Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Chapter 10: Coordination of Local Hazard Mitigation and Climate Adaptation Planning

September 2018

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Acronyms and Abbreviations

CRB	Community Resilience Building
DCR	Department of Conservation and Recreation
DMA 2000	Disaster Mitigation Act of 2000
EOEEA	Executive Office of Energy and Environmental Affairs
FEMA	Federal Emergency Management Agency
HMGP	Hazard Mitigation Grant Program
MEMA	Massachusetts Emergency Management Agency
MVP	Municipal Vulnerability Preparedness
NBS	Nature-Based Solutions
NFIP	National Flood Insurance Program
PDM	Pre-Disaster Mitigation
Risk MAP	Risk Mapping, Assessment, and Planning
RPA	Regional Planning Agencies
SHMCAP	State Hazard Mitigation and Climate Adaptation Plan
SHMT	State Hazard Mitigation Team

10. Coordination of Local Hazard Mitigation and Climate Adaptation Planning

10.1 Funding and Technical Assistance

10.1.1 Local Hazard Mitigation Planning

For more than 2 decades, the Massachusetts State Hazard Mitigation Team (SHMT) has provided grant funding and technical assistance to support the development of local mitigation plans and a comprehensive mitigation program that includes mitigation project grants.

MITIGATION PLAN PREPARATION

The Commonwealth provides funding to municipalities and regional planning agencies (RPAs) through federal planning grants for the preparation of local and multi-jurisdictional hazard mitigation plans.

Most communities in Massachusetts do not have the capacity to develop hazard mitigation plans without funding or technical assistance, and therefore, the SHMT developed a strategy consistent with the Disaster Mitigation Act of 2000 (DMA 2000) to fund RPAs through the Pre-Disaster Mitigation (PDM) grant program and post-disaster funding available for hazard mitigation planning through the Hazard Mitigation Grant Program (HMGP). The RPAs have professional planners on staff with extensive knowledge of the communities in their regions. Although most communities engage the RPAs to prepare their hazard mitigation plans, some communities apply through the State to the Federal Emergency Management Agency (FEMA) for funding to conduct their own planning process, or to hire a contractor to assist with plan preparation. Communities may also develop mitigation plans using other internal or external sources of funding. The SHMT works with these communities to assist them through the planning process. Plans are integrated with any multi-jurisdictional or regional mitigation plan in place to remain consistent across the state.

TECHNICAL ASSISTANCE

Mitigation Plan Preparation

The Commonwealth has a full-time mitigation planner who provides technical assistance to municipalities and RPAs that are developing hazard mitigation plans. In addition to receiving technical assistance from the Massachusetts Emergency Management Agency (MEMA), the RPAs provide direct assistance to municipalities. The mitigation planner is responsible for coordinating the update of the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) in accordance with DMA 2000 requirements.

In support of enhanced planning initiatives statewide, MEMA and Department of Conservation and Recreation (DCR) staff provide local communities with varying types of technical assistance across mitigation planning areas. This assistance includes site visits and meetings, workshops and trainings, and templates and resources. The State provides technical assistance throughout the process in a range of both process-related and content-related mitigation planning areas. At the beginning of a plan development or update, MEMA and DCR staff provide templates and information to assist each jurisdiction. Providing samples of previously approved annexes, plans, and templates has proven to be effective for many jurisdictions, especially those who were new to planning. Providing regular, diverse technical assistance and educational opportunities enables staff to reach a broad audience and increases awareness and understanding of mitigation planning. The State also uses social media to increase public awareness of trainings and events. Tables 10-1 and 10-2 list the types and areas of technical assistance the Commonwealth provides for mitigation planning.

Table 10-1: Types of Technical Assistance provided by the Commonwealth for Mitigation Planning

Type of Technical Assistance	
• Site visits—one-on-one or planning teams • Workshops and trainings, such as G318 mitigation planning and Hazus training • Attendance at kickoff meetings • Phone and conference calls • Web-based meetings • Emails and other written correspondence • Written correspondence	• Classroom settings • Attendance at public meetings and workshops • Samples and templates provided at the beginning of the plan development or update process, including the plan review guide, STAPLEE worksheets, Resolution for adoption, National Flood Insurance Program (NFIP) guidelines/requirements, public meeting notice, and newspaper ads announcing community meetings • Publications, such as MEMA's info bulletins and newsletters, which are distributed regularly

Table 10-2: Areas of Technical Assistance provided by the Commonwealth for Mitigation Planning

Mitigation Planning Area	
• Community Rating System (CRS) and Insurance Services Office (ISO) support and interface • Update versus new plan—Differences between the two, and what is needed? • Kickoff meetings—Detailed process involved • Public meetings—what fulfills this requirement? • Meeting with local planning teams to assist with issue resolution • Mitigation strategy development • Gaining public input and participation • Risk analysis • Capabilities assessment • Hazus development • Flood Mitigation Assistance program to develop local flood mitigation plans	• Data gathering, sources • Geographic information system mapping • Benefit-cost analysis development/training • Planning team development—who should be involved? • NFIP requirements • Repetitive Loss and Severe Repetitive Loss properties • Funding sources • Coordination with local planning mechanisms—what should be included? • Review of plan drafts under development to handle any issues the jurisdiction experiences immediately, rather than waiting until the plan is completed

MEMA Mitigation Planning and All Hazards Planning Units are working together to develop a new risk ranking concept that will standardize risk terminology across planning efforts. This will entail training by MEMA staff in a workshop-type session. MEMA has compiled a list of man-made hazards and cross-checked this with multiple plans to ensure common language across plans. MEMA is currently in the process of assisting with the Threat and Hazard Identification and Risk Assessment update, which is due in December of 2018.

