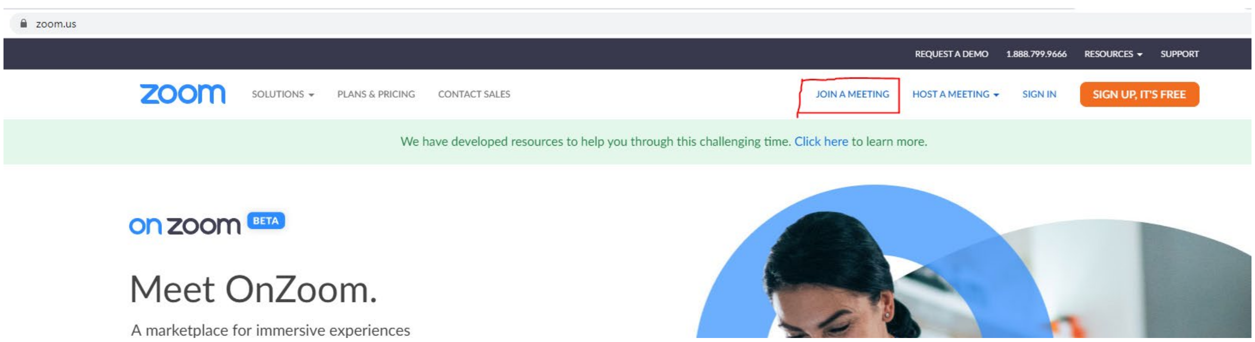
To join via computer or smartphone:

- Click on the link: https://us02web.zoom.us/j/89952189113?pwd=NTFWcUhnWW5keXc2UitqcUd6TEUzZz09
- Follow on-screen instructions
- Enter your full name under participant

Option 2 – Join on the Website or App

To join via computer or smartphone:

- Type "Zoom.us" into a web browser
- Click "join a meeting" (marked by a red box below)



- Enter the Meeting ID: 899 5218 9113
- Enter Passcode: Dec-MVP
- Follow on-screen instructions
- Enter your full name under participant

Option 3 – Join Online for Visuals and with Phone for Audio

- Join visually using the methods described in Option 1 and Option 2 above
- Call in using phone by dialing: 1-929-205-6099
- Enter the Meeting ID: 899 5218 9113
- Enter passcode: 7964317

Photo: Town of Richmond Facebook Page

TOWN OF RICHMOND

Community Resilience Building (CRB) Workshop Series

December 15th - Infrastructure | December 16th | December 17th

Weston & Sampson

WELCOME FROM W&S

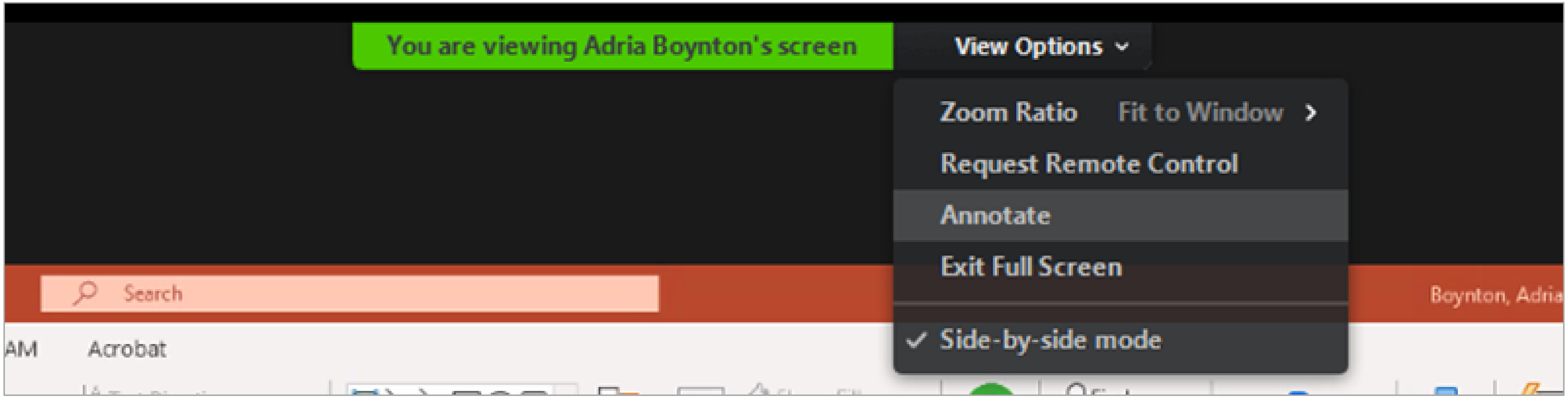
Joanna Nadeau
Resiliency Planner

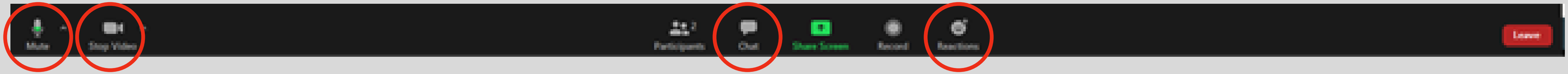
Steve Roy
Senior Technical Leader

Amanda Kohn
Sustainability Project Planner

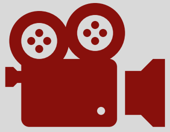
ZOOM LOGISTICS

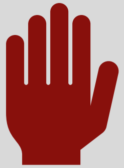
This webinar is being recorded






Mute


Video


Raise Your Hand


Comment in the Chat


Reactions

WEBINAR OUTLINE

PRESENTATION:

- Overview of the MVP and HMP Programs
- Historic and Future Climate Change Impacts

DISCUSSION:

- Pre-Selected Hazards
- Pre-Selected Features
- Identify and Prioritize Action Items

Meeting materials shared:

PDF of presentation
Agenda (for reference)

for **comment:**
Risk Matrix
Hazard Map
Critical facilities list

Municipal Vulnerability Preparedness (MVP) Program

Community Resilience Building (CRB) Process:

89% participation

312 communities

Action Grant Projects:

FY 18: **37**

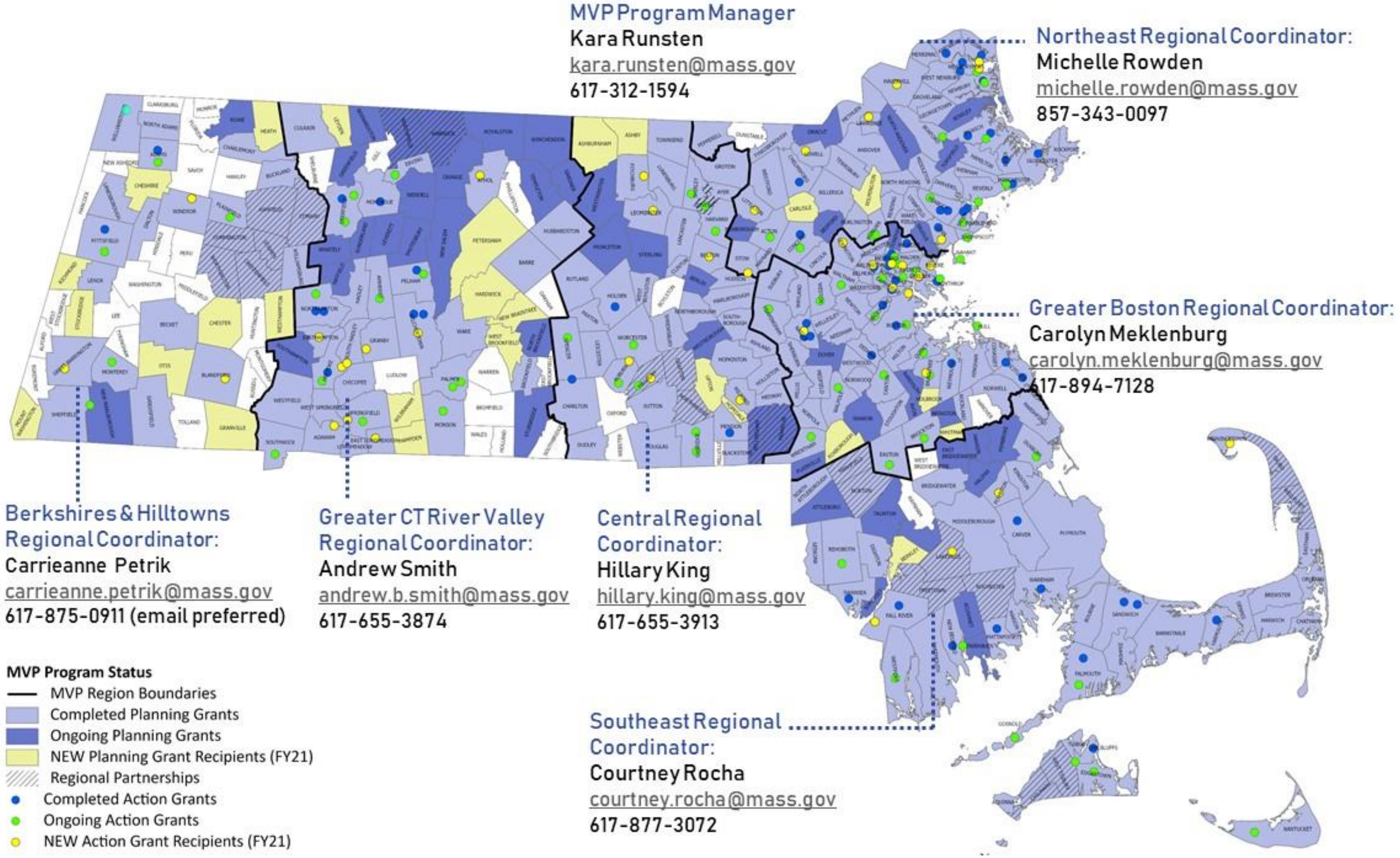
FY 19: **36**

FY20: **53**

FY21: **41**

Total Awards:

$44M to date



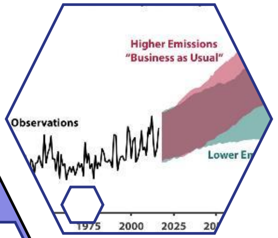
MVP Website: www.mass.gov/mvp
Berkshire/Hilltowns Regional Coordinator: carrieanne.petrik@mass.gov

MVP CORE PRINCIPLES

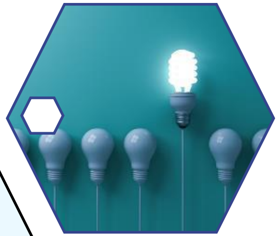
Multiple benefits to a broad cross-section of the community

Community outreach & engagement

Proactive solutions supported by climate data



Prioritize Nature-based Solutions



Address identified climate change impacts

Focus on Environmental Justice (EJ) Populations

Think outside the box (& borders)

Project monitoring & maintenance for continued success

Knowledge Sharing (successes & failures)

MVP PROGRAM

1. MVP Planning Grant

- Define climate hazards
- Identify community vulnerabilities and strengths
- Develop and prioritize adaptation actions
- Receive MVP designation

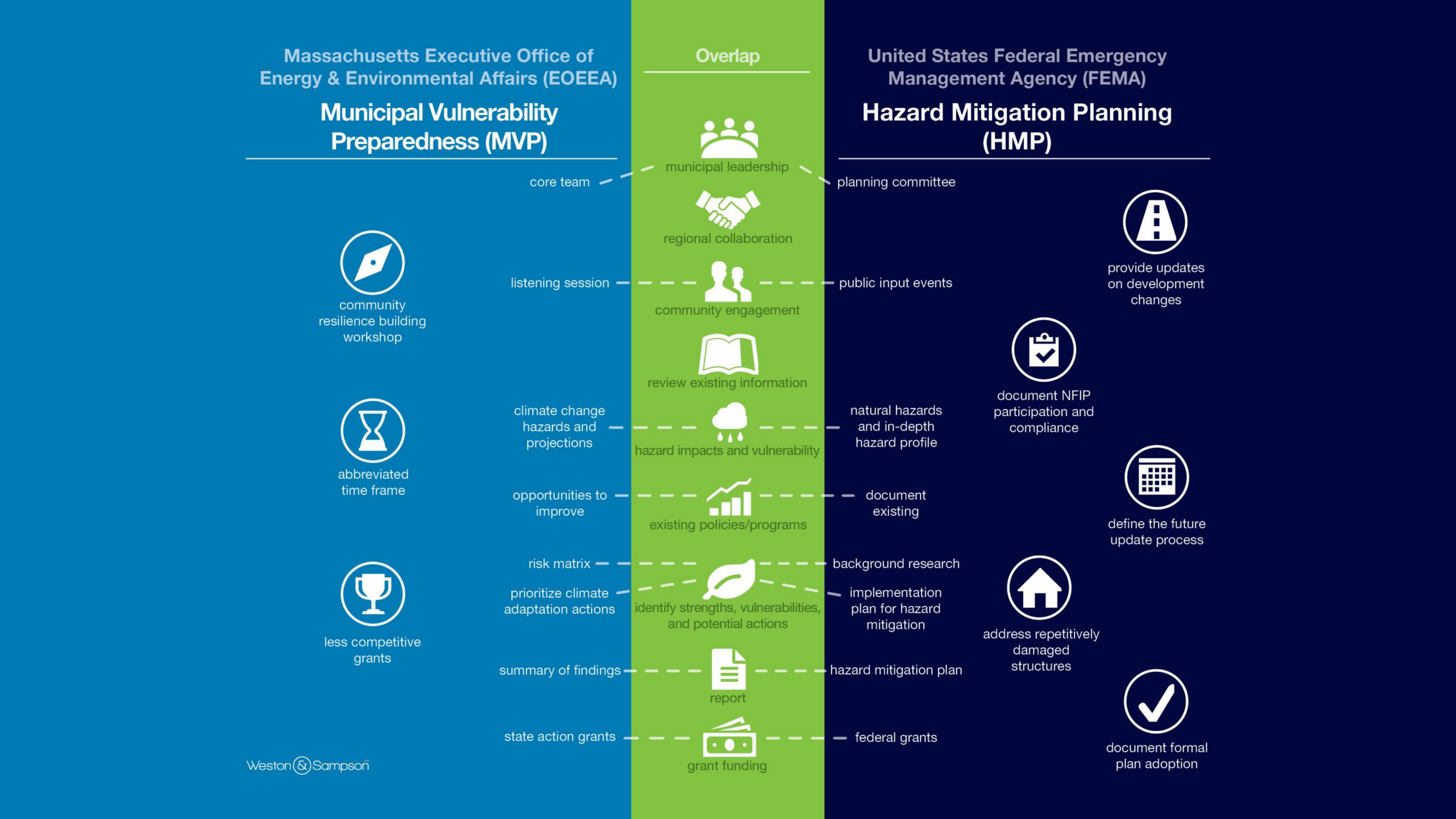
** We're also updating Richmond's Hazard Mitigation Plan!*

2. MVP Action Grant

- Implement priority adaptation actions identified during the planning process

What Can the MVP Action Grant Fund?

- Assessments
- Outreach & Education
- Management Measures
- Redesign & Retrofit
- Nature-Based Solutions
- Ecological Restoration
- Water Quality & Infiltration
- Flood Protection
- Extreme Heat Mitigation
- Drought Mitigation
- Energy Resilience
- Chemical Safety
- Land Acquisition
- Housing
- Mosquito Control


Massachusetts Executive Office of Energy & Environmental Affairs (EOEEA)
Municipal Vulnerability Preparedness (MVP)
Overlap
United States Federal Emergency Management Agency (FEMA)
Hazard Mitigation Planning (HMP)
core team
municipal leadership
planning committee
regional collaboration
community resilience building workshop
listening session
community engagement
public input events
provide updates on development changes
review existing information
document NFIP participation and compliance
climate change hazards and projections
hazard impacts and vulnerability
natural hazards and in-depth hazard profile
abbreviated time frame
opportunities to improve
existing policies/programs
document existing
define the future update process
risk matrix
background research
prioritize climate adaptation actions
identify strengths, vulnerabilities, and potential actions
implementation plan for hazard mitigation
less competitive grants
address repetitively damaged structures
summary of findings
report
hazard mitigation plan
state action grants
grant funding
federal grants
document formal plan adoption
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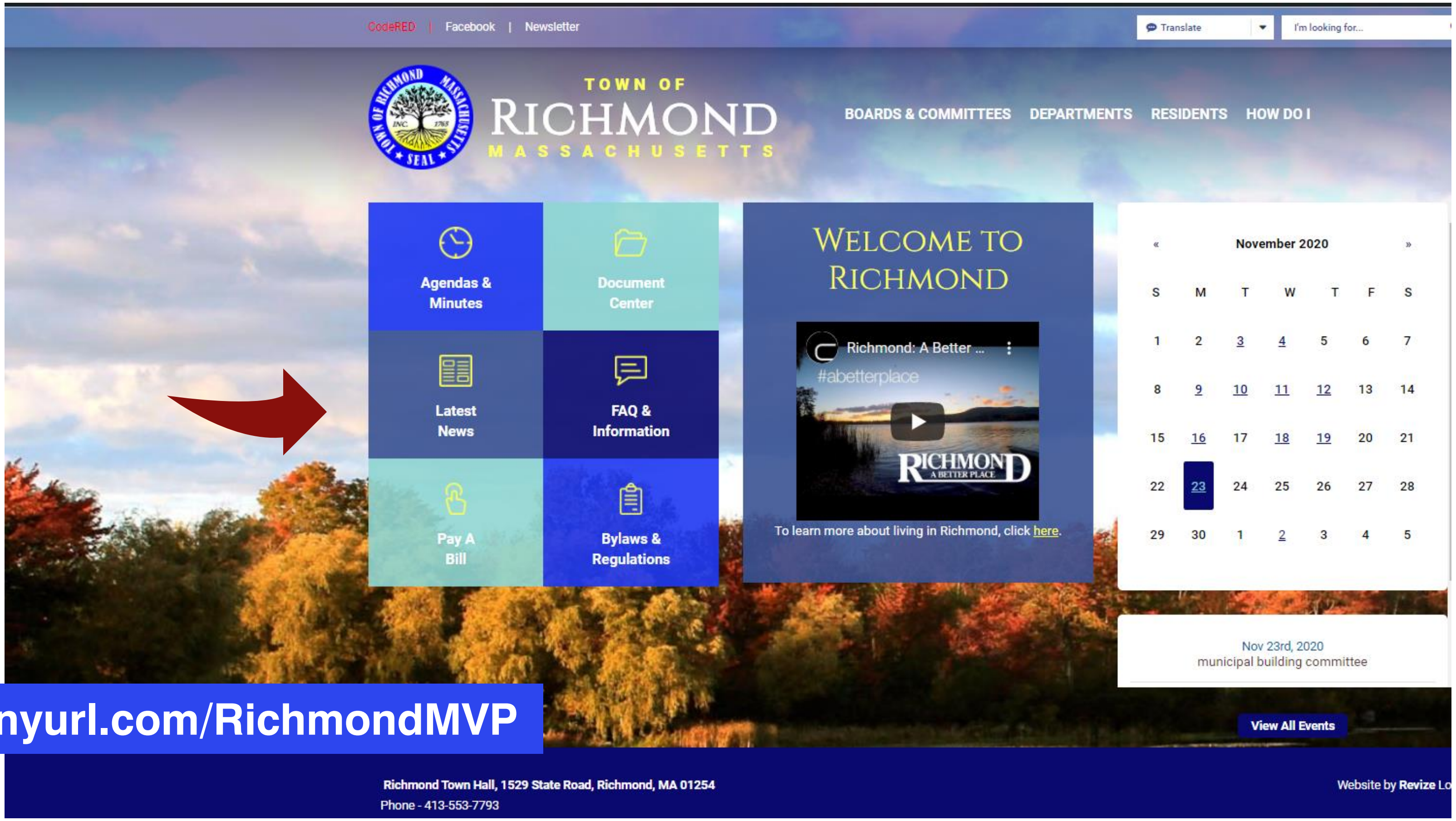
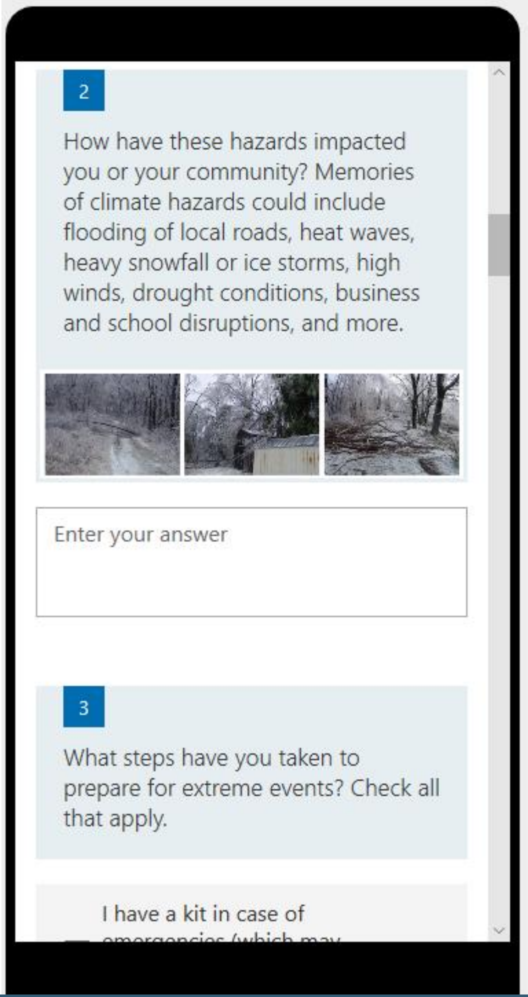
MILESTONE SCHEDULE

NOVEMBER 2020	DECEMBER 2020	DECEMBER 2020	FEBRUARY 2021	APRIL 2021	JUNE 2021
Core Team Kickoff	Listening Session #1 (video and survey)	CRB Webinars	Listening Session #2	Action Grant	MVP-HMP Plan

HELP US PLAN FOR A RESILIENT FUTURE!



tinyurl.com/RichmondMVP



tinyurl.com/RichmondSurvey1

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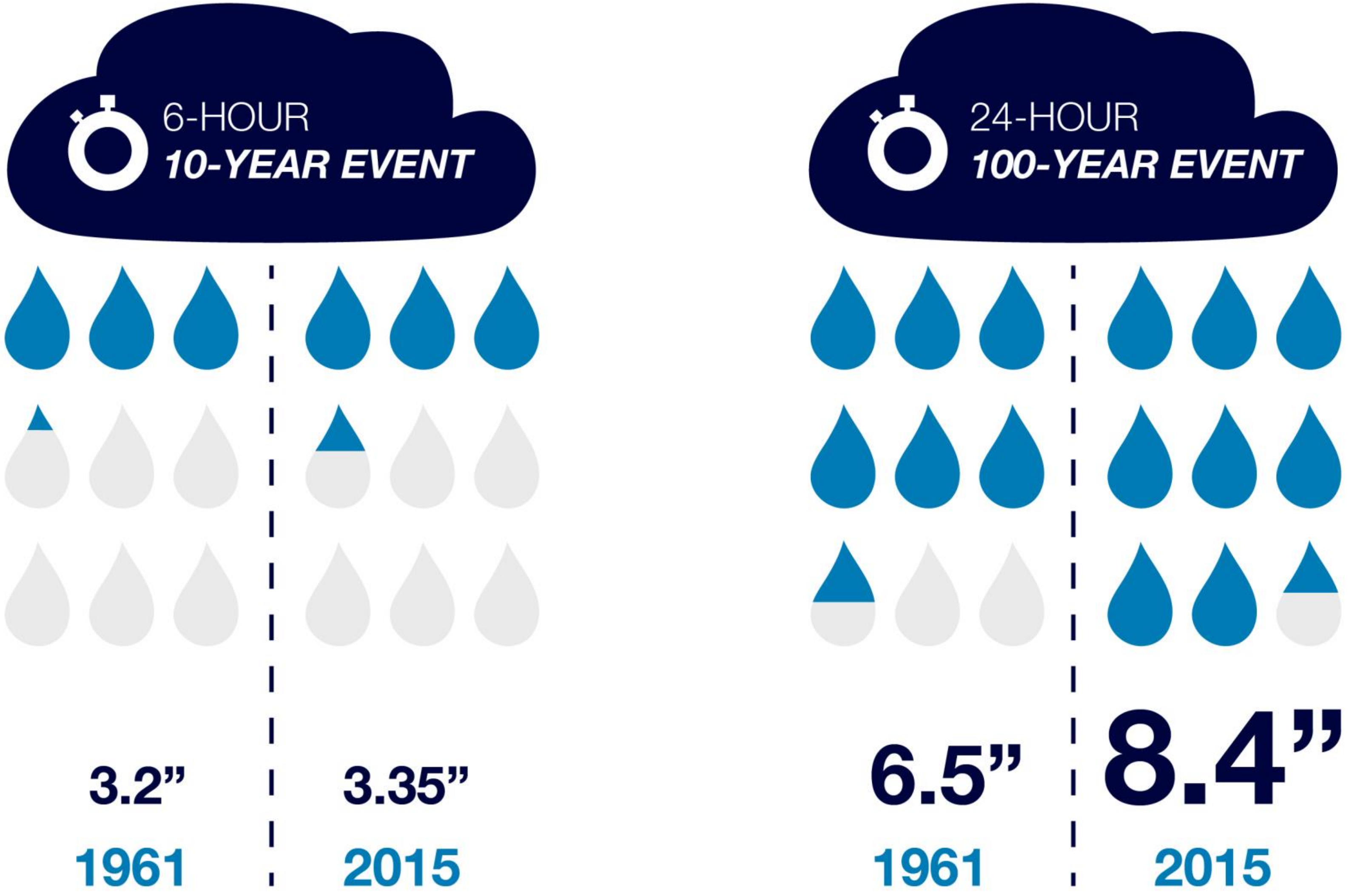
CHANGES IN **PRECIPITATION**



Sources: NOAA TP-40 (1961) and NOAA Atlas Volume 10 (2015)

Flood Prone Areas

- Lenox Mountain Road at Cone Brook
- West Road at Furnace Brook
- Dublin Road at Fairfield Brook
- Sleepy Hollow Road at Sleepy Hollow and Fairfield Brooks
- Furnace Road near Quarry Pond

FIRM Updated in 1985 for Richmond

"By 2050, Massachusetts could experience the current 100- year riverine flood every two to three years on average"

PRECIPITATION DURING **HEAVY EVENTS** IN THE NORTHEAST

INCREASED BY MORE THAN 70%

BETWEEN 1958-2010

Massachusetts Executive Office of Energy & Environmental Affairs. 2019. "Changes in Precipitation." Massachusetts Climate Change Clearinghouse. Resilientma.org/changes/changes-in-precipitation

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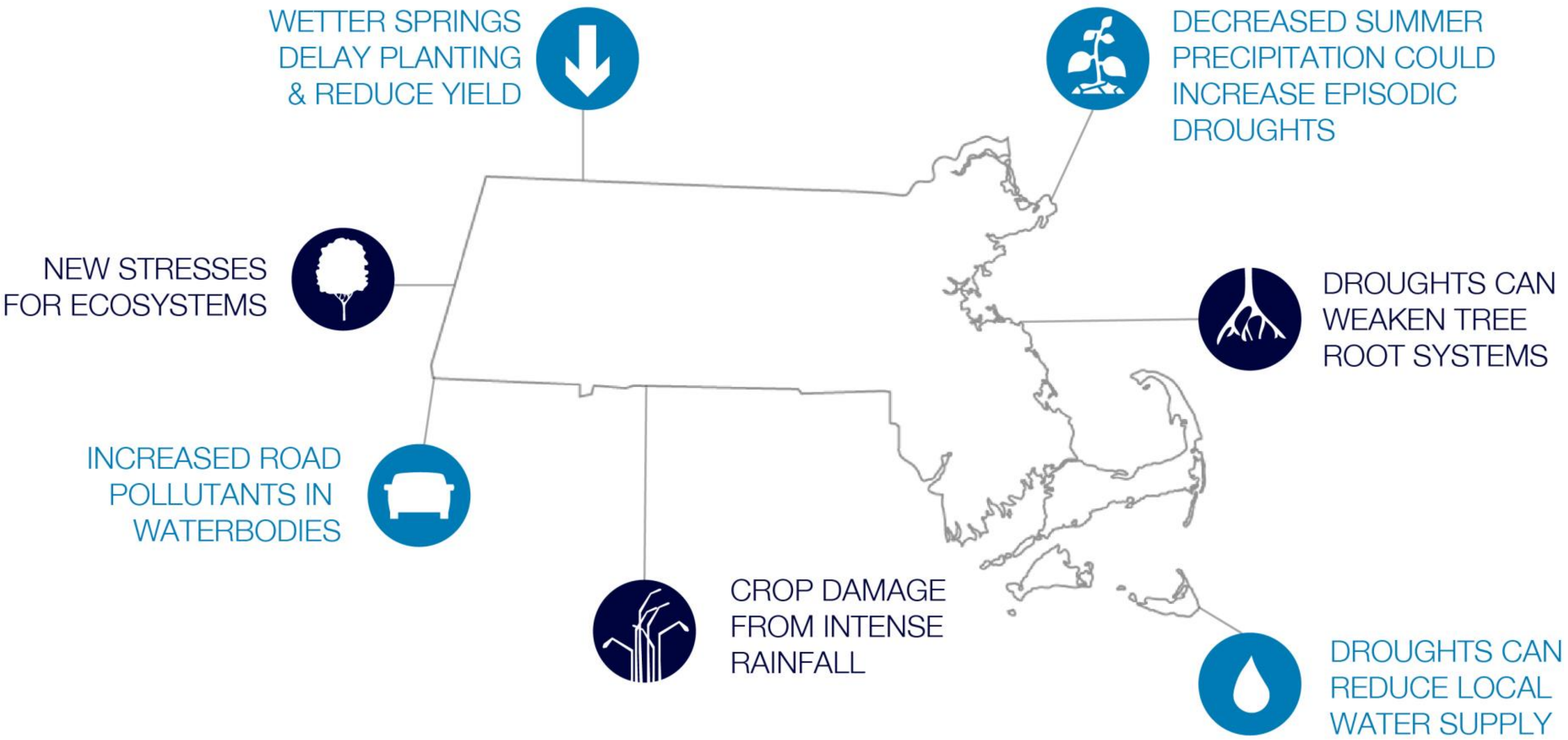
IMPACTS OF CHANGING **PRECIPITATION**

HIGHER AVERAGE ANNUAL PRECIPITATION

INCREASED BY ABOUT 10% IN THE NORTHEAST INTHE LAST 50 YEARS



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

WINTER STORMS

- The blizzard of 2013 left nearly **400,000 Massachusetts residents without power**[1]
- "Heavy blizzards are among the **most costly and disruptive** weather events for Massachusetts communities."[2]
- Snowpack likely to **decrease annually**, but snowfall will occur with **heavy intensity**
- Extended power outages, cost of snow removal, repairing damages, and loss of business can have a **severe economic impact**[3]
- **The elderly and infirmed** are populations of particular concern during these events

1. *Resilient MA Climate Change Clearinghouse for the Commonwealth. "Extreme Weather," 2017*
2. *"Massachusetts State Hazard Mitigation and Adaptation Plan." 2018. P4-226*

Graphic: Town of Richmond

HURRICANES AND NOR'EASTERS

Upward trend in North Atlantic hurricane activity since 1970

2012: Hurricane Sandy

2017: Hurricane Jose

2018: Hurricane Florence

2019: Hurricane Dorian

Nor'easters along the Atlantic coast are increasing in frequency and intensity

2008: Ice Storm

2018: 4 nor'easters in 4 weeks in March

Source: Climate Science Special Report, Fourth National Climate Assessment (NCA4), Volume prepared by the U.S. Global Change Research Program (USGCRP)Northern Middlesex

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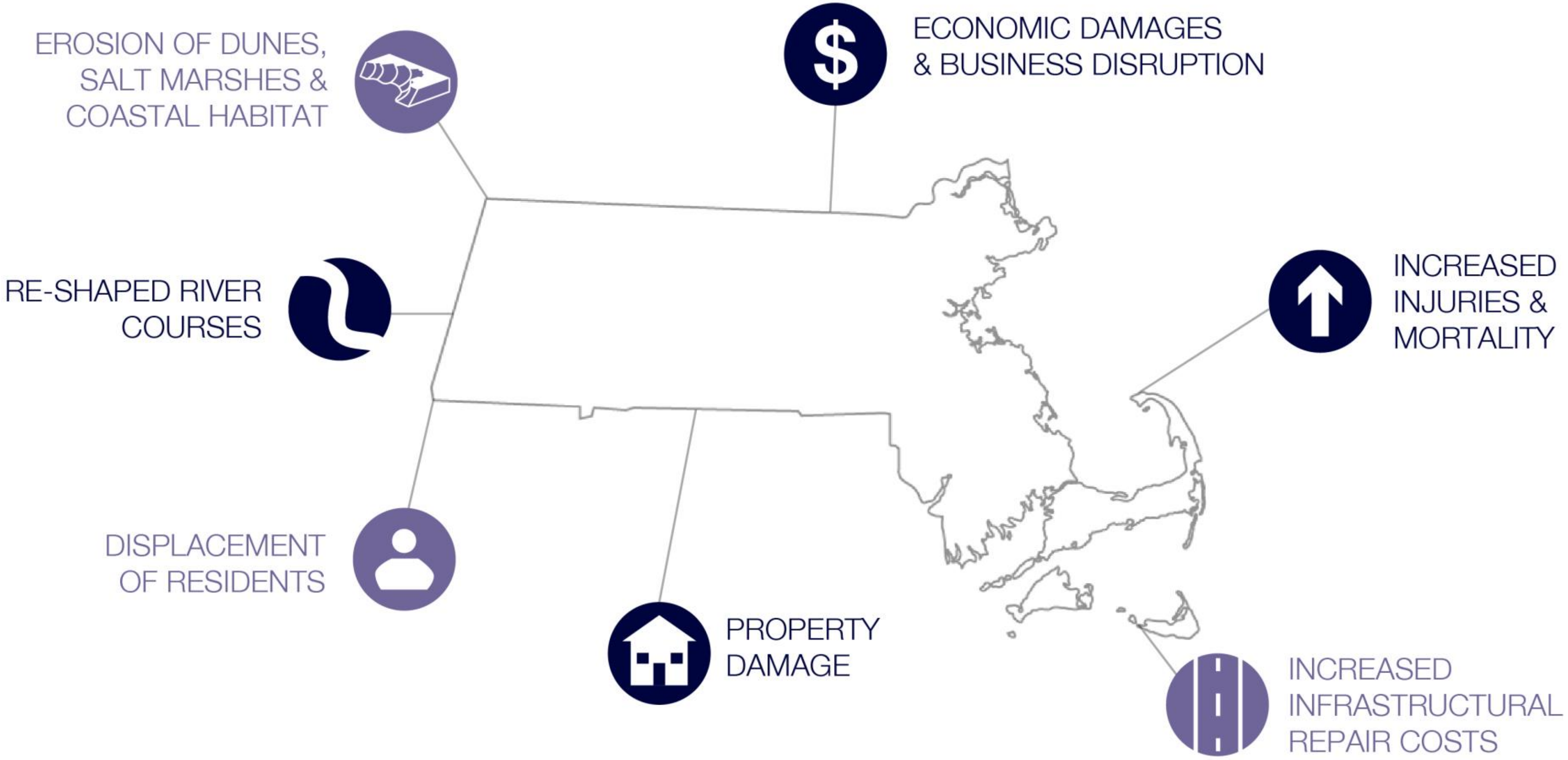
IMPACTS OF **EXTREME WEATHER**

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

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EXTREME TEMPERATURES
IN MASSACHUSETTS

6	24	35
2005 OBSERVED ANNUAL AVERAGE	**MID-CENTURY** PROJECTED ANNUAL AVERAGE	**END-OF-CENTURY** PROJECTED ANNUAL AVERAGE

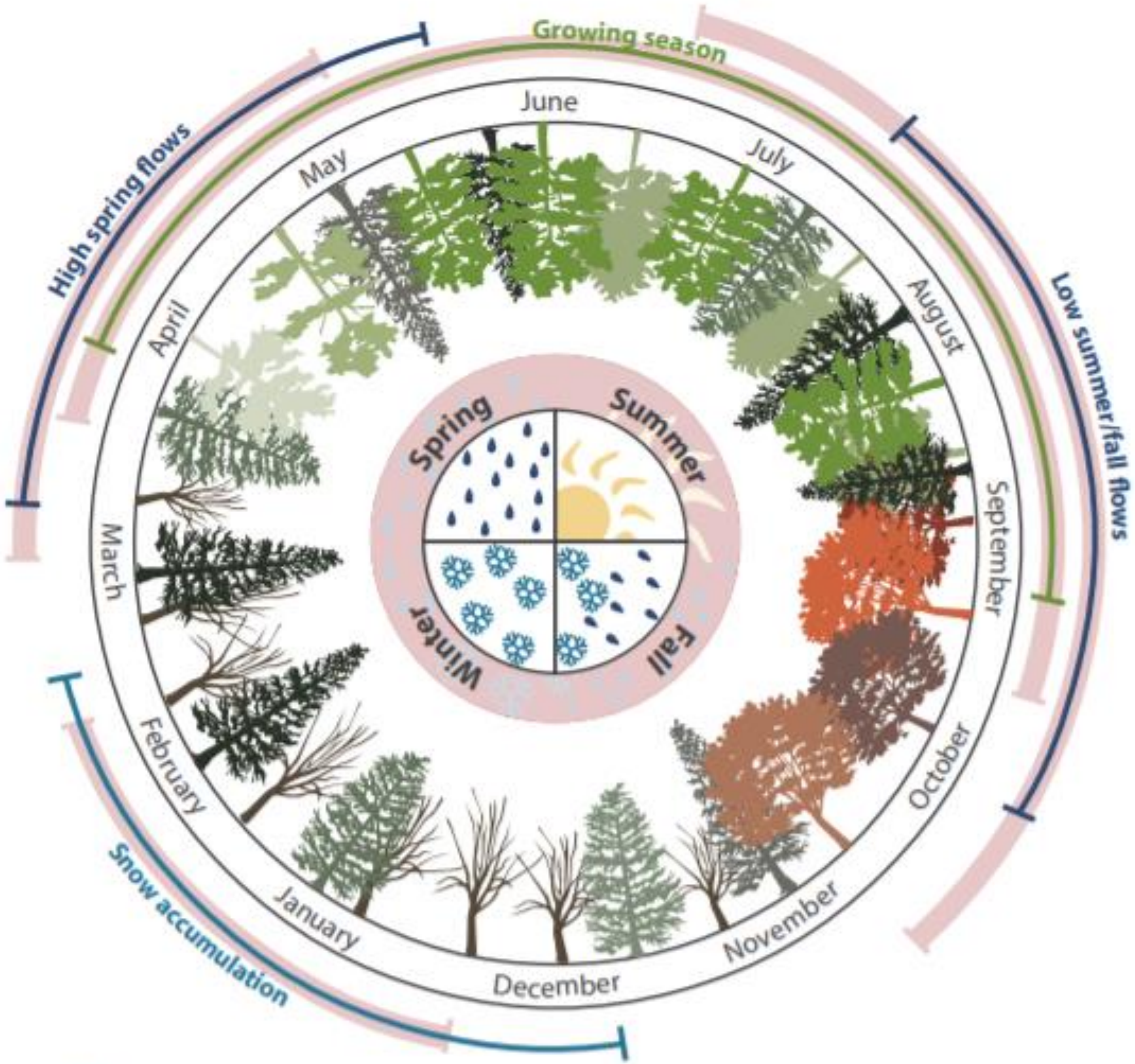
DAYS WITH TEMPERATURES ABOVE 90°F

145	114	101
2005 OBSERVED ANNUAL AVERAGE	**MID-CENTURY** PROJECTED ANNUAL AVERAGE	**END-OF-CENTURY** PROJECTED ANNUAL AVERAGE

DAYS WITH TEMPERATURES BELOW 32°F

Massachusetts Executive Office of Energy & Environmental Affairs. 2019. "ResilientMA Datagrapher." Massachusetts Climate Change Clearinghouse. Resilientma.org/datagrapher/?c=Temp/state/tx90/ANN/MA/
Notes: Mid-century projected annual averages use a 2040-2069 time range. End-of-century project annual averages use a 2080-2097 time range.

Northeast and Midwest seasonal patterns



Shifted season projected from increasing temperatures and precipitation changes

Image credit: Northeast Climate Science Center, University of Maryland Center for Environmental Science

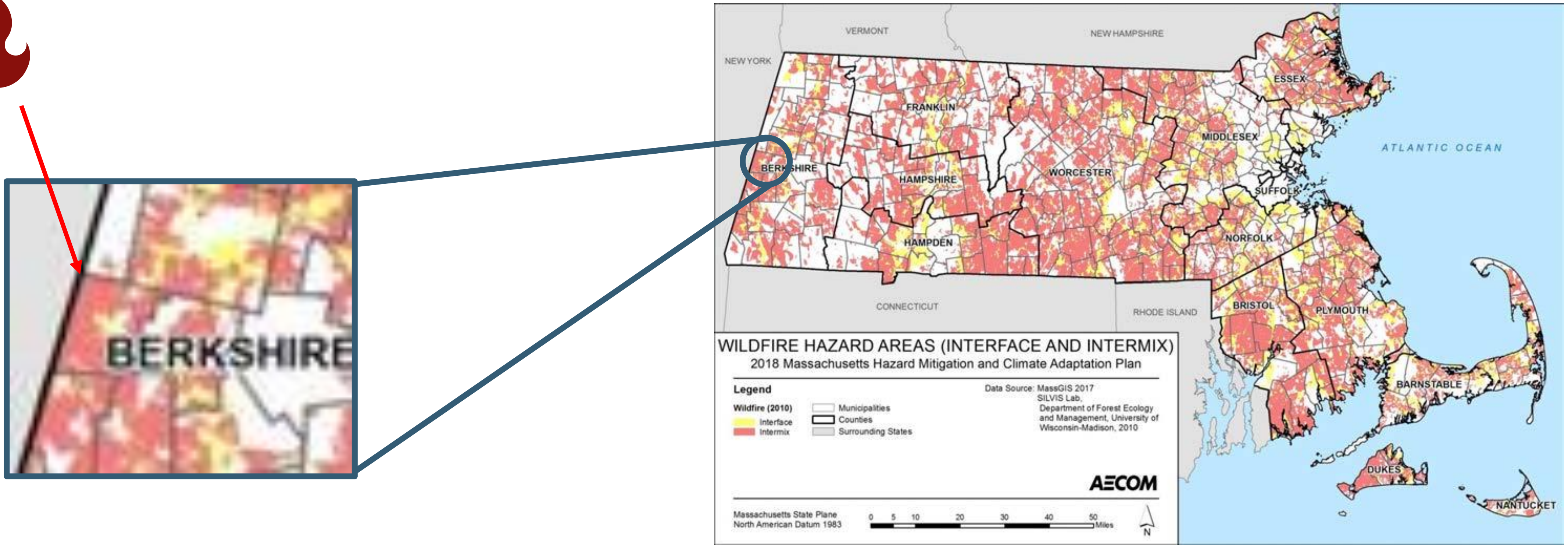
The most recent notable drought event was in 2016[1]

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[1]

What was the drought response in 2016?

1. *Source: Executive Office of Energy and Environmental Affairs, Adaptation Advisory Committee. 2011. "Massachusetts Climate Change Adaptation Report," 17.*

WILDFIRE



Map: Wildfire Hazard Areas, 2018 Massachusetts Hazard Mitigation and Climate Adaptation Plan, p4-176

Any questions

about climate hazards?