The Commonwealth has developed a number of new hazard-specific studies, such as a landslide study, Division of Capital Asset Management and Maintenance master plan, Office of Coastal Zone Management erosion maps, and a fluvial geomorphic assessment to identify areas prone to fluvial erosion. This information will become available for future local and state-level plan updates.

Another concept that MEMA has considered is the development of a hazard mitigation user's group that would meet quarterly, and be led by the Commonwealth's Hazard Mitigation Planning Coordinator. The meetings would be an exchange for best-practice discussions among partners developing plans. The intent behind this user's group concept is to exchange information concerning areas of difficulty where planners have developed innovative ideas, or to gain information on how to address specific plan areas with which they are having difficulties.

The Municipal Vulnerability Preparedness (MVP) program, described below, is one example of new technical assistance offered by the State. The MVP program has a strong focus on generating local buy-in, interest, and capacity. This program is increasing MEMA's ability to reach communities through Hazard Mitigation Program assistance.

Municipal Vulnerability Preparedness Program

The Commonwealth's MVP grant program provides support for cities and towns in Massachusetts to plan for resiliency to respond to and mitigate the impacts of climate change, and to implement key climate change adaptation actions.

> Community Resilience Building is a unique, "anywhere at any scale," community-driven process, rich with information, experience, and dialogue, where participants identify top hazards, current challenges, strengths, and priority actions to improve community resilience to all hazards today, and in the future (CommunityResilienceBuilding.org)

Funding is available to all cities and towns in the Commonwealth to support the completion of climate change vulnerability assessments and resiliency planning using the Community Resilience Building (CRB) workshop guide developed by The Nature Conservancy, now used in well over 200 communities across the country. The program provides access to MVP-certified providers, a standardized toolkit for assessing vulnerability and developing strategies, and the best available statewide climate projections and data. Grants are awarded to municipalities who wish to prepare for climate change impacts, build community resilience, and receive designation from the Executive Office of Energy and Environmental Affairs (EOEEA) as a Climate MVP Community. This designation leads to increased standing in other state grant programs, and eligibility to apply for MVP Action grants that support implementation of key priorities identified through the planning process.

The program helps communities to do the following:

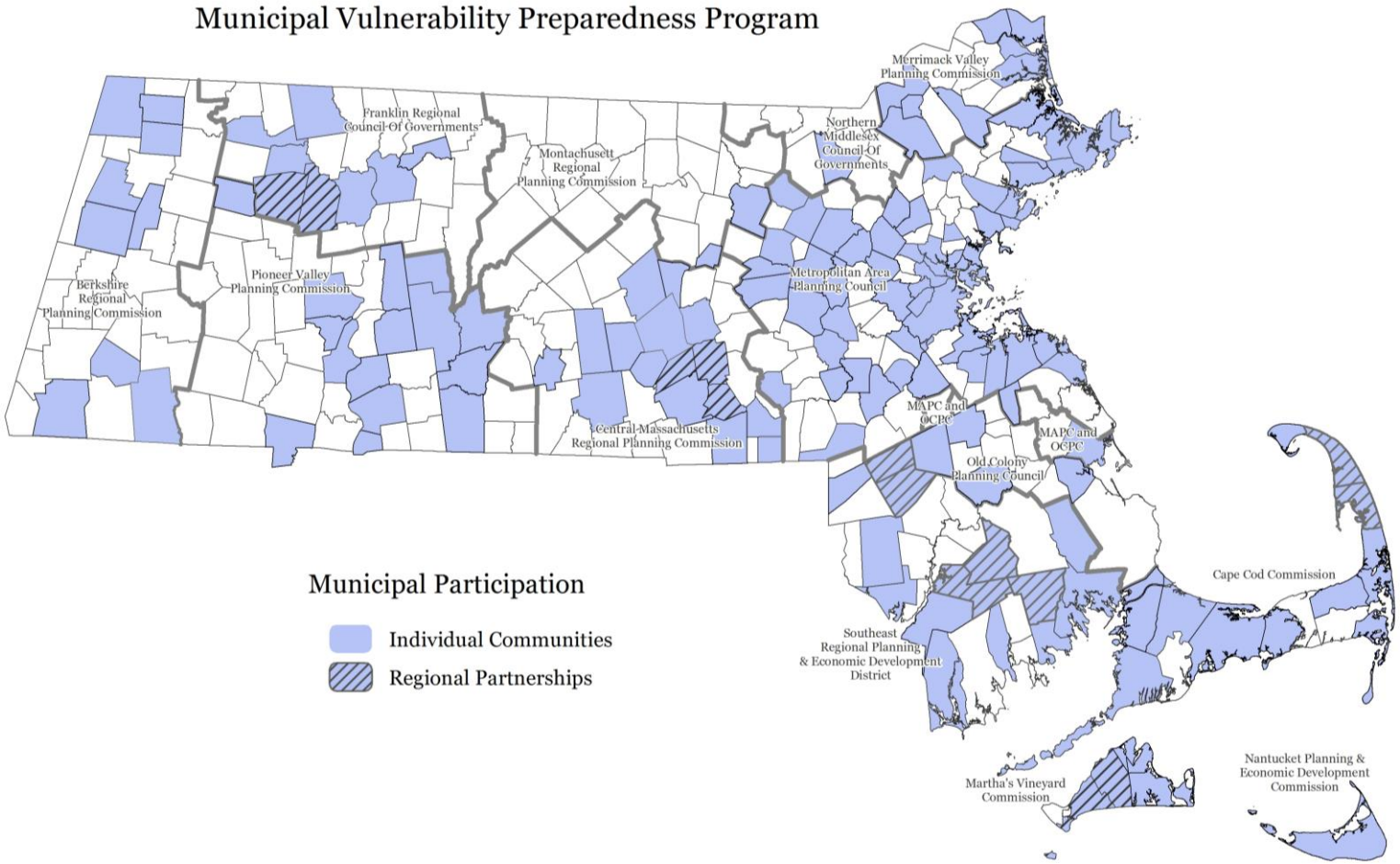
- Understand extreme weather and natural and climate-related hazards.
- Understand how their community may be impacted by climate change with a Massachusetts-specific Climate Change Clearinghouse (resilientMA.org) that has the latest science and data produced by the Northeast Climate Adaptation Science Center at the University of Massachusetts Amherst.
- Identify existing and future vulnerabilities and strengths.