RISK MATRIX

Photo: Town of Richmond Facebook Page

RISK MATRIX

Community Resilience Building Risk Matrix

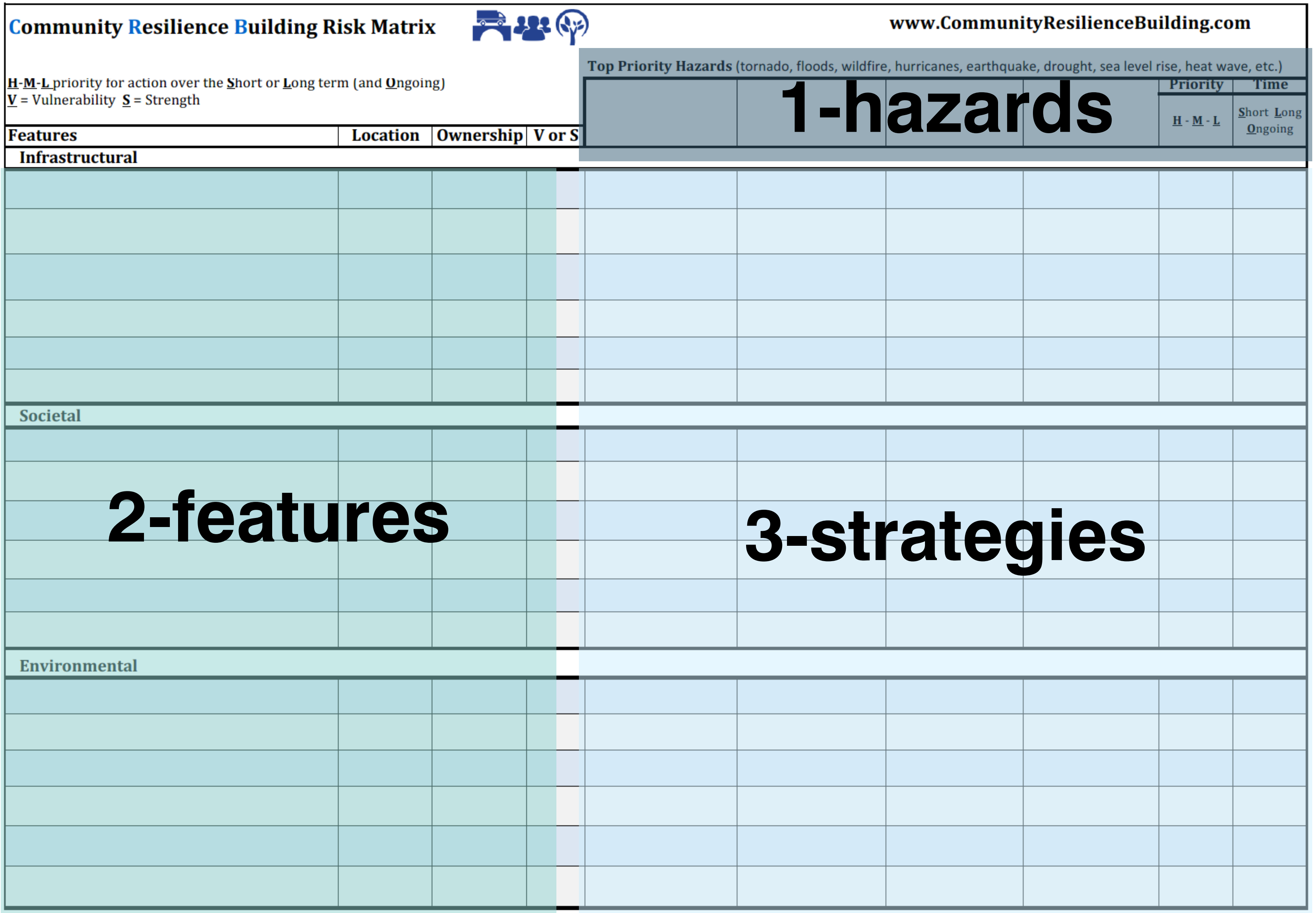
www.CommunityResilienceBuilding.com

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

RISK MATRIX

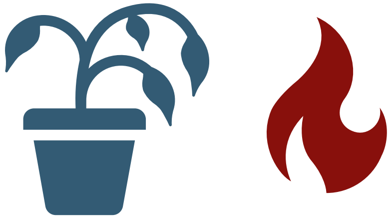

Community Resilience Building Risk Matrix
www.CommunityResilienceBuilding.com
H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength
Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)
Features
Location
Ownership
V or S
Priority
H - M - L
Time
Short Long
Ongoing
Infrastructural
Societal
Environmental
1-hazards
2-features
3-strategies

TOP CLIMATE HAZARDS IN RICHMOND

Flooding

Winter weather
(Nor'easters, ice storms,
snowstorms, blizzards)

Wind events
(thunderstorms,
hurricanes, tornadoes)



Extreme heat/
Drought/Wildfire

RISK MATRIX: FEATURES

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-M-L priority for action over the **Short** or **Long** term (and **Ongoing**)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

INFRASTRUCTURAL FEATURES

Electrical service

Photo: Eversource

Emergency Services

Photo: Town of Richmond

Wastewater Treatment and Collection

Culverts

Photo: Town of Richmond

Roadways

Photo: Town of Richmond

Water Supply

INFRASTRUCTURAL FEATURES

Photo: Town of Richmond

- Water supply - wells
- Wastewater infrastructure – Richmond Shores
- Communications network
- Dams
- Culverts and bridges
- Roadways – paved and gravel
- Solid waste management – Republic
- Electric – Eversource
- Natural gas
- Emergency shelters
- Municipal Buildings
- Fuel Storage

HAZARD POTENTIAL OF DAMS

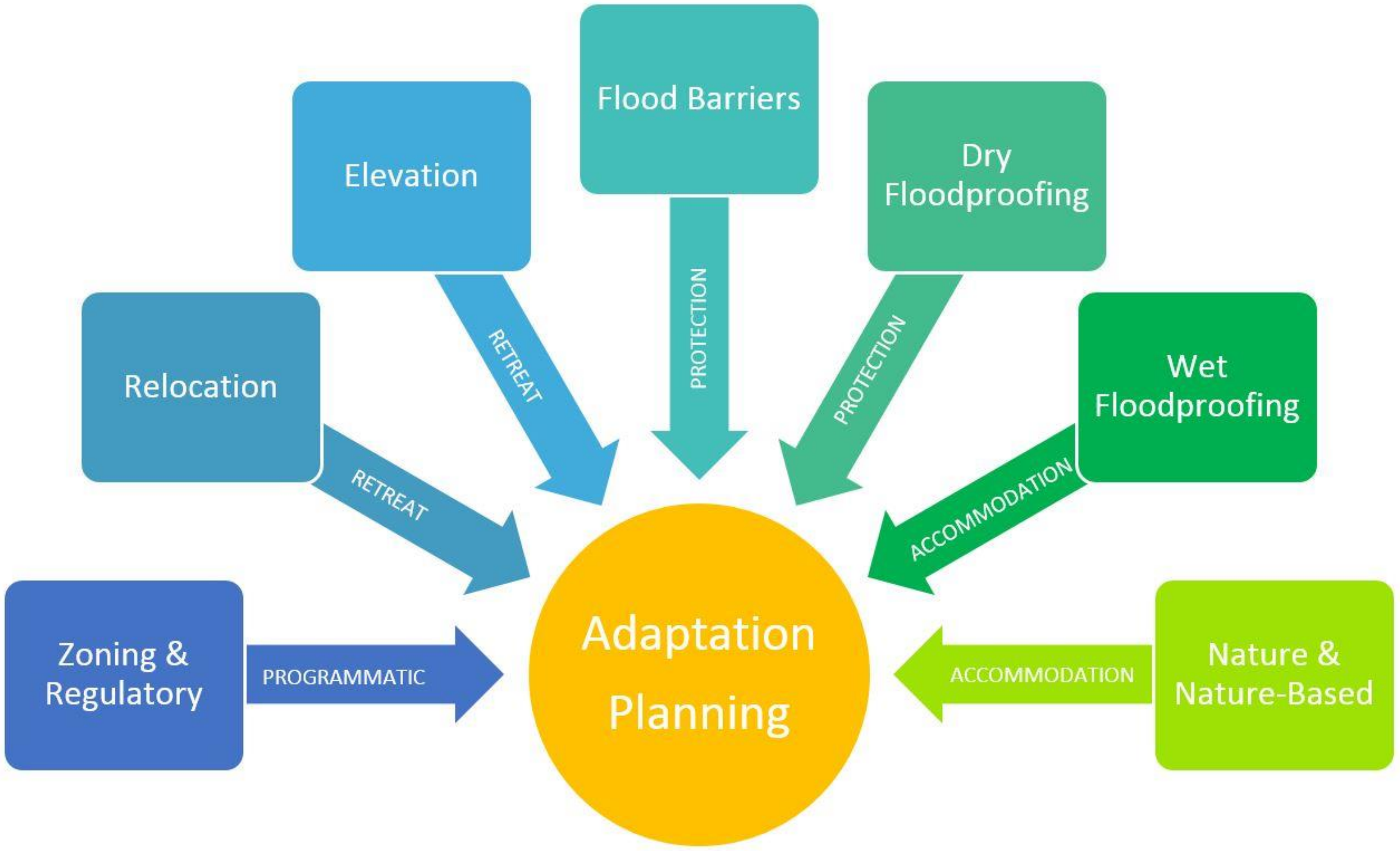
Name	Ownership	Hazard Class
Richmond Pond Dam	Private	Significant Hazard
Richmond Iron Works Dam	Private	N/A
Browne Pond Dam	Private	N/A
Rose Pond Dam	Private	N/A
Sherrill Pond Dam	Private	N/A
Strong Pond Dam	Private	N/A
Richmond Iron Works Dam	Private	N/A
Lenox Reservoir Dams (Upper and Lower)	Public	High

Office of Dam Safety, 2019

ADAPTATION STRATEGIES: INFRASTRUCTURE

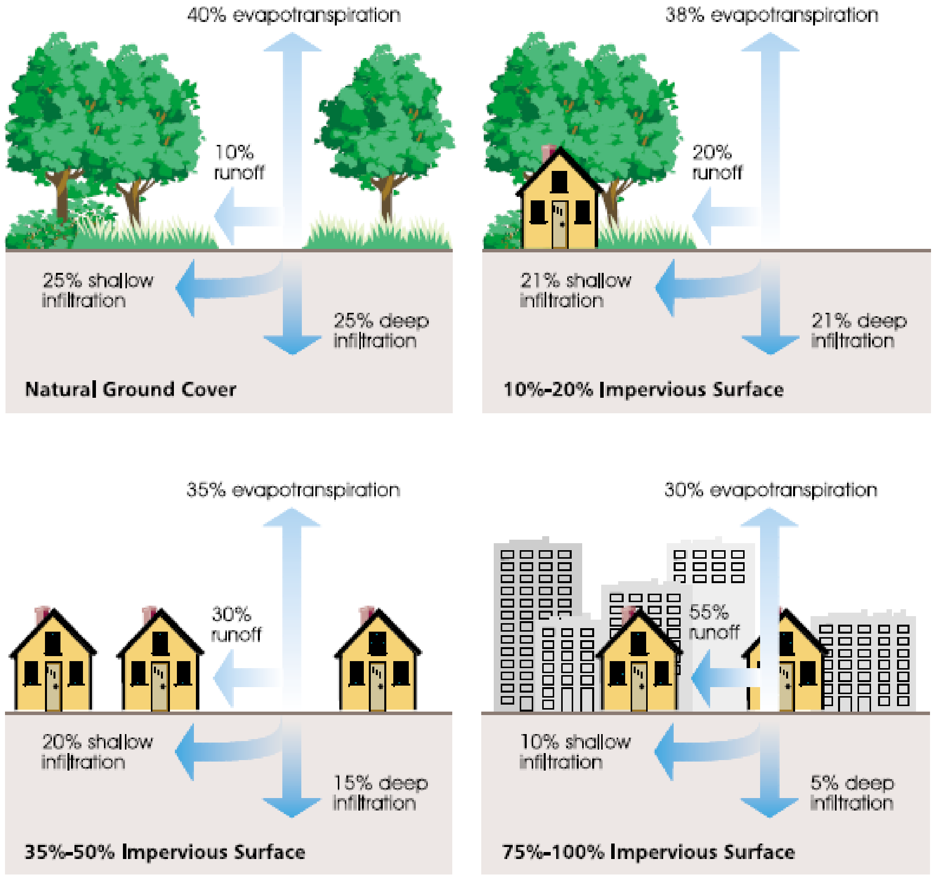
Photo: City Facebook

ADAPTATION STRATEGY TYPES



STORMWATER TERMINONOLGY

DETENTION
RETENTION
CONVEYANCE

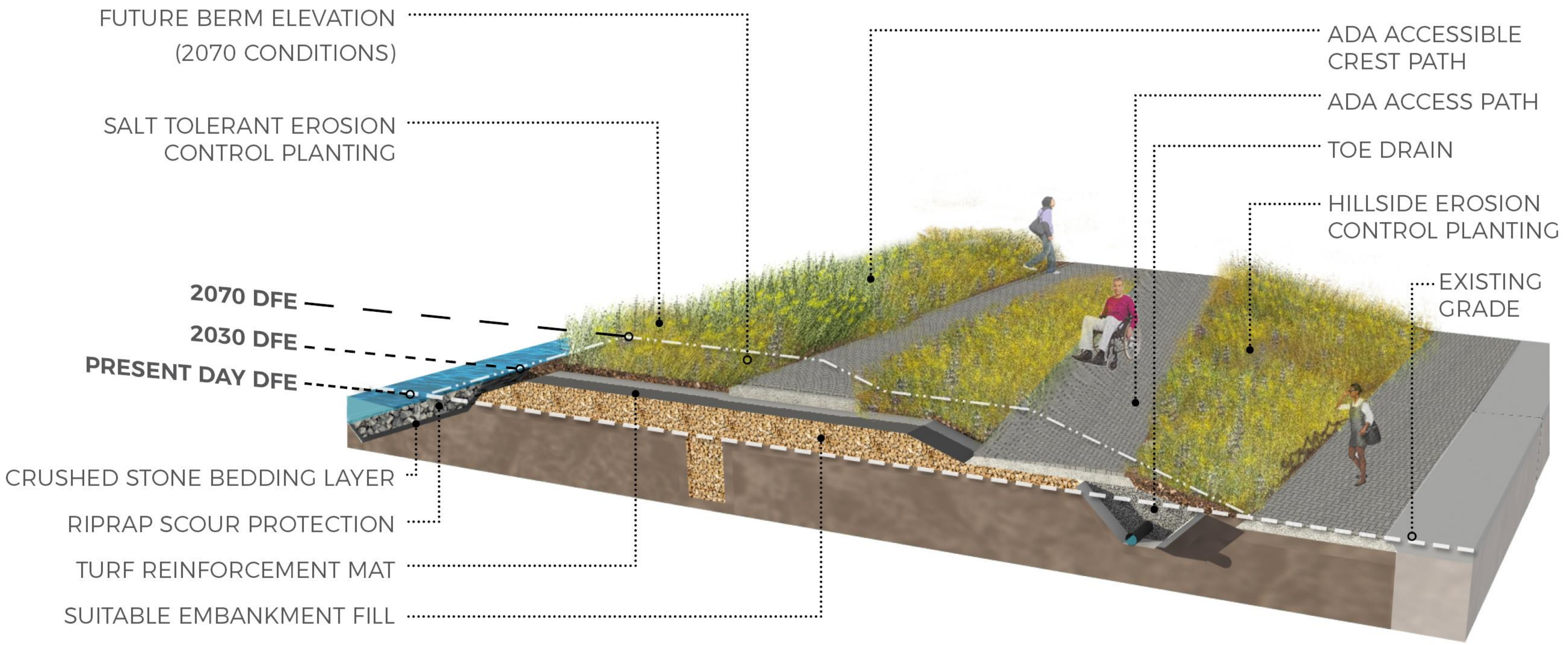


LOW IMPACT DEVELOPMENT (LID)

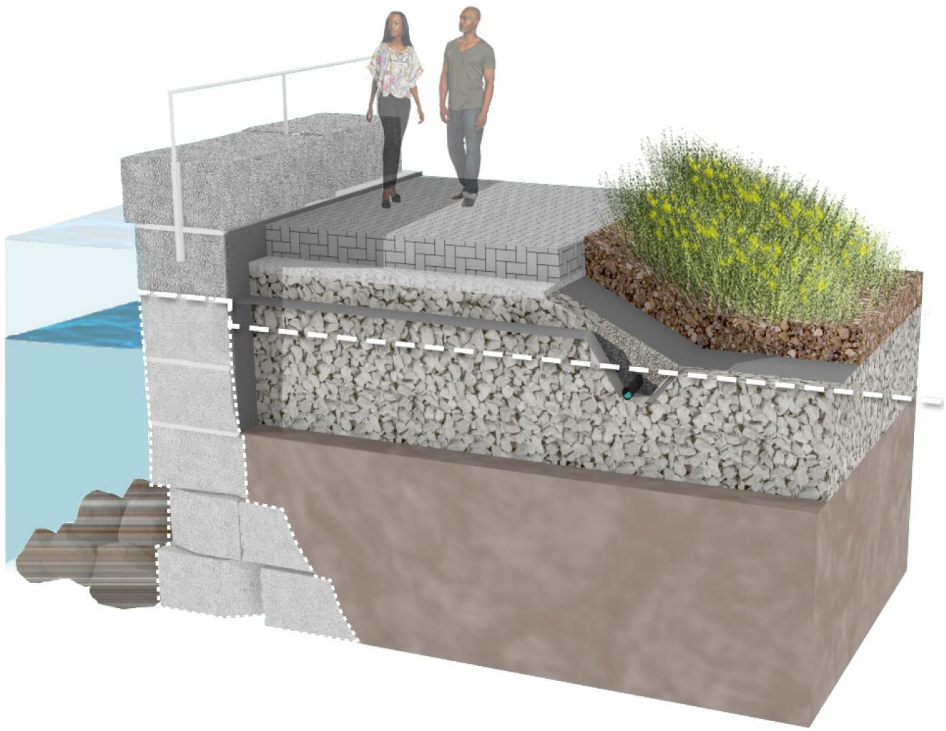
Bioretention
Rain Gardens
Tree Box Filters
Permeable Pavement

MULTI-PURPOSE FLOOD STORAGE

VEGETATED BERM



FLOOD WALLS | DEPLOYABLE BARRIERS



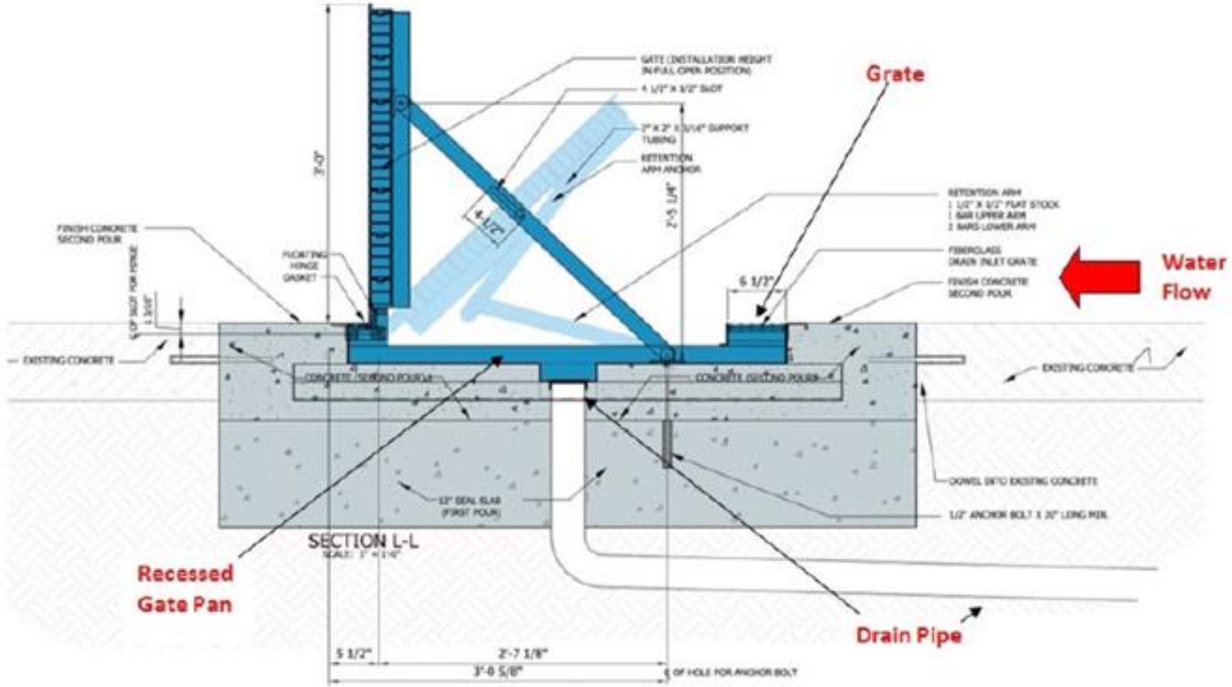
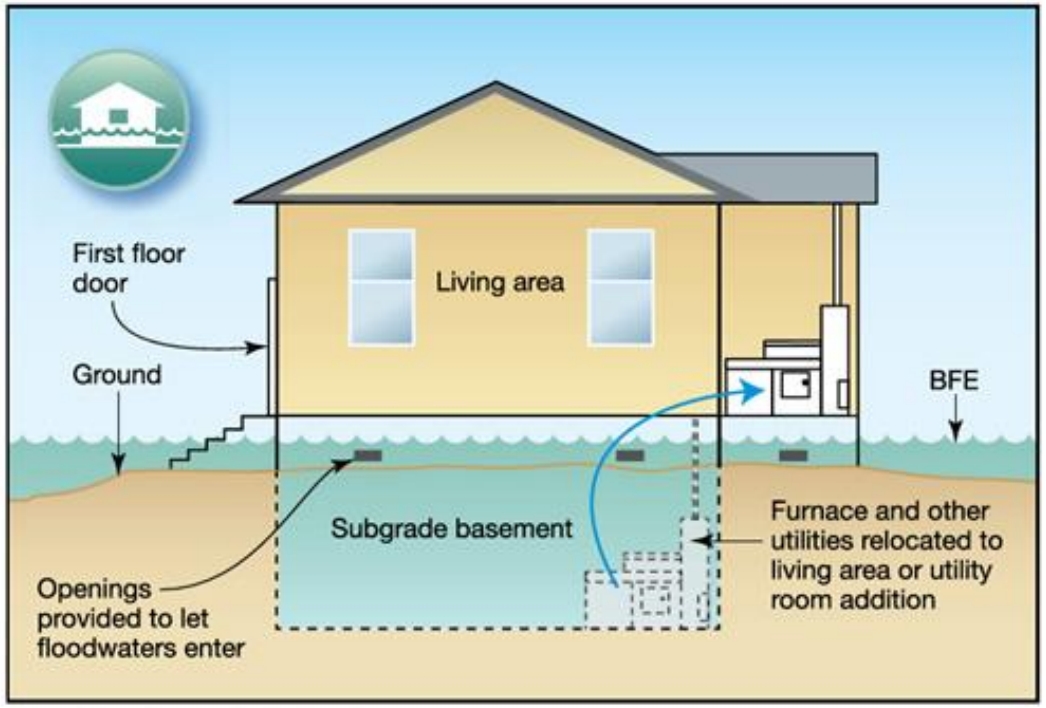


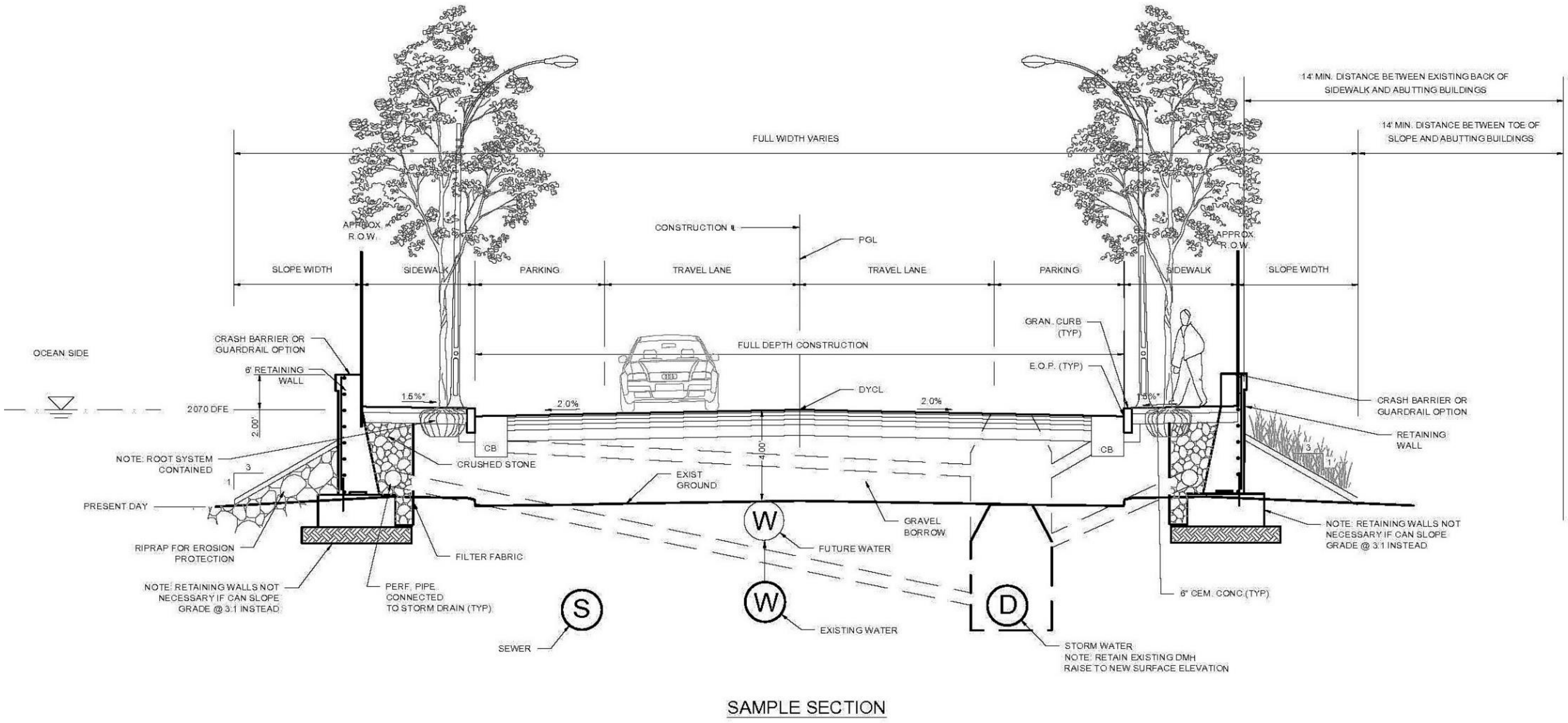
FIGURE 1 | A FloodBreak barrier gate diagram

RAISED BUILDINGS | WET FLOODPROOFING



CULVERT WIDENING TO IMPROVE HABITAT & FLOW

RAISED ROADWAYS



ROOF STRATEGIES

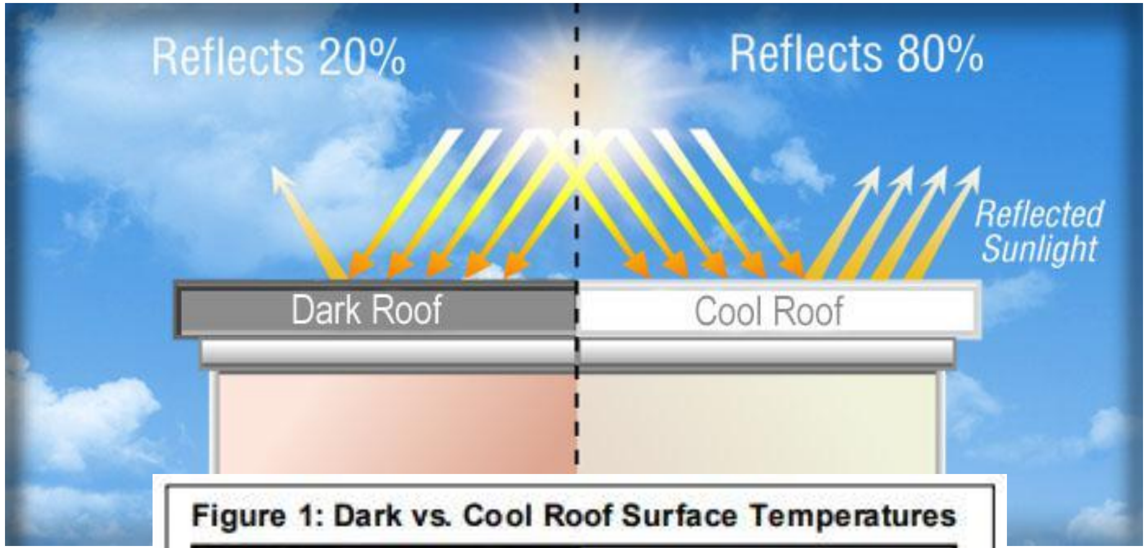
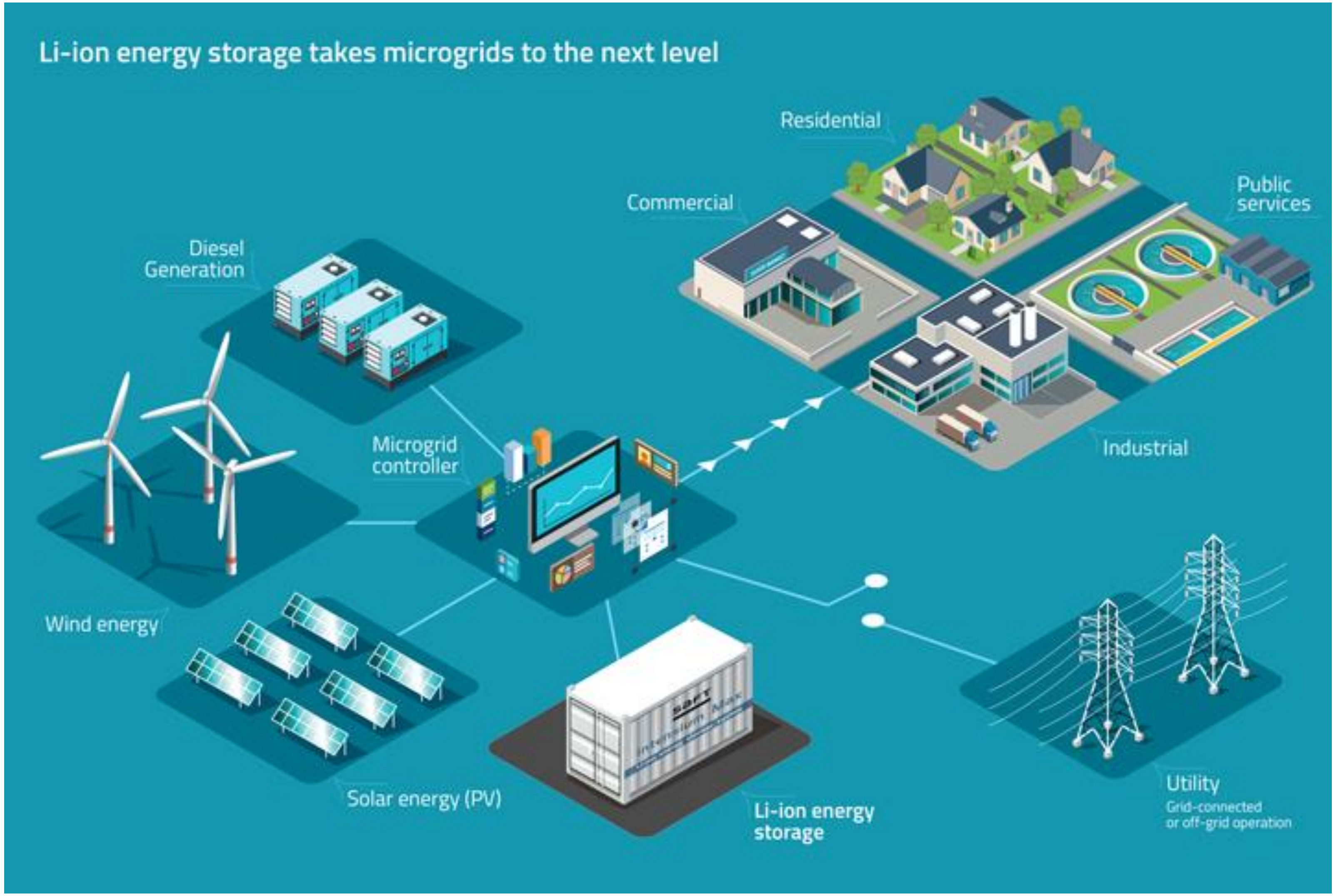


Figure 1: Dark vs. Cool Roof Surface Temperatures

A dark roof (left) becomes much hotter than a cool white roof (right) on a sunny afternoon.

RENEWABLE ENERGY/MICRO-GRIDS



RE-EVALUATE LOCAL REGULATIONS & POLICIES

BROOKLINE MUNICIPAL VULNERABILITY PREPAREDNESS (MVP) ACTION PROJECT

town of brookline, massachusetts

Weston & Sampson will audit the Town of Brookline's stormwater, floodplains, zoning bylaws, public way design guidelines, wetlands bylaws, and Department of Public Works' Site Plan Review Checklist to identify opportunities to mandate higher standards for climate resiliency and to identify any conflicts these standards might have with State policy. Our approach is centered around the promotion of nature-based solutions and strategies such as green infrastructure, low impact development (LID), open space protection, and floodplain protection. The project is funded by a Municipal Vulnerability Preparedness Action Grant from the Massachusetts Executive Office of Energy & Environmental Affairs.

Weston & Sampson will identify opportunities for incorporating standards into the Town of Brookline's bylaws and other planning instruments to increase the town's resilience against the effects of climate change, including increased temperatures as well as increased precipitation frequency/intensity and associated flooding. Implementation of this project will help to reduce risk of climate change impacts to public infrastructure, private property, natural resources, and human safety and welfare. The project's specific recommendations for bylaw amendments as well as sustainability standards for site plan review will be targeted at new and renovated projects across all building sectors: residential, multifamily and affordable housing, commercial, and institutions.

Weston & Sampson's deliverables, identified as priority action items in the town's "Climate Vulnerability Assessment," will include: recommendations for new or amended town bylaws and regulations mandating LID measures, LID Best Management Practices - narrative and Site Plan Review checklist - that targets owners and developers of new and renovated residential, multifamily, and commercial properties, and assists in educating them of the overall benefits to the environment and the value in protecting their properties from climate change impacts. The standards and checklists will serve as imperative components of the "Site Plan Review" ordinance that the town will be adopting and are intended to limit storm and flood damage, mitigate stormwater runoff, reduce impervious surfaces, and improve ecosystem resiliency.

- convene a core team of leaders from departments, boards, and commissions
- review existing By-laws
- conduct literature review of examples from other municipalities
- develop and evaluate alternatives
- develop draft recommendations; workshop them with town's Boards, Commissions, and Departments.
- develop final recommendations and assist with preparation of package to town meeting
- conduct community outreach

client contact

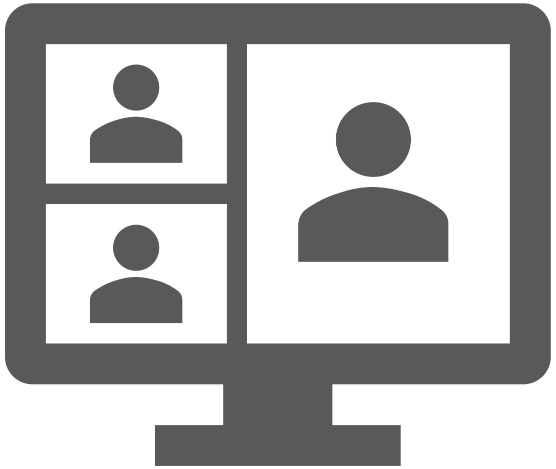
Maria Morelli
Senior Planner,
Climate Action/Land Use
Town of Brookline
Department of Planning & Community Development
mmorelli@brooklinema.gov
617-730-2670

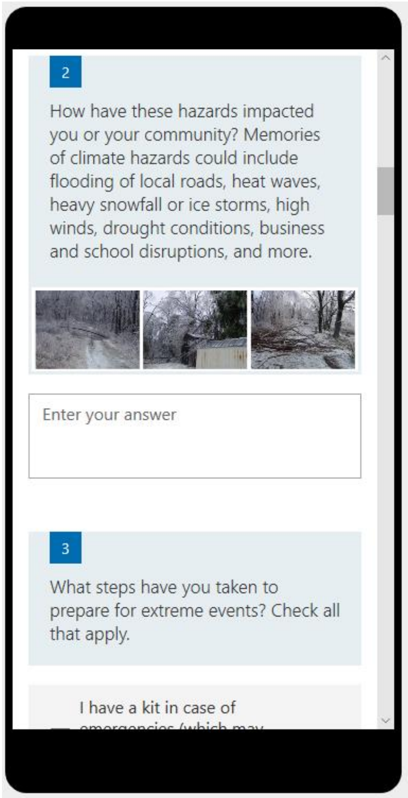
westonandsampson.com

Weston & Sampson

NEXT STEPS

Thank you for joining us today!





Join our next webinar!
December 16th: Community Assets
December 17th: Natural Resources

Watch our video and take the survey!
tinyurl.com/RichmondSurvey1

Check out our project webpage and stay tuned for upcoming events!
tinyurl.com/RichmondMVP


Photo: Town of Richmond Facebook Page

TOWN OF RICHMOND

Community Resilience Building (CRB) Workshop Series

December 15th | *December 16th – Community* | December 17th

Weston & Sampson

WEBINAR OUTLINE

PRESENTATION:

- Recap of the MVP and HMP Programs
- Climate Change Impacts

DISCUSSION:

- Pre-Selected Hazards
- Pre-Selected Features
- Identify and Prioritize Action Items

Meeting materials shared:

PDF of presentation
Agenda (for reference)

for **comment:**
Risk Matrix
Hazard Map
Critical facilities list

Municipal Vulnerability Preparedness (MVP) Program

Community Resilience Building (CRB) Process:

89% participation

312 communities

Action Grant Projects:

FY 18: **37**

FY 19: **36**

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Total Awards:

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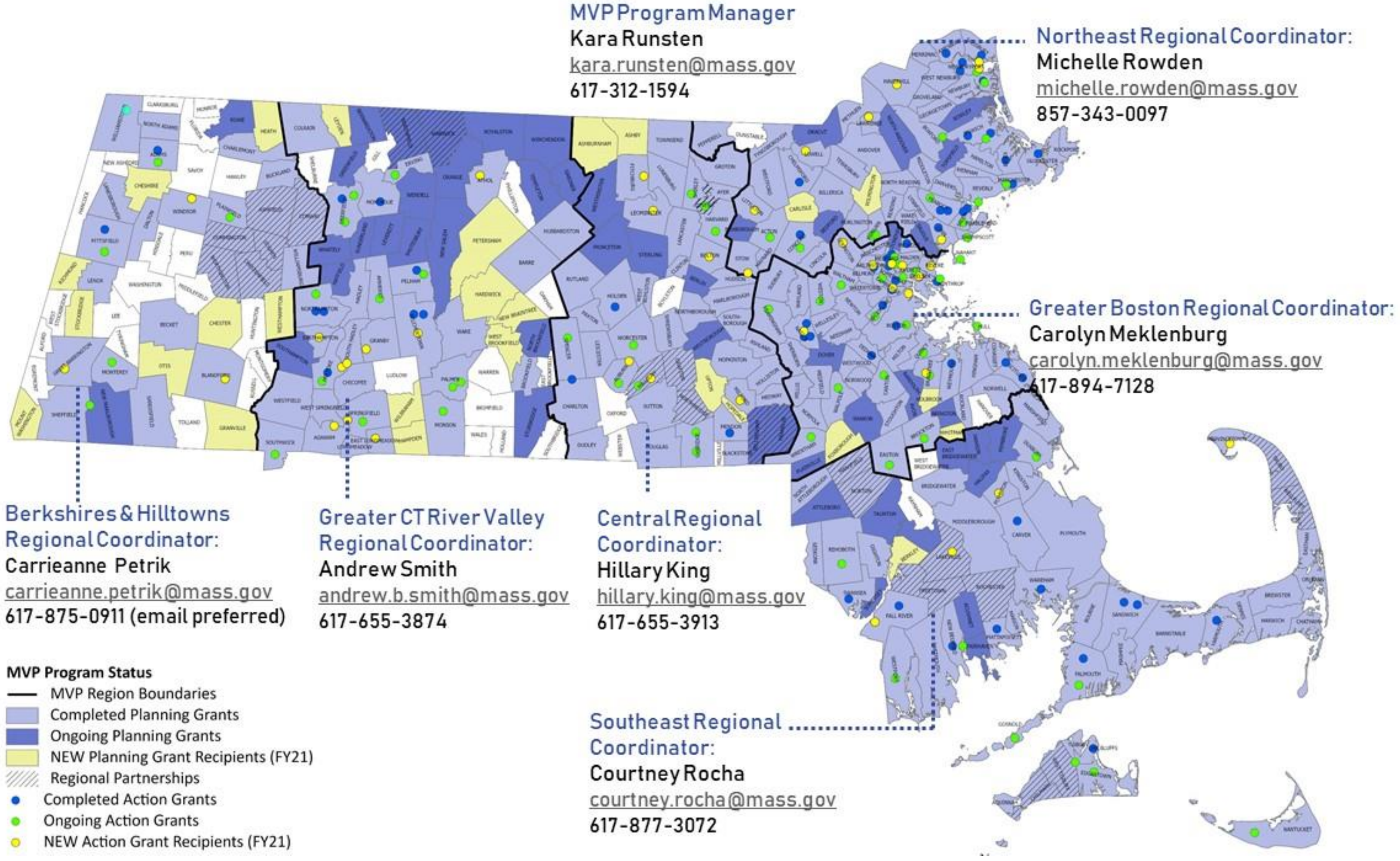

MVP Website: www.mass.gov/mvp
Berkshire/Hilltowns Regional Coordinator: carrieanne.petrik@mass.gov

MVP PROGRAM

1. MVP Planning Grant

- Define climate hazards
- Identify community vulnerabilities and strengths
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** We're also updating Richmond's Hazard Mitigation Plan!*

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MILESTONE SCHEDULE

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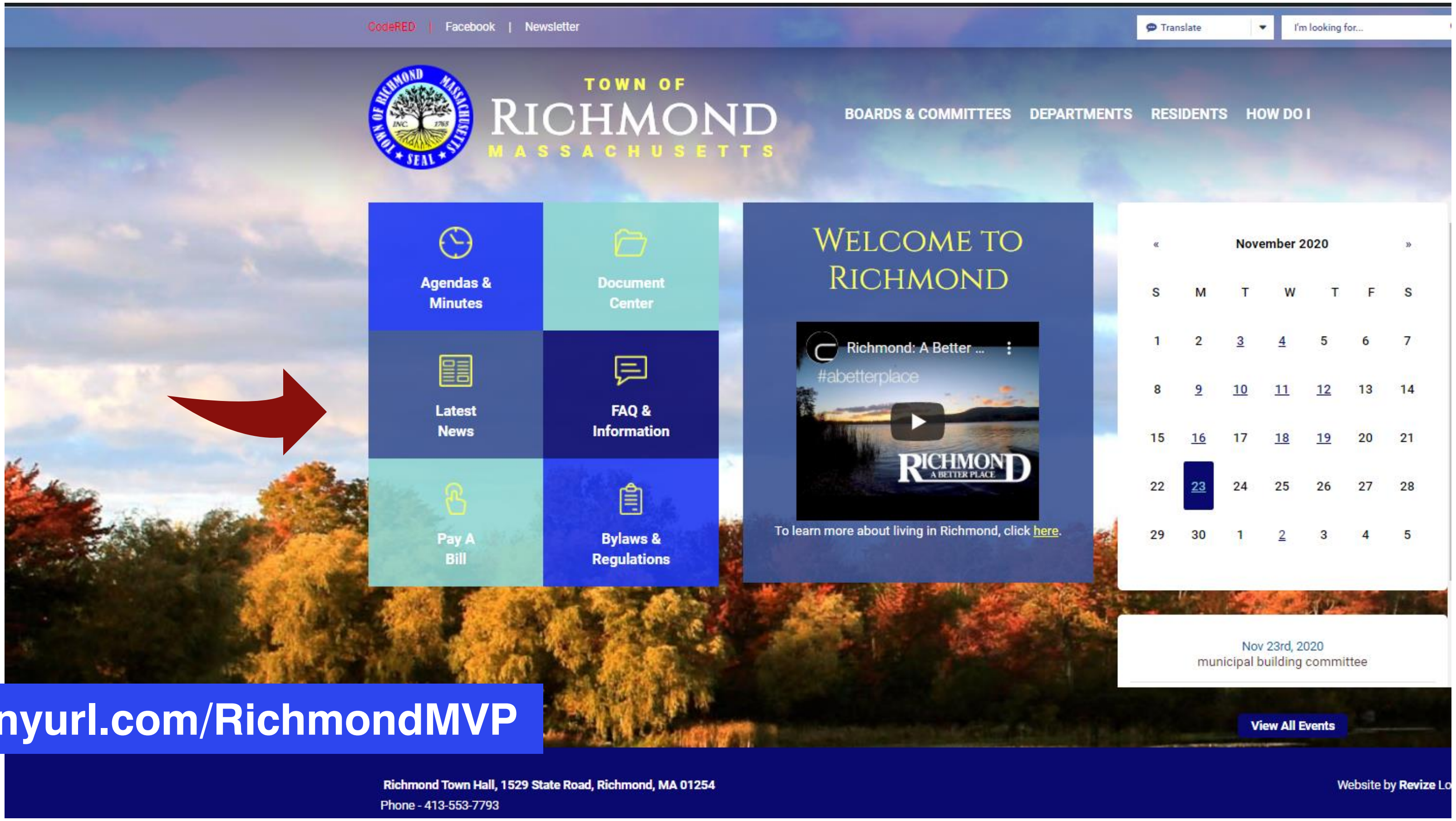
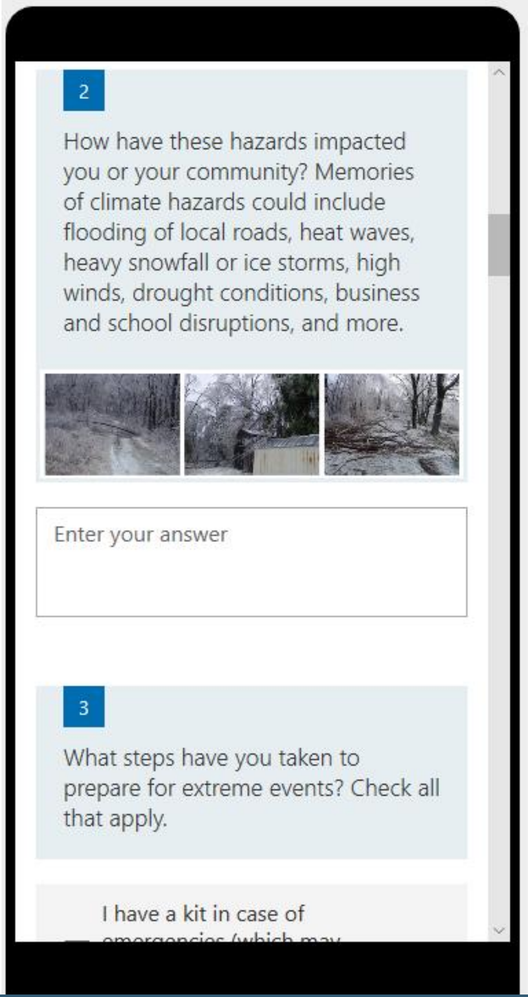
DECEMBER 2020	CRB Webinars
FEBRUARY 2021	Listening Session #2
APRIL 2021	Action Grant
JUNE 2021	MVP-HMP Plan

HELP US PLAN FOR A RESILIENT FUTURE!



tinyurl.com/RichmondMVP



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MA CLIMATE PROJECTIONS

By end of century:

Changes in precipitation

- 18% increase in consecutive dry days
- 57% increase in days with > 1 in. rainfall
- 7.3 inches additional annual rainfall
- Increase in flooding

Rising temperatures

- 10.8°F increase in average annual temperature
- 42% decrease in days/year with min. temperatures < 32* F
- 1,280% increase in 90-degree days/year

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- Overall a decrease in annual snowfall
- Likely to have fewer events with a lot of snow
- Freeze –thaw cycle to change

Regional changes

- Increase in frequency and magnitude of hurricanes and nor'easters
- 4-10.5 feet of sea level rise

Source: State Hazard Mitigation and Climate Adaptation Plan, September 2018 / resilientma.org / Northeast Climate Adaptation Science Center

Any questions about climate hazards?