- Develop and prioritize actions for the community.
- Identify opportunities to take action to reduce risk and build resilience.
- Implement key actions identified through the planning process.

Just as the Commonwealth has integrated its Hazard Mitigation and Climate Change Adaptation plans, there are many similarities between the MVP planning process and the steps required to complete a local hazard mitigation plan. The CRB process can satisfy specific elements of the FEMA Regulatory Checklist for Local Mitigation Plans. A crosswalk highlighting elements of the CRB process that can be used to catalyze and fulfill certain requirements of local hazard mitigation plan preparation has been developed to aid communities in using the grant process to develop their plan, and the Commonwealth encourages cities and towns to synchronize the planning processes.

As of June 2018, there are 156 MVP communities in the state, as shown on Figure 10-1. A number of these communities have been awarded additional funding to update their local hazard mitigation plan, to complete a local hazard mitigation plan for the first time, or to better incorporate climate change into an existing plan. EOEEA and MEMA will continue to collaborate on grant development, review, and implementation to ensure local governments are able to plan for climate change and natural hazards in the most efficient way possible.

Figure 10-1: Map of Municipal Vulnerability Preparedness Communities



10.1.2 Hazard Mitigation Assistance Projects

Massachusetts has had a FEMA-approved Hazard Mitigation Grant Program (HMGP) Administrative Plan since 1986. This plan was last updated in June 2015, and is provided as Annex 1.

The HMGP Administrative Plan describes eligible projects for pre-disaster and post-disaster hazard mitigation funding in Massachusetts. This includes the project's consistency with the SHMCAP and the goals of the community's FEMA-approved Local Hazard Mitigation Plan; compliance with local, State, and Federal laws and regulations; cost-effectiveness; and the project's ability to provide or contribute to a solution to a problem.

Massachusetts uses its Hazard Mitigation Grants Administrative Plan to guide the process for prioritizing post-disaster mitigation funding of local mitigation projects. It has used similar criteria to prioritize local PDM grant applications. It is likely that available federal funds for pre-disaster and post-disaster mitigation assistance will not be sufficient to support all eligible project applications. The State aims to award grants to the maximum number of eligible projects, and to equitably distribute HMGP grant awards across the state. Emphasis is placed on ensuring that mitigation measures provide more protection to life and property than what existed prior to the disaster event, and that they do not merely replace what is damaged.

As described in the Administrative Plan, project proposals are evaluated and prioritized by the State Mitigation Interagency Committee (SHMIC) and the SHMT according to the following criteria. These are ranking criteria; individual projects are not required to meet all criteria, and extra "points" are awarded to applications that mitigate repetitive loss and severe repetitive loss structures.

1. If the project is not implemented, there will likely be a detrimental impact, such as potential loss of life, loss of essential services, damage to critical facilities and infrastructure, and/or economic hardship (Statement of Need).
2. The project mitigation adequately mitigates current hazards and anticipates future ones. The level of protection that will exist after the project is implemented is clearly defined. (How does your project solve the problem?)
3. The project clearly describes the solution by providing a detailed scope of work.
4. The project budget is detailed.
5. The application describes how the proposed project will provide long-term hazard mitigation benefits. A well-defined Benefit-Cost Analysis is provided with relevant supporting documentation. For projects where a Benefit-Cost Ratio is not required, a qualitative analysis of the project benefits will be used.

6. The application demonstrates through a clear work schedule the capability of the applicant to implement and complete the project in a timely manner. This includes a plan for obtaining all required State and local environmental permitting.
7. The application commitment to complete the project is substantiated by providing documentation of the non-Federal cost match, signed support by the chief administrative official, and a description of the decision-making process.
8. The application details how the proposed mitigation activity is consistent with the FEMA-approved hazard mitigation plan for the state and/or local jurisdiction
9. The project is consistent with local and regional priority protection and priority development areas (e.g., Smart Growth Principles, comprehensive land use plans, and capital improvement plans), and the application provides these details.
10. The project promotes resiliency and sustainability, and provides environmental benefits.
11. The project mitigates the type of hazard that caused the Presidentially Declared Event.
12. The project is in the Presidentially Declared Disaster area.