RISK MATRIX


Photo: Town of Richmond Facebook Page

RISK MATRIX

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

1-hazards

2-features

3-strategies

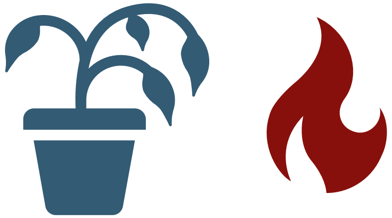
Features	Location	Ownership	V or S	Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)				Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

TOP CLIMATE HAZARDS IN RICHMOND

Flooding

Winter weather
(Nor'easters, ice storms,
snowstorms, blizzards)

Wind events
(thunderstorms,
hurricanes, tornadoes)



Extreme heat/
Drought/Wildfire

RISK MATRIX: FEATURES

FEATURES	LOCATION	OWNERSHIP	VULNERABILITY OR STRENGTH
Infrastructural	Town wide	State	Vulnerability
Societal	Multi- vs. Single-neighborhood	Town	Strength
Environmental	Specific location	Private	Both
		Shared	

SOCIETAL FEATURES

Population	Richmond	Massachusetts
2018	1,590	6,902,149
2010	1,475	6,547,790
Age		
Under 18 years	13.5%	19.8%
65+ years	30.4%	16.5%
Economics		
Median household income, 2014-2018	$90,714	$77,378
Persons in poverty	5.4%	10.0%
Additional Information		
Bachelor’s degree or higher:	50.7%	42.9%
With a disability	11.3%	7.9%
Language other than English spoken at home	2.8%	23.6%

Census Bureau

SOCIETAL FEATURES

- Historic District and buildings
- Senior Populations
- Richmond Pond
- Emergency Shelters
- Emergency Response
- Volunteer Fire and Ambulance
- Tourism/Agriculture
- Pest and Disease Control

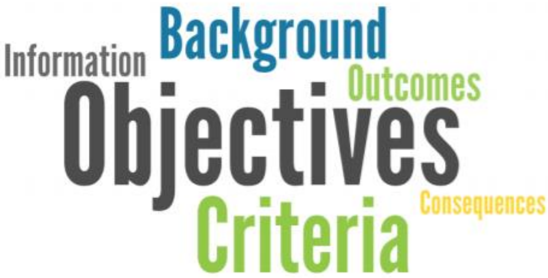
Photos: Town of Richmond

ADAPTATION STRATEGIES: COMMUNITY RESILIENCE

Photo by Richmond Fire Department

REDUCE BARRIERS TO PARTICIPATION

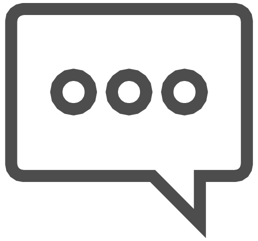
CHILDCARE



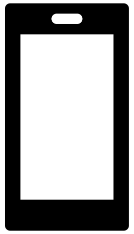
KNOWLEDGE

TRANSPORTATION

FOOD



TRANSLATION



TECHNOLOGY

WORK WITH VOLUNTEERS

MULTI-PRONGED APPROACH

VIDEO CONFERENCING

VIDEO

ONLINE

IN-PERSON

PRINT

Town of Richmond website

PUBLIC HEALTH

- Wellness checks
- Database of residents at risk of isolation
- Community Emergency Response Teams (CERT)
- Mobile markets
- Housing upgrades and investment

LOCAL BUSINESSES

DESIGN STRATEGIES | Mitigation Concepts

Illustrated here are practical strategies to mitigate damage from flooding. The recommendations comprise physical retrofits of the spaces and buildings, as well as suggestions to integrate flood resiliency into everyday operations.

Operational strategies, such as those referenced on pages 37 and 38, that do not require changes to a building's structure can also be effective strategies for mitigating risk by ensuring that vulnerable inventory, electronic systems and business records are protected from flooding and power outages.

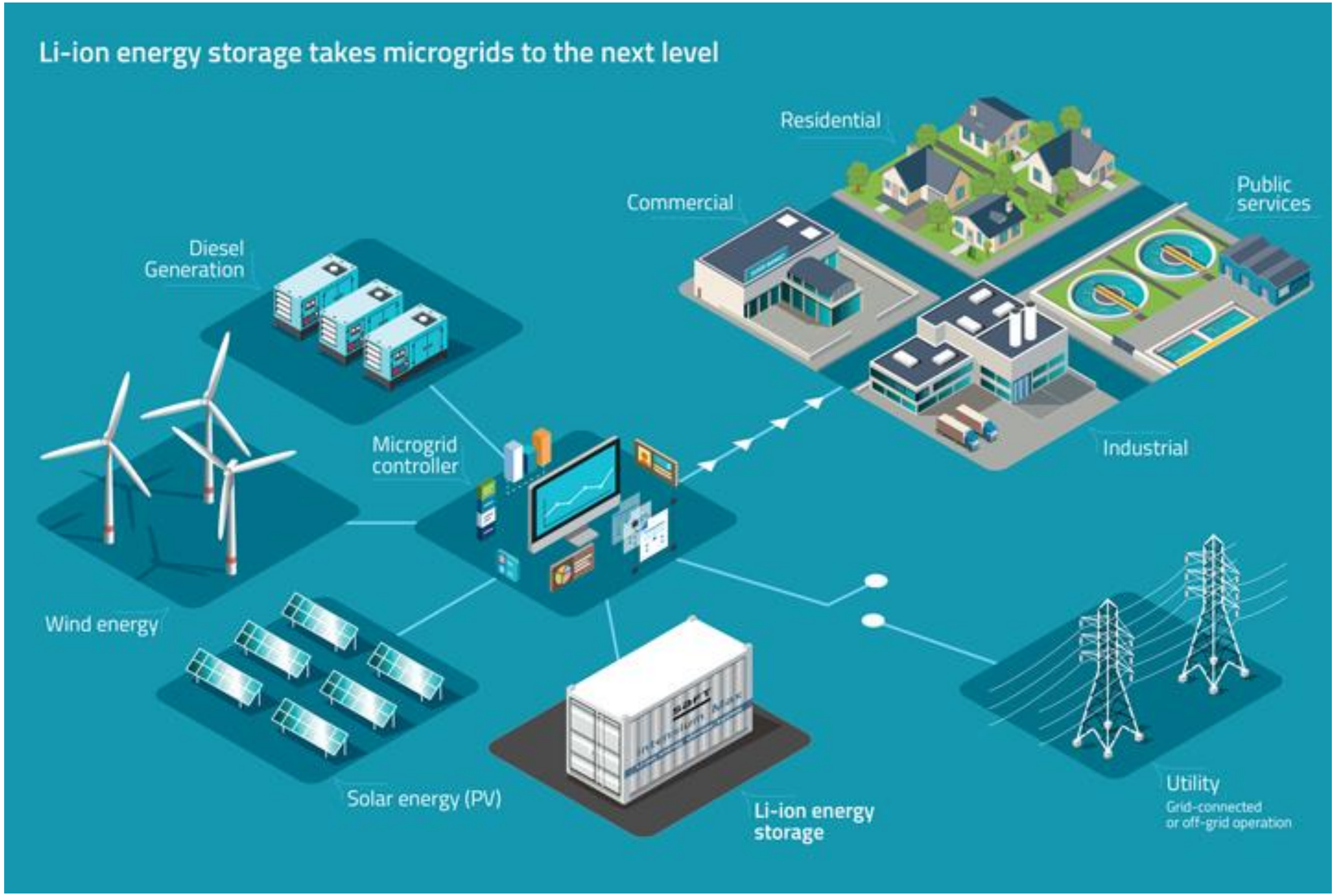
Dry floodproof
Elevate
Wet floodproof

69 | RESILIENT RETAIL

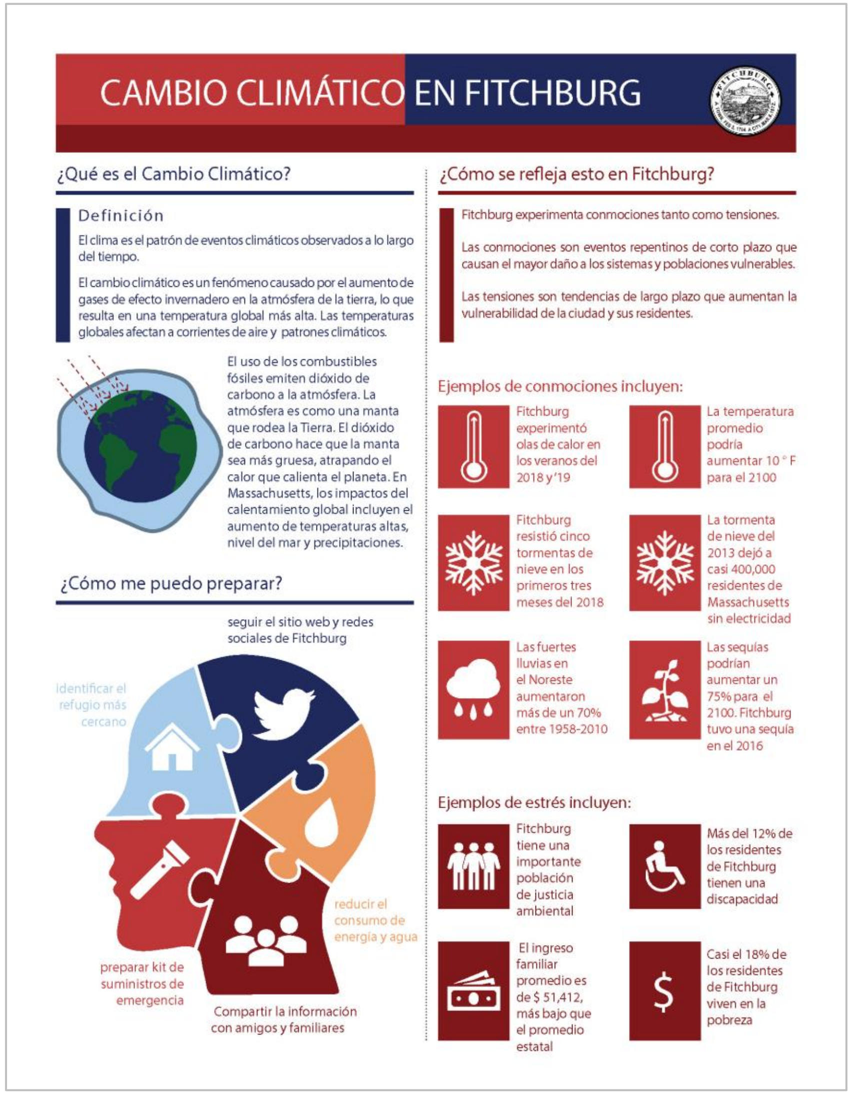
70

SHELTERS, HEATING AND COOLING CENTERS

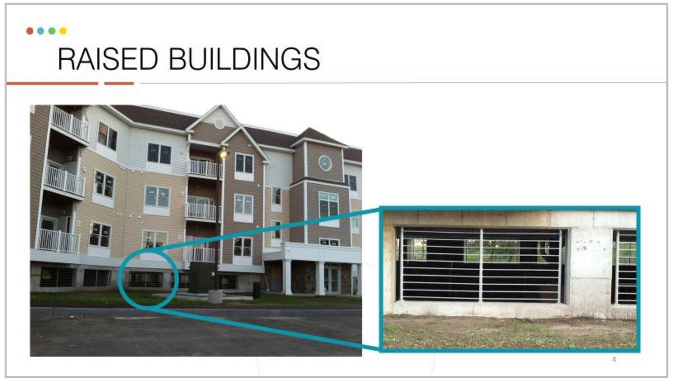
RENEWABLE ENERGY/MICRO-GRIDS

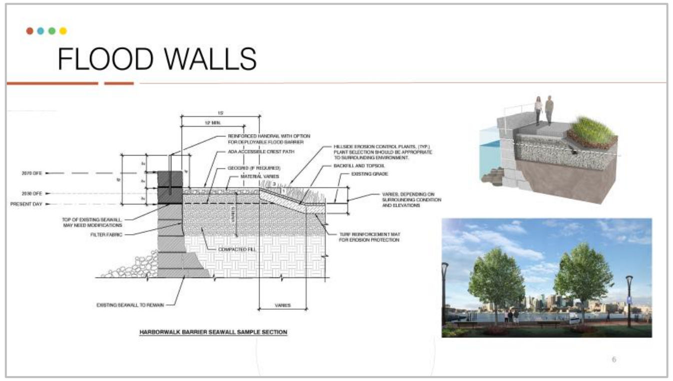


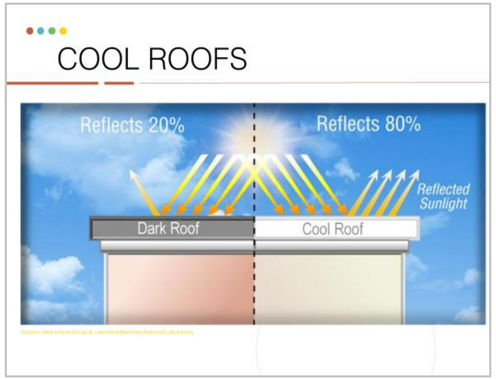
TRANSLATING MATERIALS

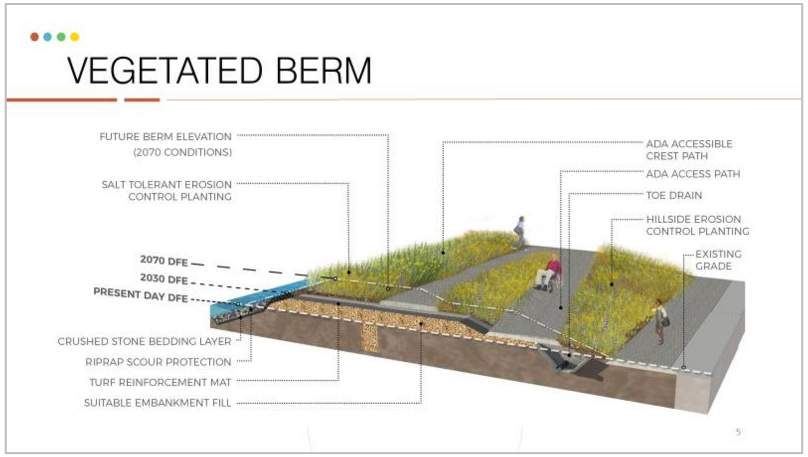


ADDITIONAL ADAPTATION STRATEGIES









NEXT STEPS

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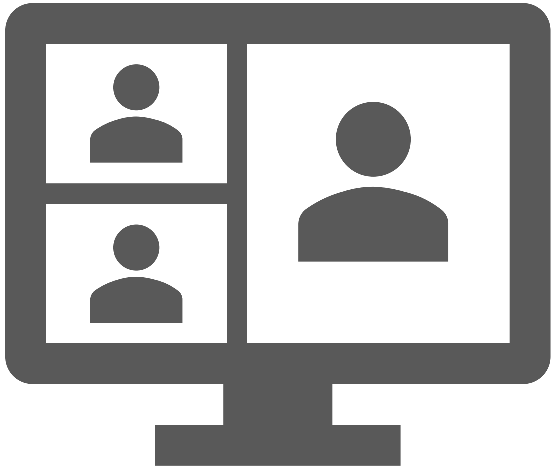

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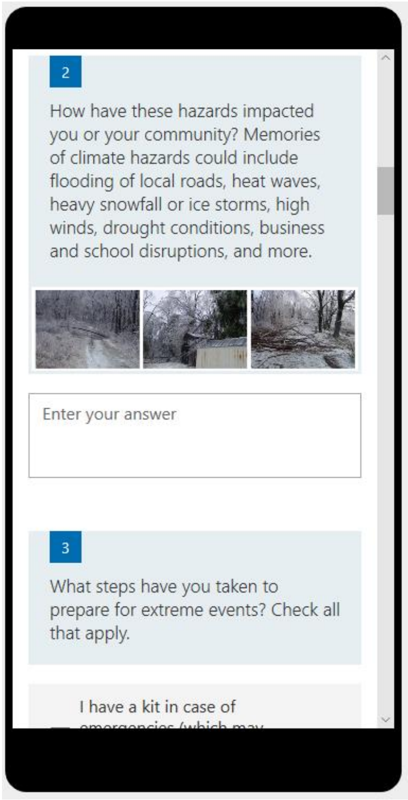

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Photo: Town of Richmond Facebook Page

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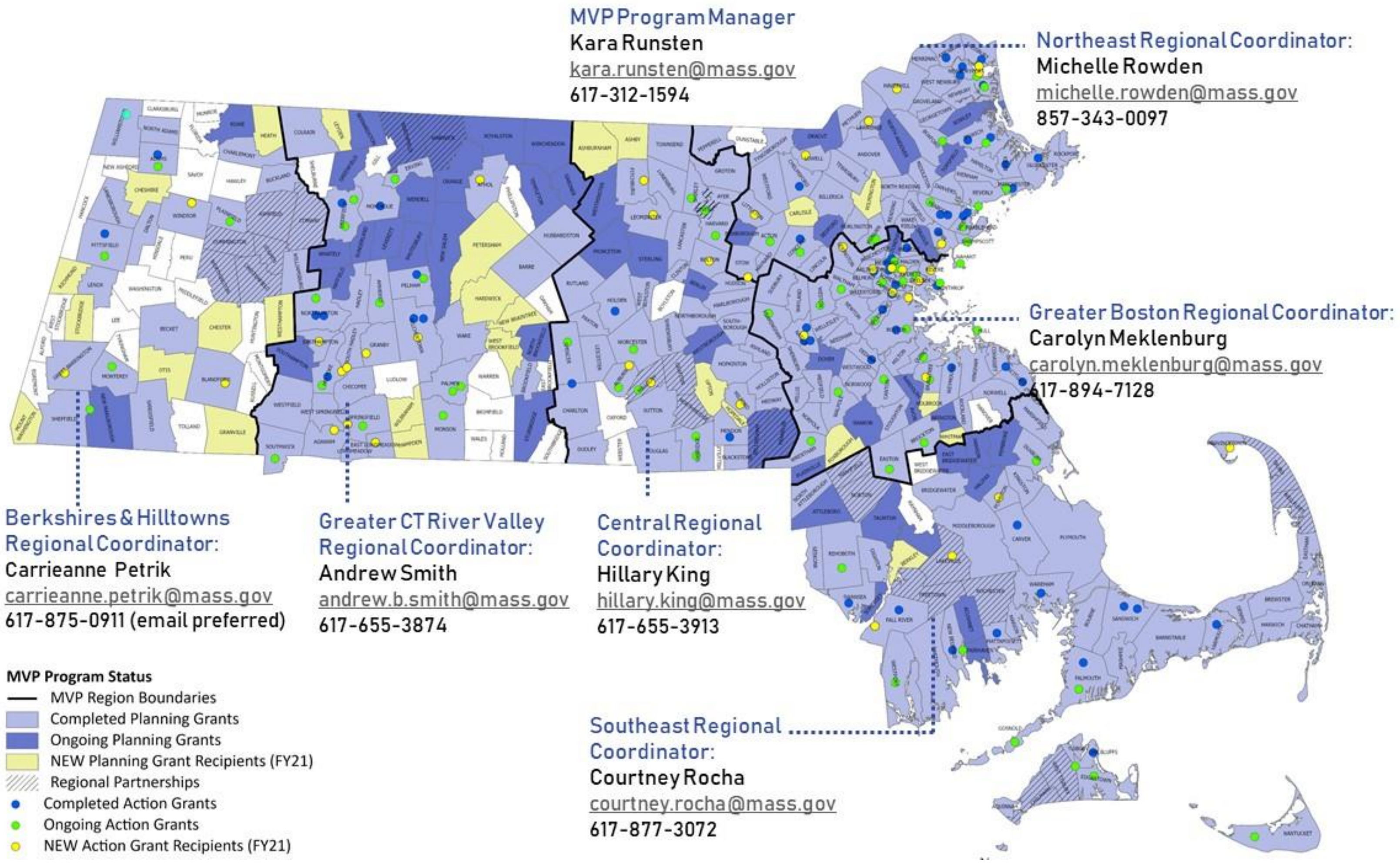

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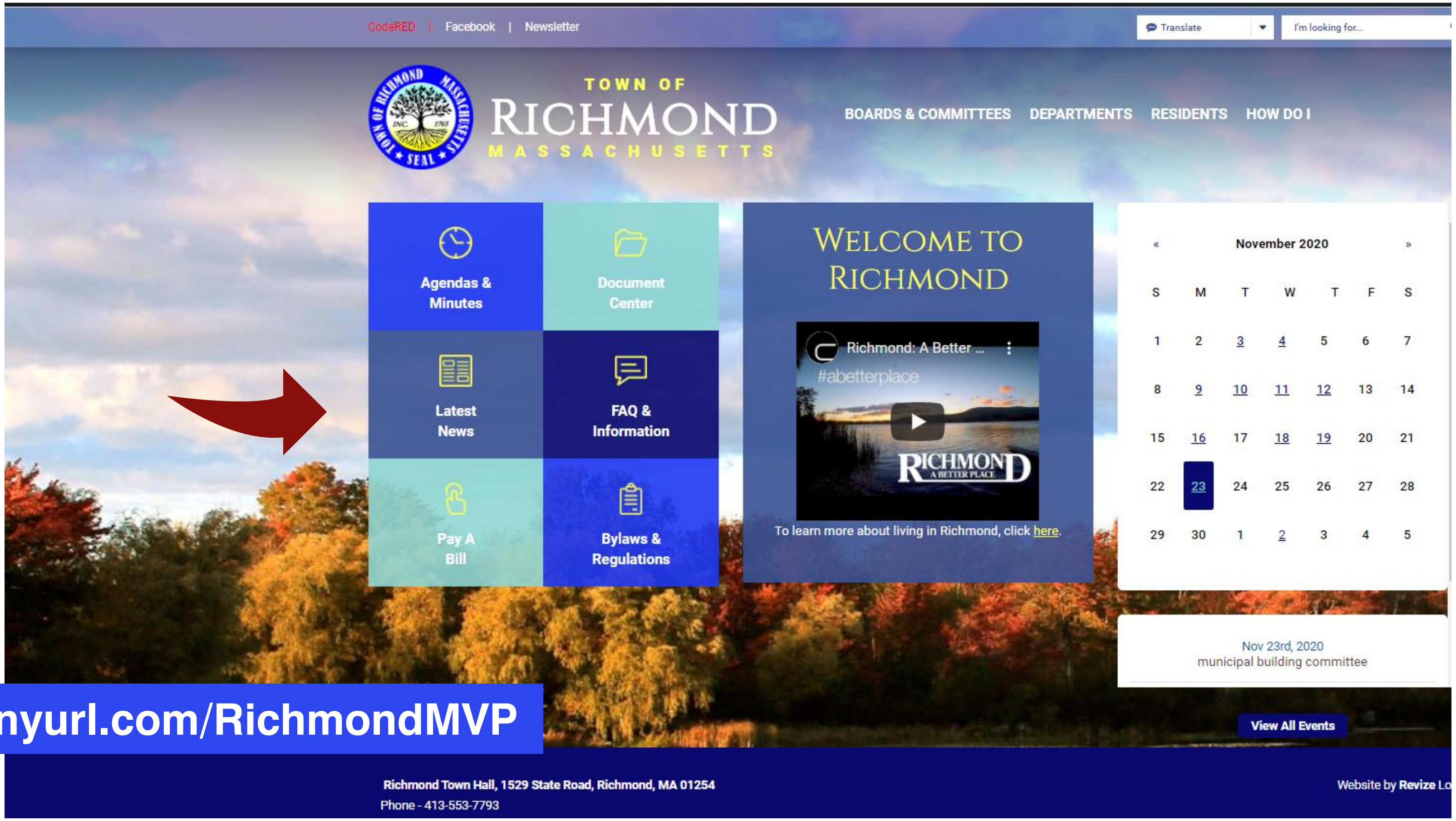

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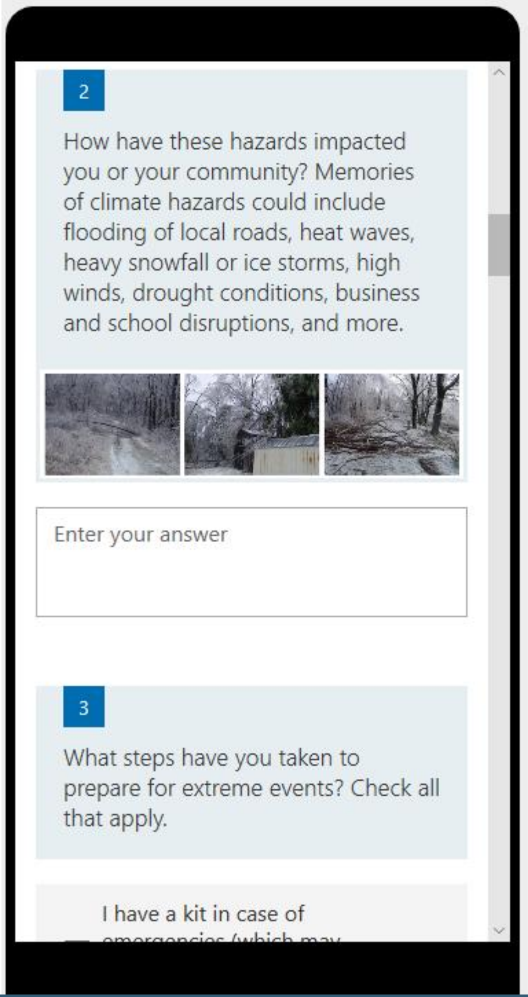

tinyurl.com/RichmondSurvey1

Preliminary Public Survey Results

tinyurl.com/RichmondSurvey1

What climate hazard are you most concerned about?

Rank	Options
1	Winter weather (Nor'easters,
2	Drought
3	Extreme temperatures
4	Severe wind events (tornado,
5	Flooding
5	Brushfires and wildfires

Preliminary results will be updated and shown here

Preliminary Public Survey Results

tinyurl.com/RichmondSurvey1

How have these hazards impacted you or your community?

Preliminary results will be updated and shown here

Preliminary Public Survey Results

tinyurl.com/RichmondSurvey1

- [ ] Water supply and infrastructure (drinking water wells)
- [ ] Wastewater infrastructure (septic systems)
- [ ] Emergency facilities, including shelters and the Fire Station
- [ ] Communications infrastructure, including CodeRed system
- [ ] Natural features, including open space, trails, trees, ponds, wetlands, streams, and fisheries
- [ ] Public facilities, including the library and schools
- [ ] Public support systems, including Meals on Wheels
- [ ] Transportation infrastructure, including roads and bridges
- [ ] Agriculture, including winery and apple orchards
- [ ] Local businesses
- [ ] Other

What are Richmond's greatest strengths?

Preliminary results will be updated and shown here

Preliminary Public Survey Results

tinyurl.com/RichmondSurvey1

What are Richmond's greatest vulnerabilities?

- [ ] Culverts, undersized drainage infrastructure, impervious surfaces, and stormwater runoff
- [ ] Impacts from beavers, including flooding, damage to electrical or gas generation equipment, and water quality concerns
- [ ] Vulnerable populations, including identifying shelter capacity, meeting medical needs, and reaching at-risk residents
- [ ] Potential dam failure
- [ ] Erosion of land surrounding bridges and roadways
- [ ] Increased public health hazards posed by climate change, including ticks and asthma
- [ ] Invasive species, crop disease, and pest infestations
- [ ] New development in hazard-prone areas
- [ ] Drinking water wells during drought
- [ ] Power outages due to extreme wind or winter weather events
- [ ] Communications/Phone outages due to extreme wind or winter weather events
- [ ] Former landfill site impacting water quality
- [ ] Degradation or loss of priority natural areas and core wildlife habitat

Preliminary results will be updated and shown here

Preliminary Public Survey Results

tinyurl.com/RichmondSurvey1

What is most important when considering natural hazard mitigation and climate resilience?

- Updating bylaws and regulati...
- Pursuing data or studies show...
- Conducting assessments and ...
- Improving stormwater manag...
- Redesigning critical infrastruct...
- Increasing public education re...
- Pursuing land acquisition to re...
- Identifying needs for shelters, ...
- Identifying needs for public fa...
- Acquiring additional emergen...
- Planning for water restrictions,...
- Planning to address invasive s...
- Other

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RISK MATRIX

Photo: Town of Richmond Facebook Page

RISK MATRIX

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Features	Location	Ownership	V or S	Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) 1-hazards				Priority H - M - L	Time Short Long Ongoing
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Societal									
2-features				3-strategies					
Environmental									

TOP CLIMATE HAZARDS IN RICHMOND

Flooding

Winter weather
(Nor’easters, ice storms,
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Wind events
(thunderstorms,
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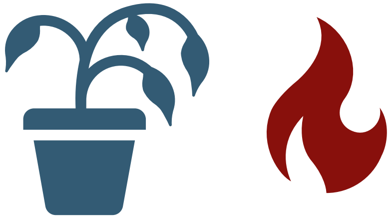


Extreme heat/
Drought/Wildfire

RISK MATRIX: FEATURES

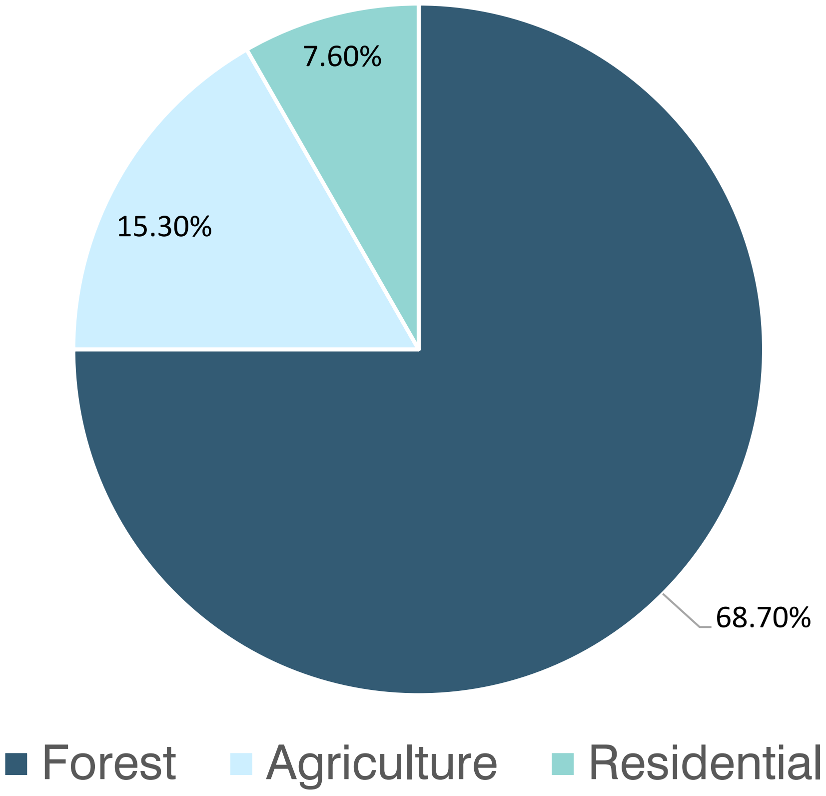
FEATURES	LOCATION	OWNERSHIP	VULNERABILITY OR STRENGTH
Infrastructural	Town wide	State	Vulnerability
Societal	Multi- vs. Single-neighborhood	Town	Strength
Environmental	Specific location	Private	Both
		Shared	

ENVIRONMENTAL FEATURES

Town Facebook page

- Open Space and Recreation Areas
- Trees and Forests
- Wildlife
- Richmond Pond
- Former Landfill
- Local Agriculture
- Invasive Species
- Flood Maps

LAND USE

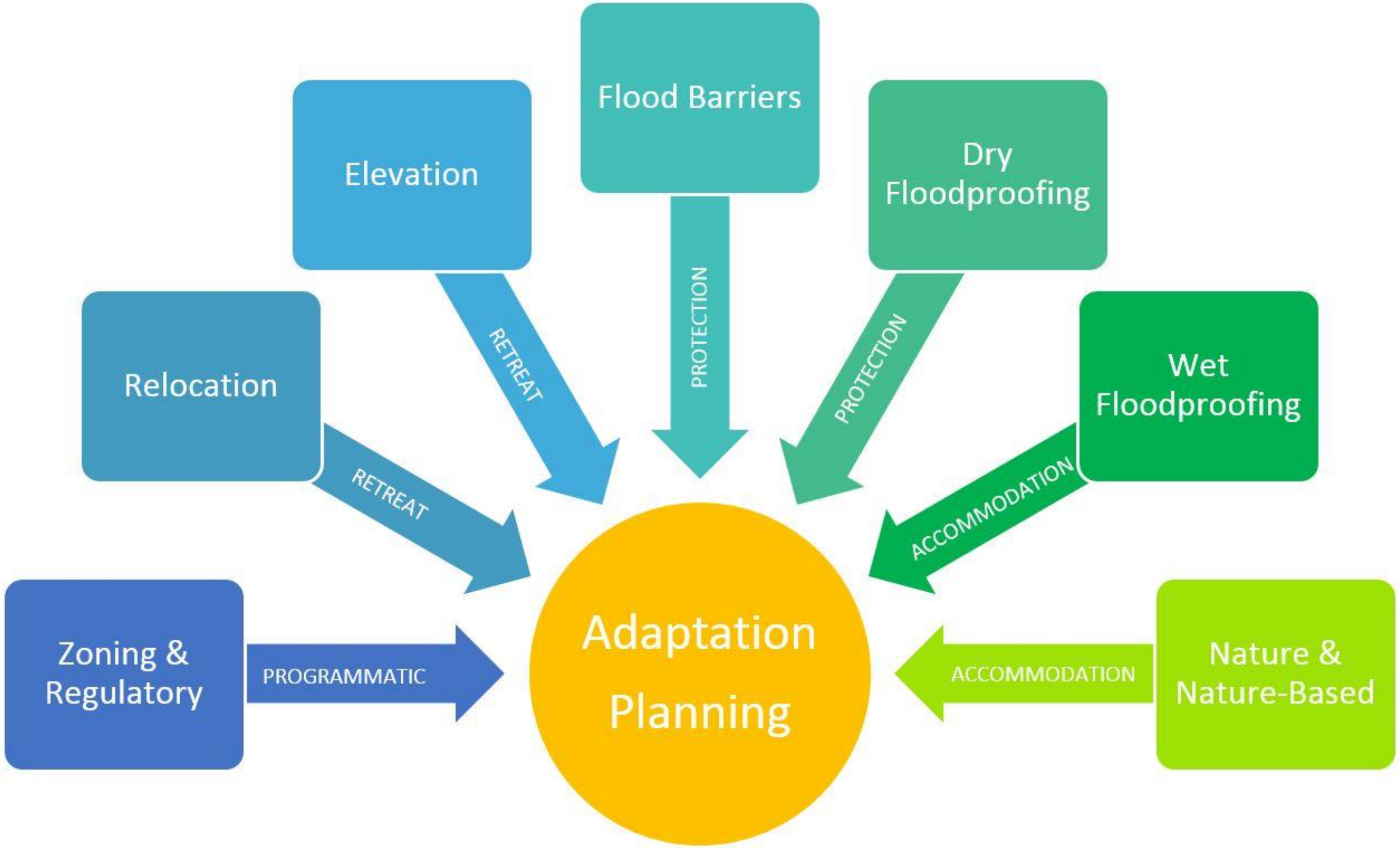


- Primarily residential
- Small retail businesses
- Commercial orchards
- Small farms

ADAPTATION STRATEGIES: NATURAL RESOURCES

Photo: Town Facebook

ADAPTATION STRATEGY TYPES



LOCAL REGULATIONS & POLICIES

EVALUATE EXISTING

- Stormwater Management Standards
- Town Wetland Bylaw
- Zoning Bylaw

ADOPT NEW

- Protection (Tree, Water Supply, Groundwater)
- Limiting Requirements (Impervious Surfaces)
- Allowances (Green Roofs)
- Incentives (Fee Waivers)

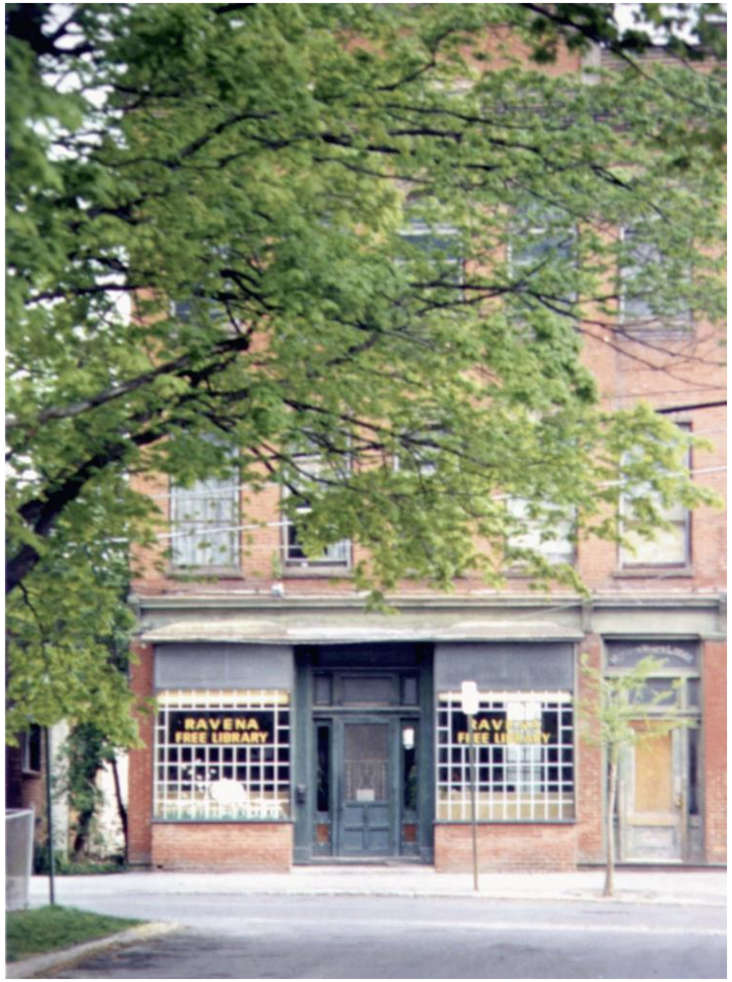
WETLAND RESTORATION

Wetlands in Troy, New York

REMOVAL OF INVASIVE SPECIES

Invasive Japanese Knotweed in Arlington, MA

TREE OR FOREST MANAGEMENT



Tree species, placement, and maintenance recommendations by W&S for Ravena, NY

LAND AQUISITION

As part of an MVP Action Grant, Mattapoisett purchased 120 acres of forest, streams, freshwater wetlands, and coastal salt marsh as conservation land to prevent development in vulnerable areas

Image from EOEAA, 2019

REMEDIATE CONTAMINATED SITES

Medfield State Hospital, Remediation along the Charles River

BANK RESTORATION & STABILIZATION

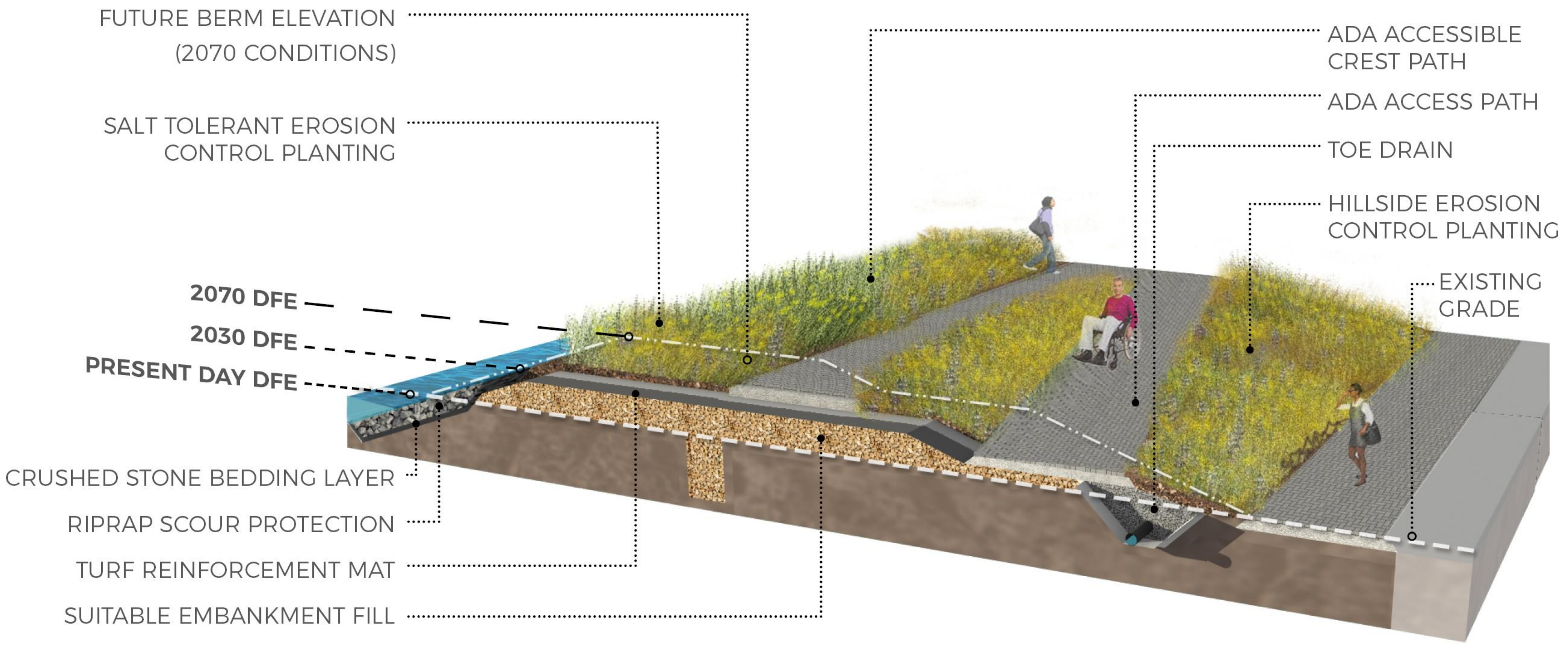
Live Crib Wall

Vegetated
Retaining Wall

Joint Planting

Gabions

VEGETATED BERM



MULTI-PURPOSE FLOOD STORAGE

LOW IMPACT DEVELOPMENT (LID)

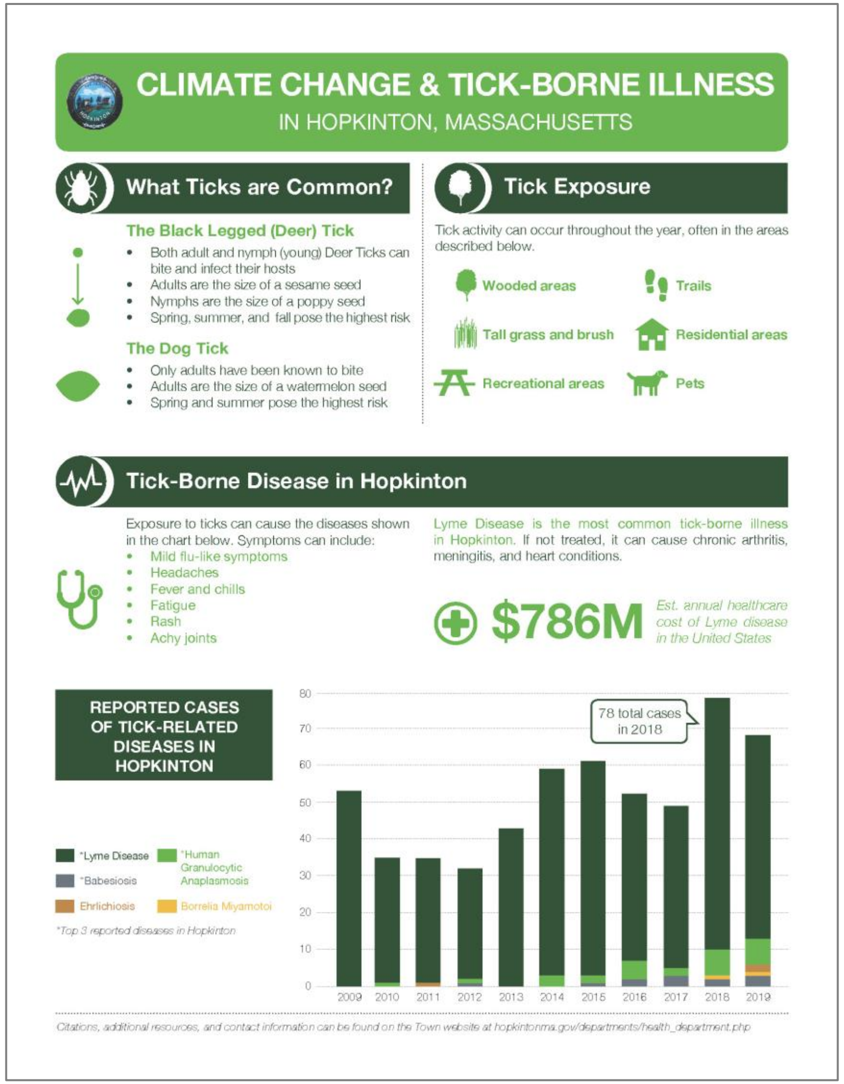
Bioretention

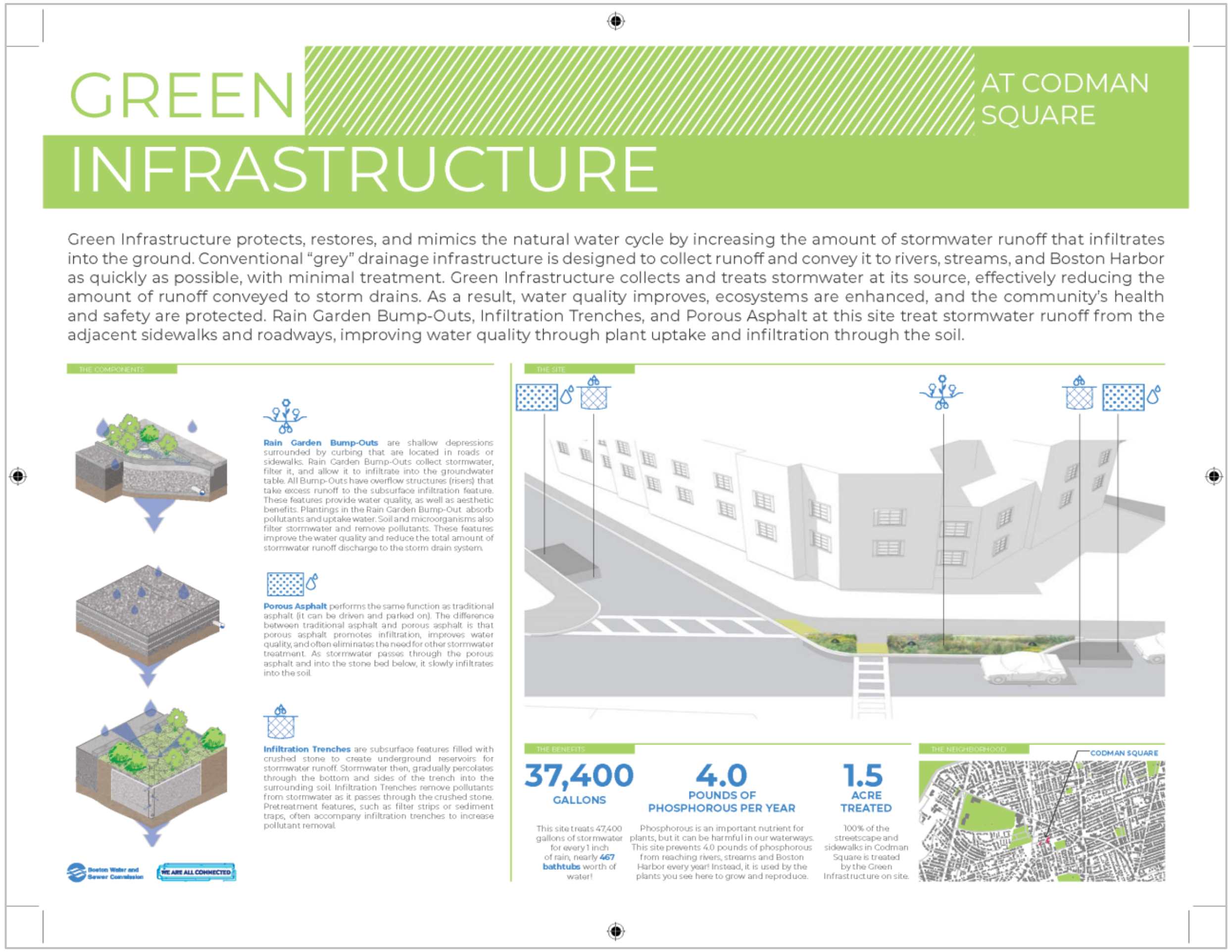
Rain Gardens

Tree Box Filters

Permeable Pavement

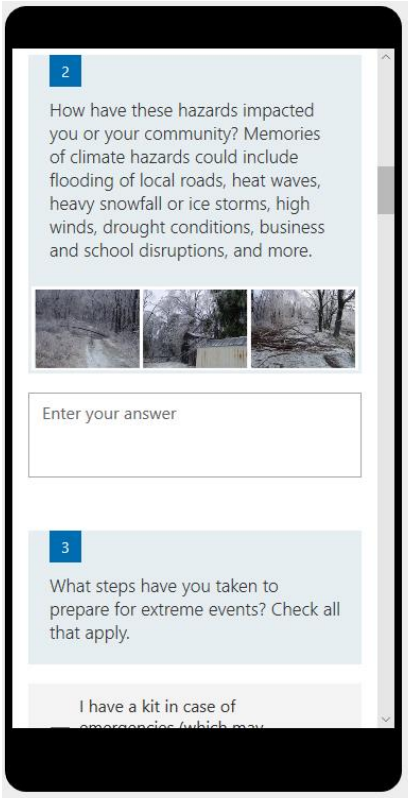
EDUCATION, OUTREACH, SIGNAGE





NEXT STEPS

Thank you for joining us today!