In areas that are experiencing greater population growth and development pressure, the potential that detrimental impacts may occur if a project is not implemented is likely greater. Additional information about project ranking is included in the HMGP Administrative Plan (Annex 1). After projects are reviewed, the Director of MEMA and the Commissioner of DCR, under the advisement of the SHMIC, recommends projects for funding to FEMA Region I. FEMA determines the final selection of grants to be awarded.

Table 10-3 displays the number of Hazard Mitigation Assistance grant applications that have been awarded in the last 5 years. Several additional applications are awaiting award or are currently wait-listed.

Table 10-3: Mitigation Projects Awarded Funding

Year of Obligation Date	Projects Awarded Funding (#)	Counties Represented (#)
2013	11	8
2014	38	9
2015	26	8
2016	25	11
2017	7	5

Source: MEMA, 2018

In addition to supporting mitigation planning, MEMA and DCR have provided significant technical assistance to state agencies, local jurisdictions, and Tribes during the process of submitting PDM and HMGP applications following presidential disaster declarations. In 2013-2017, the State provided more than 200 individuals with training to complete a successful application. The MEMA Mitigation Unit has five staff who coordinate hazard mitigation grants, conduct grant briefings, meet informally with communities, host meetings throughout the state to discuss projects, visit sub-applicants on site, and provide targeted outreach to state agencies, eligible nonprofit organizations, and professional associations. These grant briefings and technical assistance meetings increase the visibility of mitigation programs throughout the Commonwealth and enhance sub-applicants' knowledge of program requirements. The outcomes of these efforts include improved grant applications; and ultimately, more cost-effective projects that address and reduce vulnerability to hazards.

After a grant is received, a mitigation contract specialist conducts an in-person training with every grant recipient at a kickoff meeting. This meeting offers assistance with quarterly performance and financial reporting, records retention, 2 Code of Federal Regulations 200, budget concerns, and time extensions. These educational efforts result in an enhanced ability to effectively and efficiently manage the grants. The combined efforts of the HMGP coordinators and contract specialists provide communities with an opportunity to ask for guidance on the entire process, from application to final close-out. This increased participation helps sub-applicants better understand the process and have greater ease in navigating the reimbursement and close-out.

RISK MAP PROGRAM

The Commonwealth's comprehensive approach to hazard mitigation planning goes beyond supporting the development of hazard mitigation plans. To ensure continued compliance with the National Flood Insurance Program (NFIP), and in coordination with the Risk Mapping, Assessment, and Planning (Risk MAP) program, the DCR Flood Hazard Management Program assists with and updates floodplain bylaws and ordinances. DCR also conducts NFIP Community Assistance Visits, Community Assistance Contacts, and Community Information System updates. DCR provided technical assistance for State General Law update, including the development of the 9th Edition of the Massachusetts State Building Code. State agencies also conduct a range of outreach sessions and presentations for various interest groups.

10.2 Local Hazard Mitigation Plans

As of June 2018, the Commonwealth has 229 approved local mitigation plans, including 100 single jurisdiction plans. An additional 74 plans are in the process of being developed, reviewed, and approved (see Table 10-4). Thirty-seven plans have expired, and 18 communities

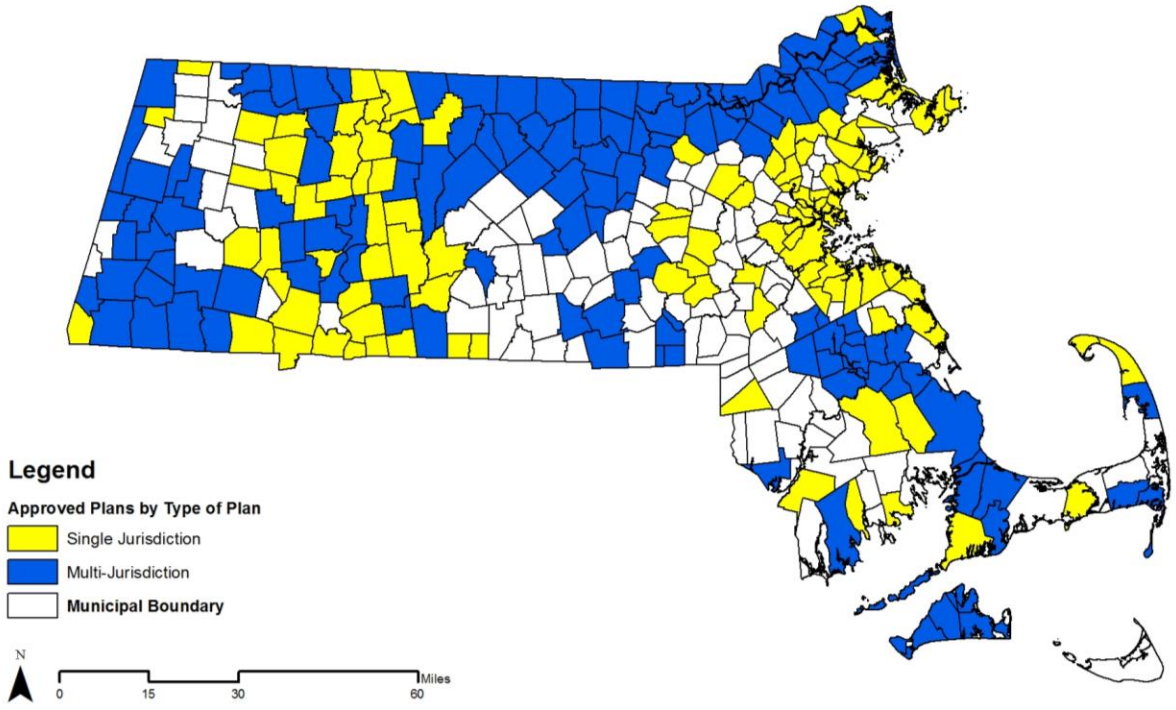
do not have a plan. Several other entities have plans in place, including University of Massachusetts Amherst, multiple University of Massachusetts campuses (Boston, Dartmouth, Lowell, Systems Office), University of Massachusetts Medical School, and Tufts University. Figure 10-2 displays jurisdictions with approved plans as of June 5, 2018.