Watch our video and take the survey by Dec. 31!
tinyurl.com/RichmondSurvey1

Check out our project webpage and stay tuned for upcoming events!
tinyurl.com/RichmondMVP

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Floods	Wind events/hurricanes	Winter storms/extreme cold	Extreme heat/drought/fire	Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Electrical infrastructure	Town Wide	Eversource	S	Eversource Energy invests time and money into clearing potentially hazardous trees and improving the robustness of the electrical system (e.g. routing lines underground).				M	O
				Town needs to partner with Eversource to continue to identify these potential hazardous areas and improve the communication. Eversource is expanding the app on outage map (publicly accessible, estimated time) to allow access to Pete to upload photos. Zoning for any new subdivisions already requires underground.				M	L
Emergency shelters	Richmond Consolidated School	Town	S V- during COVID	School has a generator, but wifi is not publicly accessible. Setup a guest account for use at the school.		New town hall-- 2 years out. Solar ready. Outside wifi. Think about heat/shading		H	S-M
Culverts and bridges - assessment forthcoming	Town Wide (Sleepy Hollow Road, culvert; Tracy Brook Wildlife Sanctuary culvert)	Town	S	Implement priority projects from the town's existing field inventory of culverts and bridges for increased flooding resiliency and storm -hardening, using future expected storm events. Including design of priority resizing and replacement projects. Green Infrastructure, Low Impact Design, and other nature based solutions should be integrated with hard-infrastructure improvements.		Prelim of top priority culvert will be finished in next few months. Address erosion with nature-based solutions and look for opps for riparian buffers.	Town is working with HVA on a road/stream crossing survey and assessment. Ensure upgrades consider stream crossing standards and size of likely future storm events.	H	S-O
Roads	Town Wide (off Rte 41, Swamp road; Rossiter Rd)	Town	V	Based on data from the road/ stream crossing assessment, set prioritization for resizing and upgrading of culverts to minimize risk.	Analysis of watershed for infiltration to reduce flash flooding downstream through forest protection zones or riverfront resource areas to implement via permitting and education.	Evaluate alternatives to sand and salt for winter road mainenance, focusing on the effectiveness, environmental imapacts, and cost.		M	M-O
					Conduct outreach to residents regarding winter road maintenance to build the understanding of the impacts of the deicing materials, and encourage safe winter driving practices.				
				Continue maintenance of drainage along gravel roads to avoid flooding, and washout		Continue to upgrade the structure of gravel roads to simplify winter maintenance and reduce potential mud from freeze/thaw cycles	Continue working with our existing dust control policy to minimize the amount of potential hazardous materials in air		
				Continue working with Street scan Program for the preservation and construction plan of paved roads to extend the life expectancy. This will coincide with road capital development plan for cost savings and preventative maintenance measures					

Drinking water wells	Town Wide	Private/ CWS / PWS	S/V	Conduct outreach to residents for the best use practices and educate them on the impacts during these events. Wells are tied to power --- education on storing water in anticipation of storms. Infiltration of GW will improve resilience during droughts = protection of source area including rivers, streams, marshes, and ponds. Think about a water tower/storage.	M	L- O
Wastewater Infrastructure	Richmond Shores - public Rest of town - septic	Town/Private	S	Continue assessing wastewater system and implementing upgrades, particularly at pump stations, collection points and treatment locations. (stormwater) Establish a priority action for reducing potential flooding impacts, address infiltration and inflow, and incorporating nature based solutions or green infrastructure approaches. Maintain plans for emergency back up power at the pump stations (beyond generators?). Explore storm hardening and protective strategies and equipment, including elevating or adding barriers to vulnerable locations in network. Keep septic system leach fields out of floodplains	M	O/L
Telephone Network/Communications	Town Wide	Magna 5 Town has Code Red System	V	Town needs to partner with Richmond Phone/Magna 5 to identify potential hazardous areas. Fiber to Town Hall (high speed internet/limited parking/no generator). Backup power at library for wifi; Increase sign-up for phone alerts -- cell phones. Cell tower has a generator. Explore areas where cable	H	S
Beavers	Town Wide	Town	V	Evaluate/maintain Beaver management plan to mitigate against unpredictable flooding/ impoundment impacts - be proactive and look holistically at management (pond levelers is current practice)	L	O
Underground Storage tank	DPW Garage	Town	V	Town owns and manages a double chamber underground fuel tank containing both diesel and gasoline. Continue to monitor fuel management system. If upgrade/replacement needed in future, try to locate out of buffer zones and flood plain.	L	O
Buildings and Facilities, Homes (shelter in place)	Town Wide	Town/Private	S	Increase tree canopy to provide shade to buildings. Consider if roofs are structurally sound where green roofs can be installed.	M	O
				Evaluate the opportunities to provide improvements at all facilities, especially emergency backup power, including feasibility of green power and battery storage (e.g. at DPW Garage and Fire Dept). Town bylaws that encourage green infrastructure and possible incentives. Community level buying/buying power to increase programs.	M	L
				Richmond School has its own backup power source. Work with insurance companies for educational material (may be use historical data to see past effects, encourage looking at changing trends due to climate change). Explore more options through the NFIP.	M	O
Societal						
Historic district and	Summit Rd,	Public/Private	neutral asset	Establish a Richmond History Museum? Perhaps as a part of the new library/townhall (Ties into	N/A	N/a
Populations at risk of isolation (could include seniors, residents with disabilities, children) or facing other risks (outdoor workers)	Town Wide	Private; Boys Club; Organizations that serve these	V	On-call transit service for seniors and other people that may need transportation services. Food service/Bartlett food service. The Church also has outreach programs for people in need. Establish list of grants for existing services. Education to normalize/encourage the use of these services. Develop a program connecting the school/youth and seniors to create a video on supporting neighbors and other topics. Lots of work happening with West Stockbridge- sharing a fire and ambulance services (new ambulance), van (W.Stockbridge bought a new van), CoA, meal and lecture series. Need to explore other services that can be provided regionally.	M	L-O

Vulnerable Neighborhoods- limited access, second homeowners	Richmond Shores, Whitewood (has good access?), Branch Farm; Branch Farm Condo Assoc. (poor access)	Private	V - limited worry about access	Develop education and outreach to residents in potential risk areas; ensure families residing in these areas are aware of potential risks and mechanisms to reduce their risk exposures (prepare, respond, adapt) including alternative evacuation routes and techniques. Attend webinar on findings of MVP Action grant on gravel/dirt roads. Snow clearing done by town-- blacktops first then move to gravel in emergency coordination with police, fire and utilities; Vehicles (swamp buggy) could be an option - the storage and cost may be a deterrent	M	L
Emergency Response (Volunteers/Communications)	Code Red/Facebook page/ Fire and ambulance	Public; fire shared with W. Stockbridge	S	The Town has recently signed an IMA with West Stockbridge Fire Department in order to increase response times for both Fire and EMS. They are also part of the Berkshire County Mutual Aid Agreement and with surrounding towns in Columbia County, NY; Localized advertising for people to sign up for Code Red (right now we put a banner up in summer) could put in Richmond Record, facebook, etc., to communicate to part time residents or renters about CodeRd situations (improve channels beyond those that only reach owners).	M-H	M-O
Emergency Shelter	Richmond Consolidated School	Public	S/V	Richmond has a sheltering plan in place but needs to update and maintain emergency shelter protocols and supplies.	M	M
				Update staffing protocol and training for emergency situations; New town hall-- 2 years out. Solar ready. Outside wifi. Think about heat/shading enhancements for the building	M	M
Tourism	Balderdash; Bartletts; Hilltop	Public/Private	S/V	Inclement weather has a negative impact on the use of the apple orchards, open spaces and trails Drastic fluxuation in temperatures would discourage the attandance of events	M	M-L
Recreation (includes the school Tennis court and baseball/athletic fields, playground and a dormant trail)	Richmond Pond Beach, Olivia's Overlook (road is in Richmond but the rest is in Stockbridge), Steven's Glen, Hollow Fields; Trails; Tracy Brook Wildlife	Town	V	Beach facilities need improving; limit/regulate the parking for road safety near trails, especially on Lenox Mt. road; work with BNRC for more bike access/paths/road safety, inclusing consideration of reduced speed limits; tie into the Berkshire County trails plan; Land acquisition/protection for Richmond connections to BNRC High Road effort-- expanding trail; BNRC key player in this discussion and might be able to provide some van service; add bike parking at the trailheads and encourage biking to these destinations (unsafe in some areas like Olivia's Overlook). New Municipal Building with common space for social activities is needed as right now elder exercise classes are in same room as Town Office areas.	M	M
Environmental						
Trees and Forest	Town Wide	Public/Private	V/S	Develop a comprehensive tree and forest management program that builds to identify, remove, and replace problem trees, preserve forests and street cover; provide guidance and resources to gradually move towards more climate-resilient trees and forest communities; increase awareness of scenic mt act; assessment on tree species to recommend with climate change	H	O
Open space and recreation areas	Town Wide	Public/Private	S/V	Continue working with nature sanctuaries for the preservation of nature trails and open use recreation areas; coordinate this plan with the Open Space and Recreation Plan actions; trail along the buffer zone with educational signage; ConCom owns several properties with invasives that need some plans to manage - Nordean Swamp, southern side of town beach road is a wildlife management area and some is owned by Boys Club; Open space ownership/condition/coordination plan; Central ridge where High Road runs, on Richmond side the only protection is the scenic mt act- not highly protected at this point - look for partnerships for purchase of the land for sale and to acquire for protection and habitat.	M	O

Wildlife	Town Wide	Public/Private	S V-Beavers	Add to existing Town wide plan to maintain open space corridors and appropriate habitat for small and large mammals (coyotes, bear, deer), turtle habitat, vernal pools; consider the role of predators; natural heritage group has a plan for turtles along rivers and streams. Identify the vernal pools throughout the town; research beaver best management practices and develop a comprehensive beaver management plan. Identify and mark possible wildlife crossing areas (also related to stream crossing survey under culverts and bridges), consider installing wildlife crossings for migratory species under busy roads.	H	O
Richmond Pond and other ponds	Richmond Pond		S/V	Evaluate the opportunities to improve watershed protections to preserve and improve the water quality. Work with Pittsfield in the continued development of plan to monitor cyano bacteria and algae blooms. Coordinate (RPA and ConCom) with Pittsfield and new owner on development plans to protect water quality, wildlife, and recreational values Develop a management plan to include the maintenance of several detention basins and storm water run-off within the Richmond Pond watershed; coordinate with the Richmond Road-Stream Crossing Management Plan.	H	O
Streams and Rivers			S/V	Local Flood Hazard Analysis, which essentially models flood depths under different mitigation scenarios to understand which projects would do the most to reduce flood risk; update list of streams -- some are not named or mapped and need to be for protection; implement the Richmond Road-Stream Crossing Management Plan. Assess buffer zone policy for streams (100 ft for intermittent; 200 ft for perennial) to limit disturbance.	H	S
Former Landfill	Cone Road	Town	V	Maintain a comprehensive plan for management of land fill, which would include upgrading the capping process, monitoring neighboring wells and routinely cutting vegetation	L	L
Invasive Species - multiflora rose, bittersweet, etc.; link between invasives and ticks	Town Wide	Public/Private	V	Develop a comprehensive invasive species management plan from inventory stage through management planning and implementation to address existing invasive populations that threaten features such as open space or forests, both which contribute to resiliency, as well as anticipate new invasives that are likely to move into the area as climates shift; develop a list of species recommended for planting; buy species in bulk for sale in town to incentivize	H	S-O
Wetlands			S/V	MACC recommendation: 50ft of no disturbance, work towards 100 ft no disturbance buffer zones; Address fertilizer use, invasive species, stormwater impacts, protect water quality	H	S-O
Flood Mapping, bylaws (Scenic Mountain Act and local bylaw; Wetlands Protection Act and bylaw; River protection act; Zoning bylaws, Scenic Roads bylaw)	Town Wide	Public enforcement/ Private development	S/V	Update the Town Flood Maps (underway but may take a few years); any proposed bylaw updates need to consider affordable housing compliance; currently ask for compensatory flood storage and tree plantings; currently send out ideas for plantings along the shorelines of ponds. Develop a Master Plan to identify areas where development can occur and where we need protection to update zoning including floodplain overlay; education on bylaws/scenic mt act; utilize cpa funds for vegetation improvements (balance with taxes); new resident packet or liaison for new residents	H	S
Pest and disease control and vector borne disease (ticks, mosquitos, Asian long horn tick, Asian tiger mosquito)	Town Wide		V	Town is part of Berkshire County Mosquito Control- monitors mosquitos but can't look at ticks; develop a plan for addressing emerging pest species, including consideration of negative chemical impacts on animals and humans; habitat for bats/construct bat houses; wetland health improvements-- removing phragmites; education about shoreline plantings	M	O
Local Agriculture	Town Wide	Private	S/V-fertilizer	Conduct strategic planning to support regional agriculture in the face of climate change. Planning should address hazard resiliency and approaches to connect growers with local buyers, including low impact farm stands and exploring food-only farmers market; Right to Farm community	M	M-O

General Objective	Mitigation Action	Timing (years)	Responsibility
Food Security	Public outreach to normalize and encourage the use of food outreach services.	3-5	Board of Health; Council on Aging
Future Development, Regulatory Tools, and Planning	Explore affordable housing constraints caused by current zoning and regulations	1-3	Planning Board
Local Businesses	Develop a strategic plan to support regional agriculture in the face of climate change	3-5	Agriculture Commission
Local Businesses	Enhance access to local buyers through strategies such as a farm stand and food-only farmers market	1-3	Agriculture Commission
Parks and Open Spaces	Explore land acquisition/protection partnerships for expanding wildlife corridors, wetlands, and other biologically important areas	3-5	RLT, BNRC, ConCom
Private Wells and Septic Systems	Conduct outreach to residents about the best practices of wells, including the need for backup power or storing water before possible storm-caused power outages.	1-3	Board of Health
Public Water Supply	Create a comprehensive management plan for landfill, which would include upgrading the capping process, monitoring neighboring wells and routinely cutting vegetation	5-10	DPW, State, Board of Health
Public Water Supply	Conduct a heat/drought vulnerability assessment on Richmond's water supply and infrastructure.	3-5	DPW, Board of Health
Residents at Risk of Isolation	Develop preparedness outreach materials on evacuation routes, ways to get help, and support your neighbors in emergency	3-5	Board of Health
Residents at Risk of Isolation	Develop a preparedness program that connects at-risk seniors with youth via partnership with school/regional organizations	3-5	Board of Health
Residents with Barriers to Preparing or Adapting (includes low income residents)	Assess regional housing needs to include affordability and climate migration, and identify opportunities for increasing housing diversity	5-10	Planning Board
Roads, Bridges, and Public Transit	Evaluate alternatives to sand and salt for winter road maintenance	3-5	DPW

General Objective	Mitigation Action	Timing (years)	Responsibility
Roads, Bridges, and Public Transit	Increase winter road safety outreach to residents located near frequently washed out roads, including guidance on evacuation routes	3-5	DPW
Roads, Bridges, and Public Transit	Develop roadway capital development plan for preventative maintenance measures on paved roads and expansion of paved areas (i.e. upgrading gravel roads)	3-5	DPW
Wastewater System	Improve outreach to discourage pumping from private homes when flooded to wastewater	3-5	Sewer operator

Appendix D

Public Engagement

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

Richmond MVP Survey

Summary of Survey Results and Public Comments

Introduction

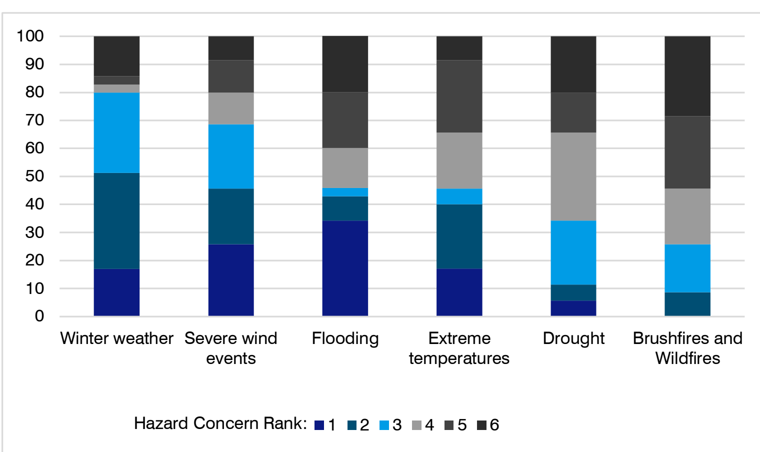
The Town of Richmond was awarded a Municipal Vulnerability Preparedness (MVP) Planning Grant to improve the Town's resilience to climate change and to mitigate natural hazards. The MVP Program aims to provide technical and financial support for cities and towns across the Commonwealth to plan for, and mitigate the impacts from, climate change. As part of the virtual Public Listening Session, the project team shared a survey with the community to collect public feedback related to climate hazards, strengths, vulnerabilities, and priority adaptation action items. Key information related to the results of this survey are summarized below:

- The survey was accessible on the Microsoft Forms website from December 10-December 31, 2020.
- A link to the online survey was shared on December 10, 2020 through the following means:
    - Posted on the Town's social media pages
    - Posted on the Town's webpage
    - Printed in the Town newspaper
    - Shared in an email blast to the town's residents and the project stakeholder list
- The project team received 36 online responses.

The following summary provides an overview of the survey responses, along with key findings and recommendations for using this information. A spreadsheet of short-answer responses from survey participants, along with a copy of the original survey, are included as attachments to this document.

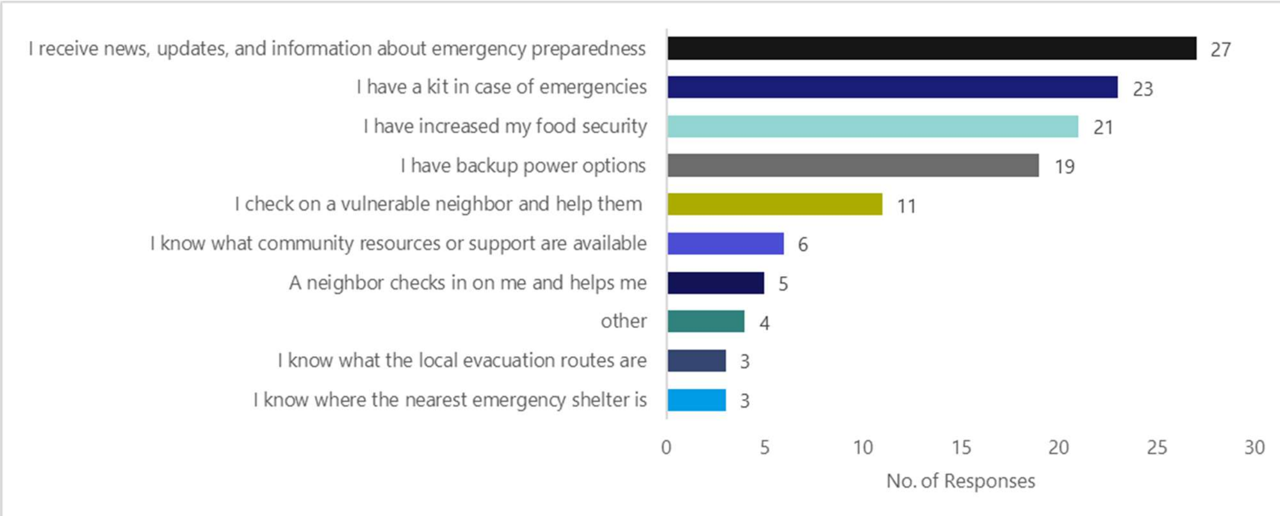
Survey Results

What hazard are you most concerned about?