Table 10-4: Local and Multi-Jurisdiction Hazard Mitigation Plan Status

Plan Status	Number
Approval Pending Adoption	3
Approved	229
Undergoing Local Development	56
Undergoing Local Revisions	10
Undergoing MEMA Review	2
Undergoing FEMA Review	3
Expired	37
None	18

Source: MEMA, June 5, 2018

Figure 10-2: Map of Communities and Regions with Approved Plans as of June 5, 2018



Source: MassGIS; MEMA, 2018

The local mitigation planning process is coordinated by MEMA. MEMA sends a letter to remind communities of the upcoming expiration of their plan 3.5 years after the approval. MEMA also provides communities with information about funding to prepare the plans. From this time, communities have 1.5 years to complete a plan update, undergo the State and Federal review process, and formally adopt their plan prior to the plan expiration. The average time to develop the mitigation plan is 12 months. The state plan review process is typically initiated within 45 days of receiving the plan from a community. It is recommended that plans are submitted to FEMA for review 60 days prior to expiration of the plan to avoid a lapse in the time a community has an approved plan on record.

MEMA's mitigation planner records plans in the MEMA Mitigation Plan Database the day they are received. Figure 10-3 summarizes the State's procedure for reviewing plans that have been submitted to MEMA for review. The State reviews local plans to ensure they align with State mitigation priorities. These local plan reviews also help inform the routine evaluation and amendment of the mitigation goals, strategies, and actions included in the SHMCAP.

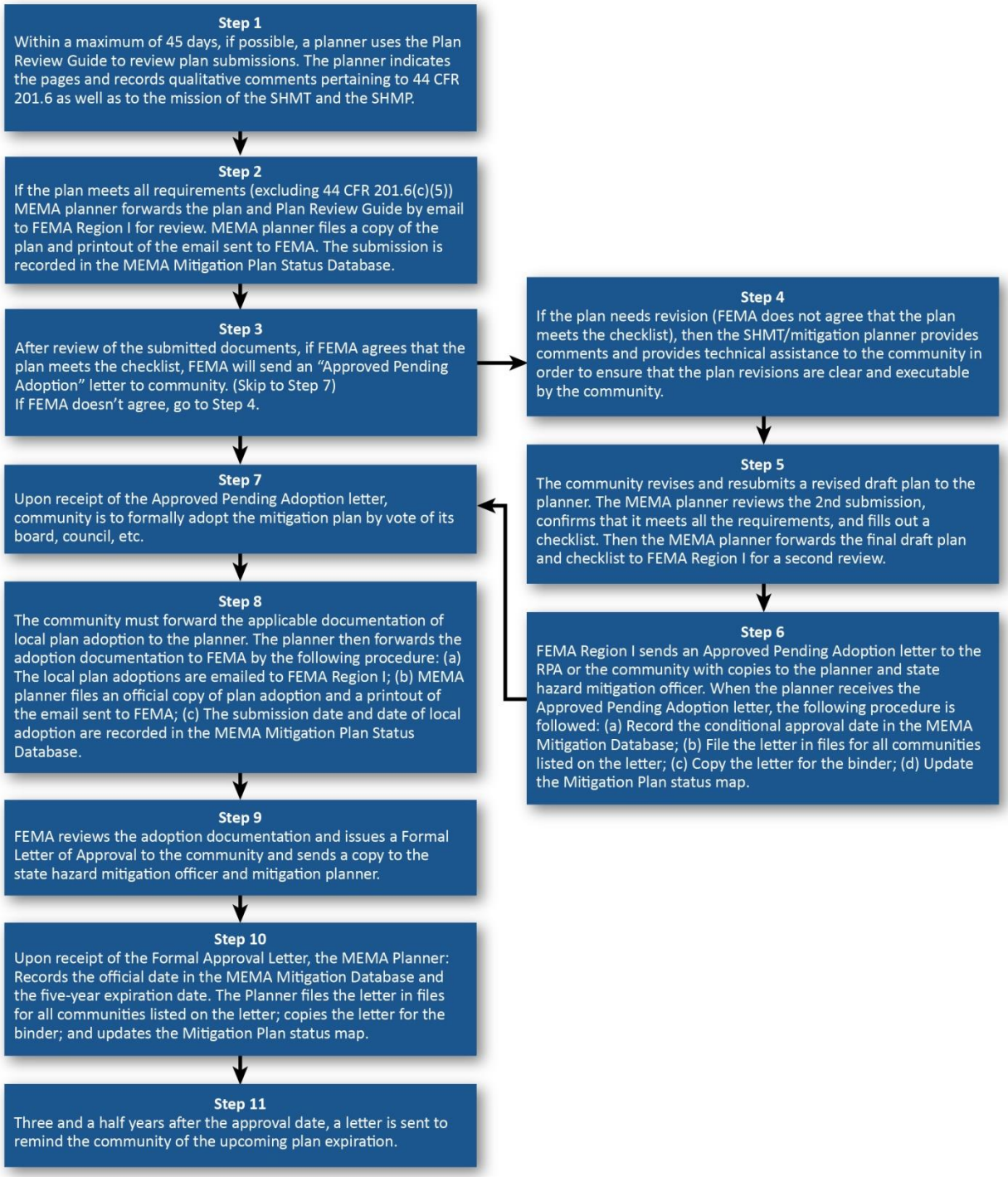
As local and multi-jurisdictional plans are approved, the hazard mitigation measures (and other elements) are entered into the Local/Regional Database, which is later incorporated into this section of the plan. For this update, measures were reviewed and analyzed by the SHMT to identify any trends and issues. Depending on future funding, the Commonwealth will provide participating RPAs and communities with technical assistance as needed to implement cost-effective hazard mitigation measures.

The greatest challenges to developing, updating, adopting, and implementing local mitigation plans is local buy-in, interest, and capacity. Hazard mitigation plans are often developed or updated without the active participation or leadership of local planning and community development staff. The State guidance includes helping local communities inform and engage local leadership, staff, and stakeholders. The State also helps communities identify key players, and builds support for hazard mitigation integration. This includes helping to establish channels for interdepartmental or interagency communication and cooperation.

Local land use planners are less willing to embrace hazard mitigation planning as falling within their professional purview. To address this challenge, the State helps local planners and stakeholders to become familiar with the risks facing their communities, and assesses communities' capacity to plan and implement mitigation activities. The State helps to review existing hazard mitigation plans and local planning policies, regulations, and programs to identify areas of overlap or gaps where integration is needed.

Another challenge is that hazard mitigation plans often include mitigation strategies or actions that are focused on a disconnected series of emergency services, structure or infrastructure protection projects, and public outreach initiatives, with less emphasis on nonstructural measures

Figure 10-3: Steps in the MEMA and FEMA Plan Review Process



available through local land use planning or policy alternatives. In response, the State educates the planning team on land use policies that can build community resilience by taking into consideration information on the location, frequency, and severity of hazards and setting forth recommendations that influence development in a way that does not increase risks to life and property.

Further, hazard mitigation plans are typically completed as stand-alone documents that cover multiple jurisdictions. It is relatively uncommon for them to be directly linked or integrated with other community-specific planning tools, such as comprehensive land use plans and development regulations. The State provides guidance to overcome this barrier by helping local communities identify ways to use current projects, future initiatives, or potential funding opportunities as vehicles for implementing aspects of their hazard mitigation plan or other resilient community principles.

Excerpt from Town of Milford Hazard Mitigation Plan: Climate Change Impacts

Climate change is a long-term change in the Earth's climate and encompasses increases in ambient temperature, sea level rise, and shifting seasonal and weather patterns. Climate change is not a hazard in and of itself, but it can impact the severity, duration, frequency, and probability of occurrence of other natural hazards.

According to the Massachusetts Climate Change Adaptation Report, "By the end of the century, under the high emissions scenario of the Intergovernmental Panel on Climate Change (IPCC), Massachusetts is set to experience a 3° to 5°C (5° to 10°F) increase in average ambient temperature, with several more days of extreme heat during the summer months. Days with temperatures greater than 32°C (90°F) are predicted to increase from 5 to 20 days annually that Massachusetts experiences today to between 30 to 60 days annually; while up to 28 days annually are predicted to reach above 38°C (100°F), compared to up to two days annually today (Frumhoff et al., 2006, 2007). Sea surface temperatures are also predicted to increase by 4°C (8°F) (Dutil and Brander, 2003; Frumhoff et al., 2007; Nixon et al., 2004), while winter precipitation—mostly in the form of rain—is expected to increase by 12 to 30 percent. The number of snow events is predicted to decrease from five each month to one to three each month (Hayhoe et al., 2006)" (EOEOEEA, September 2011).

Of the hazards discussed in this section, climate change is expected to impact flood hazards, severe weather, and fire most significantly. Winter precipitation is expected to increase by 20 to 30 percent, and could occur more as rain than as snow. Heavy rainfall is likely to occur more frequently and more intensely, and likely to result in more frequent and more severe floods. Precipitation patterns may shift to prolonged wet and dry periods, leading to increased frequency of short-term droughts (Union of Concerned Scientists, 2017). Brush and other outside fires may be more likely to occur in waves that crest every 2 to 3 years, mostly due to the dry and hot weather patterns in the spring and summer that allow for an increased vulnerability of vegetation to brush fires (Ostroskey, 2014).

10.3 Local Climate Adaptation Plans

Across the state, several local and regional climate action and climate adaptation plans have been adopted and are in various stages of implementation. A screening of these local plans was completed as part of the preparation of this SHMCAP. Appendix F includes this preliminary list of local climate action and climate adaptation plans.