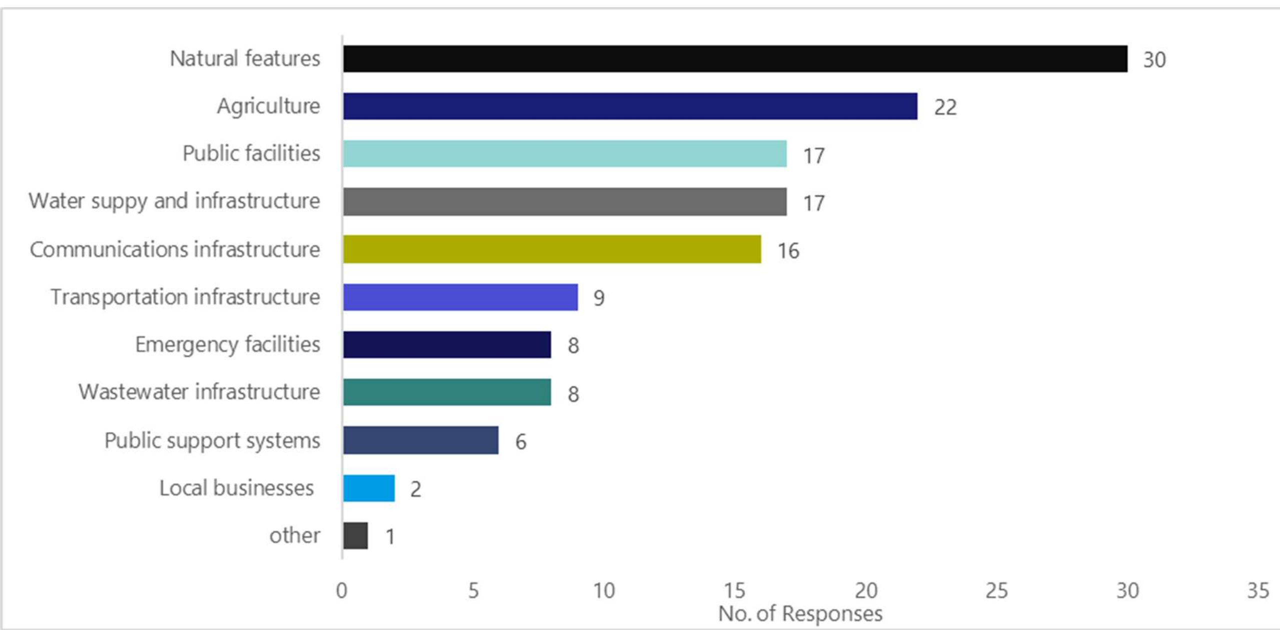


- Survey results suggest that winter weather (Nor'easters, snowstorms, blizzards, ice storms), severe wind events (tornado, thunderstorms, hurricane), and flooding are the hazards of most concern
- Extreme temperatures and drought are hazards of secondary concern
- Brushfires, and wildfires are hazards of least concern

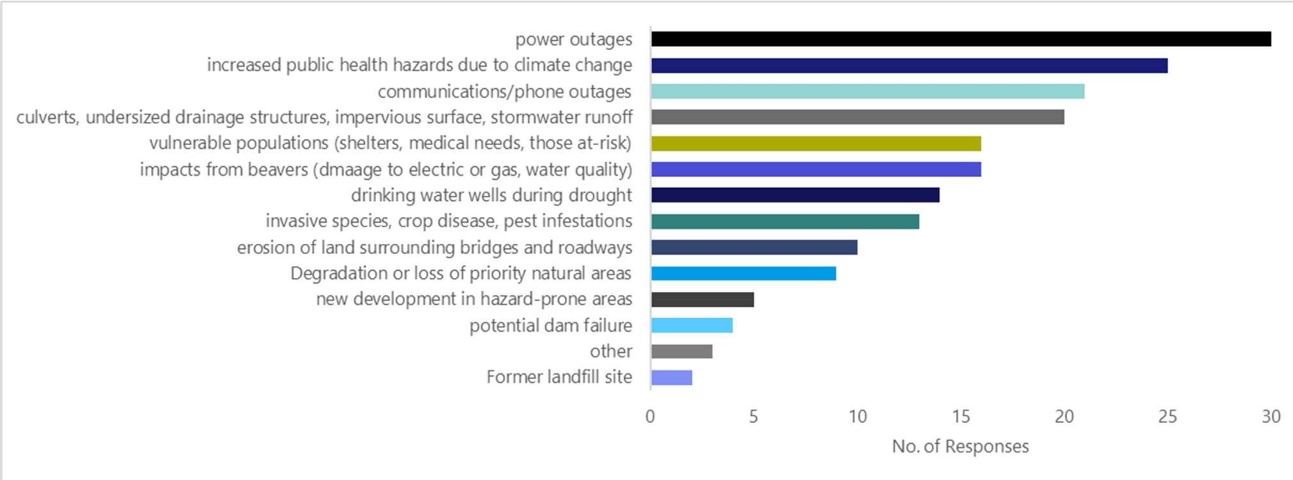
What steps have you taken to prepare for extreme events?



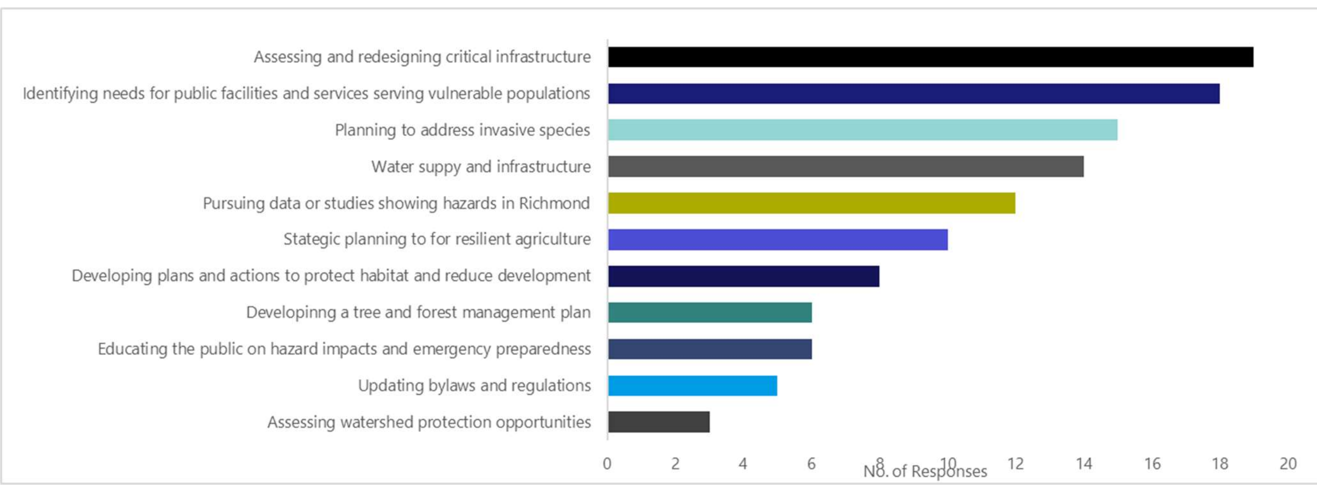
What are some of Richmond's greatest strengths?



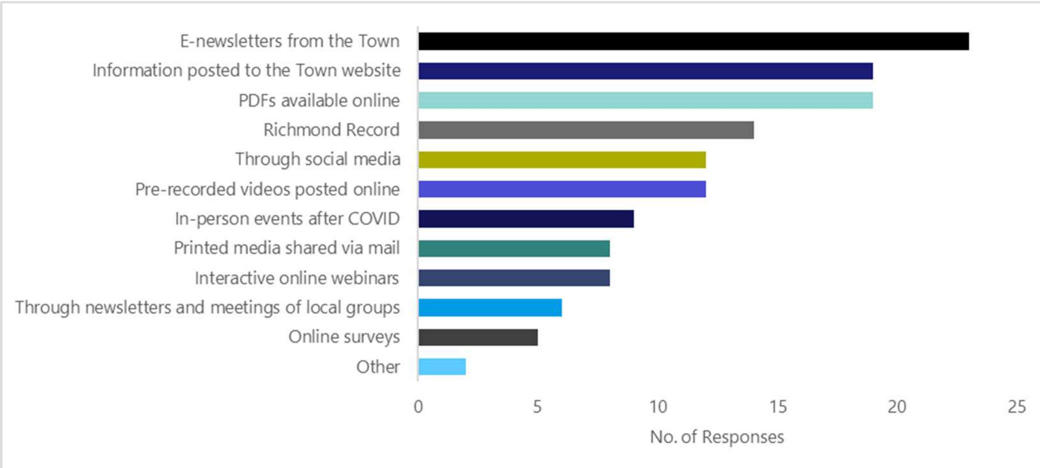
What are some of Richmond's greatest vulnerabilities?



What is most important for Richmond's natural hazard mitigation and climate resilience strategies?



How would you like to receive information about climate change risks and resiliency projects in Richmond?



Summary of short-answer responses:

How have these hazards impacted you impacted you or your community? Memories of climate hazards could include flooding of local roads, heat waves, heavy snowfalls or ice storms, high winds, drought conditions, business and school disruptions, and more.

- Wind storms and winter storms (ice storms, snowstorm, Nor'easters) and associated power outages and property damages appear to have the greatest impact on the residents of Richmond. Seventeen out of 36 responses cite these hazards. Four responses specifically mentioned tornadoes in their response. The next commonly mentioned hazard was flooded, muddy, and impassable roads, due to heavy precipitation. Additionally, three residents cited the impacts of extreme heat.

We recognize that there are overlaps in preparing for, and responding to, any challenge in our community. We are interested in documenting the community experience of COVID-19 in Richmond. What worked well, and what could improve?

- Most of the responses discussed that Richmond generally avoided many of the largest negative impacts of COVID-19 due to its location, ruralness, and amount of open space. Many respondents acknowledged that though the rural area assisted in the containment COVID-19, there were additional challenges including access to grocery delivery and isolation for vulnerable populations. Many actions were perceived to work well, such as mailing out information to all residents, Zoom and parking lot meetings, and limiting entry to Town buildings.

Are there any additional comments or questions that you would like to share with the project team?

- Participants emphasized local vulnerabilities and the need for resources for vulnerable populations such as seniors. Many acknowledged how fortunate they are to live in a small town that has a lot of experience dealing with severe weather and supporting each other.

Key Findings & Next Steps

As the bar graphs indicate, severe storms, including wind storms, winter storms, and heavy precipitation leading to flooding are the main concerns for residents. These storms can lead to power outages and washed out roads. Power outages, communications outages, drainage infrastructure, and increased public health hazards due to climate change are among the Town's vulnerabilities. Conversely, natural features were identified as the Town's greatest strength. According to participants, climate adaption measures should primarily focus on assessing and redesigning critical infrastructure and identifying needs for public facilities and services serving vulnerable populations. Many participants also highlighted that the Town also needs a plan to address invasive species. Participants indicated that they would like to receive additional information on climate change and resiliency through E-Newsletters from the Town and information and PDFs posted to the Town's website and online.

The project team should use the findings of this survey to:

- Address climate hazards such as winter weather, severe wind events, and flooding
- Pursue funding for climate adaptation projects related to:
    - Assess and redesign critical infrastructure
    - Identify needs for public facilities and services that serve vulnerable populations
    - Create a plan to address invasive species
    - Conducting a vulnerability assessment on Richmond's water supply and infrastructure
- Share more information online, including through Town E-newsletters and on the Town's website.
- Use the email addresses collected to send out additional updates related to climate initiatives in Richmond. Additionally, the next public meeting should be advertised via email to respondents who shared their contact information.

Attachments

- Attachment A: Richmond Survey
- Attachment B: Short Answer Responses Spreadsheet
- Attachment C: Email Addresses (not for public version)

Richmond Hazard Mitigation and Municipal Vulnerability Preparedness (HM-MVP) Survey

Hello! We hope you are doing well, and thank you for taking our survey.

Climate change has the potential to impact how we support our community's health and vulnerable residents, how we build our infrastructure, and how we protect our natural resources. Your voice represents a unique perspective on the Richmond community, and by taking this survey you will help us prepare for a more resilient future. #ResilientRichmond

This planning process is just getting started, so stay tuned for more information and upcoming opportunities for participation by checking the Town's website at tinyurl.com/richmondmvp (http://tinyurl.com/richmondmvp). The survey will be open until December 31, 2020.

If you have additional input, questions, or barriers to participating, please contact Joanna Nadeau (Resiliency Planner at Weston & Sampson) at nadeau.joanna@wseinc.com (mailto:nadeau.joanna@wseinc.com) or (928)503-4049.

Survey Questions

1

What climate hazard are you most concerned about? Please rank the following options from most concerning (at the top of the list) to least concerning (at the bottom of the list)

Flooding

Extreme temperatures

Winter weather (Nor'easters, snowstorms, blizzards, ice storms)

Drought

Brushfires and wildfires

Severe wind events (tornado, thunderstorms, hurricane)

2

How have these hazards impacted you or your community? Memories of climate hazards could include flooding of local roads, heat waves, heavy snowfall or ice storms, high winds, drought conditions, business and school disruptions, and more.

3

What steps have you taken to prepare for extreme events? Check all that apply.

- [ ] I have a kit in case of emergencies (which may include food, water, flashlights, batteries, and other supplies)
- [ ] I receive news, updates, and information about emergency preparedness in Richmond
- [ ] I know where the nearest local shelter is
- [ ] I know what the local evacuation routes are
- [ ] I know what community resources or support is available to me
- [ ] I have backup power options (generator, solar panels, extra firewood)
- [ ] I have increased my food security with a garden or stockpiling nonperishable foods
- [ ] I check on a vulnerable neighbor and help them with food, snow removal, or other support during an extreme event
- [ ] A neighbor checks in on me and helps with food, snow removal, or other support during an extreme event
- [ ] Other

4

What are some of Richmond's greatest strengths? Check all that apply.

- [ ] Water supply and infrastructure (drinking water wells)
- [ ] Wastewater infrastructure (septic systems)
- [ ] Emergency facilities, including shelters and the Fire Station
- [ ] Communications infrastructure, including CodeRed system
- [ ] Natural features, including open space, trails, trees, ponds, wetlands, streams, and fisheries
- [ ] Public facilities, including the library and schools
- [ ] Public support systems, including Meals on Wheels
- [ ] Transportation infrastructure, including roads and bridges
- [ ] Agriculture, including winery and apple orchards
- [ ] Local businesses
- [ ] ______________________

Other

5

What are some of Richmond's greatest vulnerabilities? Check all that apply.

- [ ] Culverts, undersized drainage infrastructure, impervious surfaces, and stormwater runoff
- [ ] Impacts from beavers, including flooding, damage to electrical or gas generation equipment, and water quality concerns
- [ ] Vulnerable populations, including identifying shelter capacity, meeting medical needs, and reaching at-risk residents
- [ ] Potential dam failure
- [ ] Erosion of land surrounding bridges and roadways
- [ ] Increased public health hazards posed by climate change, including ticks and asthma
- [ ] Invasive species, crop disease, and pest infestations
- [ ] New development in hazard-prone areas
- [ ] Drinking water wells during drought
- [ ] Power outages due to extreme wind or winter weather events
- [ ] Communications/Phone outages due to extreme wind or winter weather events
- [ ] Former landfill site impacting water quality
- [ ] Degradation or loss of priority natural areas and core wildlife habitat
- [ ] Other

6

What is most important for Richmond's natural hazard mitigation and climate resilience strategies? Please select your top three actions.

- [ ] Pursuing data or studies showing the projected impacts of future climate hazards in Richmond, such as updated flood maps or a wastewater system assessment
- [ ] Assessing and redesigning critical infrastructure including roads, bridges, and culverts to improve stormwater management and prepare for future hazards
- [ ] Planning to address invasive species and their impacts on natural resources
- [ ] Educating the public on hazard impacts and emergency preparedness
- [ ] Developing plans and actions to protect habitat corridors and reduce development in hazard-prone areas
- [ ] Updating bylaws and regulations to incorporate climate change considerations
- [ ] Identifying needs for public facilities and services to better support vulnerable residents during an extreme event, such as emergency shelters and backup power
- [ ] Developing a tree and forest management plan in partnership with utility companies to manage potential hazardous areas and preserve forests
- [ ] Strategic planning to identify how regional agriculture can be resilient to natural hazards and climate change
- [ ] Assessing watershed protection opportunities and developing regional partnerships to improve water quality
- [ ]

Other

7

We recognize that there are overlaps in preparing for, and responding to, any challenge in our community. We are interested in documenting the community experience of COVID-19 in Richmond. What worked well, and what could improve?

8

How would you like to receive information about climate change risks and resiliency projects in Richmond? Check all that apply.

- [ ] Interactive online webinars
- [ ] Pre-recorded videos posted online
- [ ] Online surveys
- [ ] PDFs available online, including informational fact sheets and reports
- [ ] Printed media shared via mail, including informational fact sheets and flyers
- [ ] Information posted to the Town of Richmond website
- [ ] E-newsletters from the Town
- [ ] Through social media, including Facebook
- [ ] Through the newsletters and meetings of local groups and regional organizations
- [ ] In-person events after a COVID-19 vaccine is widely available
- [ ] Richmond Record
- [ ] ____________

Other

9

Are there any additional comments or questions that you would like to share with the project team?

10

Thank you for completing Section #1 of our survey. If you are interested in receiving additional updates related to climate initiatives in Richmond, please enter your email below.

Optional Demographic Questions

The following questions are not required. However, by answering these demographic questions, you will help us assess if our survey has broad participation.

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Please tell us about your connection to Richmond by selecting all that apply:

- [ ] I rent a home or apartment in Richmond
- [ ] I own a home in Richmond
- [ ] I work in Richmond
- [ ] I own a business in Richmond
- [ ]

Other

12

Please select your age range:

- ◯ Under 18 years old
- ◯ 18-24
- ◯ 25-35
- ◯ 36-45
- ◯ 46-55
- ◯ 56-65
- ◯ 66-75
- ◯ Over 75

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How would you describe yourself?

- White
- Black or African-American
- American Indian or Alaskan Native
- Asian
- Native Hawaiian or other Pacific Islander
- Multiple races
- Other

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Are you of Hispanic, Latino, or of Spanish origin?

- Yes
- No

How have these hazards impacted you or your community?	What worked well, and what could improve, based on how Richmond handled preparations for and response to COVID?	Other Comments
Severe snowstorms, threat of tornado	We observed mandatory 14 day quarantines each time. That made challenges for us in getting groceries (we planned ahead well so we didn't need to shop) and getting our mail from our PO Box during those 2 weeks. It would be helpful to have volunteers to assist residents who were being responsible about observing quarantining rules.	
We live in the Berkshires. Bad weather is part of our life. We should prepare for what we know not speculate on what might or might not happen in the future. Me need real data and facts on past weather and not rely on memories.	COVID-19 should not be a consideration in this planning.	
Roller-coster temperatures have extended mud season, impacting our many gravel roads. Heavier rains are causing washouts of roads and driveways. High winds cause blowdown in our woods and forests.	I think Richmond did pretty well. We were subject to the national "not-a-problem" problem; but I think Richmond residents were better than average in following common-sense restrictions.	
Snowstorms	isolation seems to work well!	
Poor roads, heavy snow high winds	Limited delivery options for food	
Most of these hazards have been temporary. So far.	Limiting the public, in public buildings limited the spread. A better phone system, to answer questions would help.	

How have these hazards impacted you or your community?	What worked well, and what could improve, based on how Richmond handled preparations for and response to COVID?	Other Comments
ice storms and high winds	More information on this as it happens	We may be more fortunate in New England as a region relative to Climate Change impacts but observing other parts of our country and their devastating impacts as well as the melting glaciers we have seen in our world travels are alarming.
Frequent downed power lines and loss of power.	Our space, frontage and minimum land requirements per household have helped mitigate the pandemic	
flooded and closed roads, local tornados, ice storms and power outages and here that includes no lights, and water and toilet due to septic systems and no power at all	RCS administration and teachers were rock stars but it still is a struggle on children and families. For elderly it was extremely isolating and scary. I used instacart to get groceries delivered and avoid going to the grocery store whenever possible, but that costs extra money also.	
Washed out roads. Impassible Muddy roads	Richmond did well respond to, and adjusting to COVID-19.	
Flooded, not passable roads and subsequent road repairs. Home damage from flooding. Car damage from icy roads.	Richmond hardly had an impact on our COVID experience. Not sure anything done in Richmond made a difference for us. We’ve mostly sheltered at home, getting grocery delivery and not leaving our home.	

How have these hazards impacted you or your community?	What worked well, and what could improve, based on how Richmond handled preparations for and response to COVID?	Other Comments
Ice storms, out of season snowstorms (early October and early May) have been troublesome. Sudden high winds are beginning to be more regular and are causing issues as trees topple (uproot and snap-off) due to saturated soil and diseased trees. Ash trees, bountiful in Richmond have been heavily impacted by the Emerald Ash Borer will be a growing concern, both in our forests and along roadways, over the next decade. Bittersweet is also growing prolifically and is choking otherwise healthy tree species. Other invasive plants are rapidly infiltrating forests and fields crowding out native species and drawing nutrients from the soil.	Richmond has been a wonderful place to wait out a pandemic. The sparse population and rural environment have allowed residents to get outside and take advantage of our natural beauty without feeling the impacts and constant reminders that city folks experience on a daily basis. As climate change occurs I believe there will be an exodus from from large metropolitan areas to rural communities that can support a working/schooling from home environment. This may increase property values, making Richmond a challenging place for young people to afford to live, raise a family and otherwise contribute to community life.	
Certainly recall the flooding from hurricane Irene and another instance of training thunderstorms around same time	We have followed Mass DOH & CDC guidelines	
winter storms cause power outages which are dangerous for all residents without backup power supplies.	We seemed to shelter in place well, but there are few places to socialize in Richmond anyway.	
Winter storms with high volumes of snow resulting in power outages for extended periods of time. High wind events resulting in some destruction of property and loss of power.	Worked Well: Mailing information out to all resident, not just on web site/e-newsletter and keeping updated. Closing Town Hall for everyone's safety. Offering grab-and-go meals for seniors during initial phase. Offering safe voting opportunities.	

How have these hazards impacted you or your community?	What worked well, and what could improve, based on how Richmond handled preparations for and response to COVID?	Other Comments
Been here 40 years and had 2 floods into my field from a brook on the edge of our property. Our field is about 10 ft above the bed of the brook, in the last 5-6 years. One of which washed out the shoulder of our Town Road. Also the tick population has exploded and deer are not the problem as mice and other wildlife can carry the Deer Tick. Have not had real extreme heavy snowfalls since the early 80's (2-3 ft). We remember a week at at time when temperatures were18-20 degrees below zero for almost a week. Recent years we have not seen hardly any days below 0 F. We had to put in A/C a few years ago to make the worst days liveable.	Zoom and Parking Lot Town and Board Meetings. They worked except Board Meetings that required realtime review and discussion of technical data was not possible or efficient on Zoom. Closing off Town Hall and requiring everyone entering to be masked was good. Minimum social distancing was not always possible in our Town Hall. Activities such as the senior exercise classes were not possible since the spacing requirements could not be met.	
Tree and property damage from high winds.		I'd like to see the qualifications reviewed for seniors and real estate taxes. Instead of 70+ I think we should drop it to at least 65yo to help the local seniors. I love the privacy of living in Richmond but as a senior it can be very isolating , also and there is not an emergency system in place to check in on people living alone.
Power outage		Thank you for doing this important work

How have these hazards impacted you or your community?	What worked well, and what could improve, based on how Richmond handled preparations for and response to COVID?	Other Comments
High winds took down several trees.		We have a small town with limited exposure to climate change. We are generally well prepared due to our experience with Berkshire bad weather.
drier than normal seasons, extreme fluctuations in temperature		
Always worried about local tornados and power outages.		
Flooding can generate infestation of mosquitoes which can lower quality of life for people and domestic animals. These mosquitoes can also be potential vectors of mosquito borne diseases WNV and EEE.		
Flooding of local roads and culverts being clogged. I am downhill of the Lenox Reservoir. If it is breached my house will disappear.		
flooding of local roads, heavy snowfall or ice storms, high winds, tornados		
Flooding washed out West Rd. a couple of times years ago. The heavy snowfall that was causing roofs and carports to collapse was also concerning.		
Mostly they have impacted our roads.		
Roads have been closed		
the high winds that closed off Lenox road, waiting for the power company to figure out their response time.		
The snow storms can be brutal		

Appendix E

Plan Adoption

Appendix F

FEMA Approval