Massachusetts communities are increasingly incorporating climate change impacts into their hazard mitigation plans. The extent to which climate change has been incorporated into local hazard mitigation plans varies across jurisdictions. The Town of Brookfield's 2018 Hazard Mitigation Plan, for example, discusses how climate change is expected to exacerbate many of the hazards described in the community's Hazard Mitigation Plan, and identifies the impacts that a changing climate may have on Brookfield's hazard risk profile in the future. In its Hazard Mitigation Plan, the Town of Milford summarizes climate projections and identifies hazards that are expected to be most impacted by climate change.

Following the completion of the 2018 SHMCAP, the State will continue to encourage and support the inclusion of climate adaptation in local mitigation plans. The State's Climate Change Clearinghouse, resilient MA, is a key resource that has been developed and will be maintained to provide the public, municipal decision-makers, and other stakeholders with user-friendly, scientific information on climate change projections and impacts. The website provides guidance and resources for climate change planning, including identifying impacts and risks, and assessing vulnerability.

The MVP program, described in Section 10.1.1, is another resource and tool that the State will continue to use to support the inclusion of climate adaptation planning in local hazard mitigation plans. An example of how the State supports communities through the MVP program is provided in the following callout.

Throughout Franklin County, Massachusetts, communities are experiencing more extreme weather events—especially heavy rains and flooding—along with higher temperatures and other climate-related conditions. These types of conditions are predicted to increase as a result of climate change.

In the face of these and other changes, municipalities have more of a sense of urgency to increase their resilience and adapt to extreme weather events and mounting natural hazards. Relatively recent events in Franklin County, such as Tropical Storm Irene and "Snow-tober," have reinforced this sense of urgency and compelled communities like the Town of Colrain to proactively plan and mitigate potential risks. This type of planning will reduce the vulnerability of Colrain's people, infrastructure, and natural resources; and will empower Colrain's officials and citizens alike to take steps to protect themselves and their community.

In the spring of 2018, with funding from the Massachusetts Executive Office of Energy and Environmental Affairs, the Franklin Regional Council of Governments (FRCOG) offered the Town of Colrain technical assistance in completing their Community Resilience Building Workshop to achieve designation as a Municipal Vulnerability Preparedness Community or "MVP" Community. As a State-certified MVP Provider, the FRCOG helped the Town of Colrain engage in a community-driven process that brought together climate change information and local knowledge to conduct the workshop, whose central objectives were to:

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

10.4 Local Plan Integration

The SHMT reviews each multi-jurisdictional or local mitigation plan according to Stafford Act guidelines and applicable FEMA guidance, and completes a checklist. During this review, the Commonwealth confirms that the plan is consistent with the SHMP/SHMCAP. The State Hazard Mitigation Planning Coordinator, who is a member of the SHMT, manages this review and analysis. The State works with the local governments, planning teams, and RPAs to ensure that their plans are revised to reflect changes in development and progress in local mitigation efforts, and also to demonstrate that the community has revised the plan to reflect changes in their mitigation priorities and measures.

The Hazard Mitigation Planner reviews a wide array of plans across the Commonwealth to incorporate best practices from the cities and towns to present an all-inclusive / all-hazards approach to mitigation planning that fully encompasses all of the potential hazards that may affect the Commonwealth. In turn, this all-inclusive approach provides information about current mitigation strategies from the Berkshires to the coast of the Atlantic that informs the development of the state plan, and better prepares Massachusetts for future disasters.

As part of the SHMCAP planning process, MEMA undertook a review of more than 20 local hazard mitigation plans that had been approved in the last 12 months. MEMA identified and synthesized common vulnerabilities from these plans for each hazard recognized in the SHMCAP. Several actions and mitigation strategies were developed for each hazard. These commonalities and the steps taken to mitigate adverse effects of hazards on communities are summarized in Table 10-5. This summary of local risk assessments and mitigation strategies, in addition to the SHMT's familiarity and knowledge of Massachusetts communities and their existing hazard mitigation plans, helped to inform the development of the risk assessment and risk reduction actions identified in the SHMCAP.

Table 10-5: Common Vulnerabilities across Local Jurisdictions in Local Hazard Mitigation Plans

Hazard	Common Vulnerabilities	Actions and Mitigation Strategies
Inland Flooding	• The impact of flooding on life, health, and safety is dependent on several factors, including the severity of the event, and whether or not adequate warning time is provided to residents. Exposure includes the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to those who reside in a defined hazard zone, but should consider everyone who may be affected by a hazard event (e.g., risk while traveling in flooded areas or compromised access to emergency services during an event). The degree of such impacts will vary, and is not strictly measurable. Of the population exposed, the most vulnerable include the economically disadvantaged and population over the age of 65. Those over the age of 65 are vulnerable because they are more likely to seek or need medical attention, which may not be available due to isolation during a flood event. They also may have more difficulty evacuating. • If evacuation routes and critical facilities are flooded, emergency response or evacuations could be hampered.	• Improve maintenance for culverts, trenches, and drainage systems. • Implement green infrastructure for stormwater management. • Land Acquisition: The towns, in conjunction with other public/private entities, should continue efforts to acquire parcels of land subject to flooding. • Drainage system maintenance and repair. Street sweeping and catch basin cleaning.
Drought	• Long-term drought can have moderate to high-risk effects on both the environment and the economy. • Reduced water levels also cause loss of landscape due to restrictions on outdoor watering, and therefore less crop production and loss of business revenues. • Under a severe long-term drought, communities could be vulnerable to restrictions on water supply. Potential damages of a severe drought could include losses of landscaped areas if outdoor watering is restricted, and potential loss of business revenues if water supplies are severely restricted for a prolonged period. • Because of this hazard's regional nature, a drought would likely impact the entire community, resulting in reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat.	• Promote drought-tolerant and site design measures. • Establish bylaws to enforce water conservation. • Reduce outdoor watering to ensure adequate supply during water supply emergencies. • Promote drought-tolerant landscaping and site design measures.
Landslide	• The effects of a landslide are localized. • Vulnerable communities tend to be communities that are more inland and in close proximity to Mount Greylock. • Impacts include localized road closure and sustained structural damage. • Transporation and ability of emergency support agencies to respond are concerns. • It is difficult to determine demographics of populations vulnerable to landslides. • Should a landslide occur in the future, the type and degree of impacts would be highly localized. The town's vulnerabilities could include damage to structures, damage to transportation and other infrastructure, and localized road closures. Injuries and	• Increase efficiency of debris removal and demolition. • Coordinate debris management with Regional Emergency Planning Committees. A debris management plan would include information on the amount, type, and disposal of demolition debris, storm debris, and hazardous waste; and identify sites for sorting, chipping, and transporting the debris after the hazard event.

Hazard	Common Vulnerabilities	Actions and Mitigation Strategies
	casualties, while possible, would be unlikely, given the low extent and impact of landslides in the Commonwealth.	
Coastal Flooding	• Specific populations that required increased assistance are people over age 65 and the economically disadvantaged, due to an increased need for timely evacuation notice, transportation, and medical support.	• Improve maintenance for culverts, trenches, and drainage systems. • Implement green infrastructure for stormwater management.
Coastal Erosion	None identified	None identified
Tsunami	• A tsunami has the capability of affecting any town/county within the "buffer zone," which encompasses any land 1 mile from the coastline. • These are only predictions of the geographical extent of a tsunami's effect because of the lack of experience/occurrences of tsunamis on the east coast. It is difficult to determine demographics of populations vulnerable to a tsunami.	• Coordinate with debris management agencies to create a plan that determines specific procedures in which disposal of storm debris, hazardous waste, and demolition debris will be handled. • Coordinate debris management with Regional Emergency Planning Committees.
Average/ Extreme Temperature	None identified	• Promote green building and cool roof design. • Designate a local cooling center, and identify staffing protocol for mid-week and weekend servicing of the facility.
Wildfires	• Increased risk and rate of wildfires combined with the reduced water levels can cause heightened mortality of both wildlife and livestock.	None identified
Invasive Species	None identified	None identified
Hurricane/ Tropical Storm	• The impact of a hurricane or tropical storm on life, health, and safety is dependent on several factors, including the severity of the event and whether or not residents received adequate warning time. It is assumed that the entire Commonwealth's population is exposed to this hazard. Residents may be displaced, or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors, including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing. Of the population exposed, the most vulnerable include the economically disadvantaged and population over the age of 65. Those over the age of 65 are vulnerable because they are more likely to seek or need medical attention, which may not be available due to isolation during a flood event. They also may have more difficulty evacuating. • Hurricanes typically have regional impacts beyond their immediate tracks. Falling trees and branches are a significant problem because they can result in power outages	• Assess and inspect public buildings to withstand wind loads to diminish loss of life. • Conduct regular tree trimming to avoid communication line damage. • Coordinate a debris management plan prior to a disaster. • Assess public buildings for ability to withstand wind loads. • Purchase Barriers and Signage: The towns should seek funds to purchase additional barricades (jersey barriers) and signage to aid in the blockade and evacuation of hazard areas during a storm event. • The Tree Department and local electric company, National Grid, conducts regular tree trimming.

Hazard	Common Vulnerabilities	Actions and Mitigation Strategies
	when they fall on power lines or block traffic and emergency routes. • Hurricanes have the capability to displace citizens in direct impacts zones to long-term sheltering facilities, and can cause severe injuries and death due to infrastructure damage, debris, and downed trees. • Towns in the direct impact zone of hurricanes (coastal towns) are taking steps to improve their preparedness and response to hurricanes.	The towns respond to downed tree limbs caused by winds, lightning strike reports, and other weather-related incidents. • Coordinate debris management with Regional Emergency Planning Committees. A debris management plan would include information on the amount, type, and disposal of demolition debris, storm debris, and hazardous waste; and would also identify sites for sorting, chipping, and transporting the debris after the hazard event. • Improve drainage.
Severe Winter Storm/ Nor'easter	• The impact of a nor'easter on life, health, and safety is dependent on several factors, including the severity of the event, and whether or not residents received adequate warning time. It is assumed that the entire Commonwealth's population is exposed to this hazard (wind and rain/snow). Of the population exposed, the most vulnerable include the economically disadvantaged and population over the age of 65. Those over the age of 65 are vulnerable because they are more likely to seek or need medical attention, which may not be available due to isolation during a flood event. They also may have more difficulty evacuating. • The Commonwealth is vulnerable to both the wind and precipitation that accompany nor'easters. High winds can cause damage to structures, fallen trees, and downed power lines leading to power outages. Intense rainfall can overwhelm drainage systems, causing localized flooding of rivers and streams, as well as urban stormwater ponding and localized flooding. Fallen tree limbs, as well as heavy snow accumulation and intense rainfall, can impede local transportation corridors and block access for emergency vehicles. • Deaths are primarily attributed to automobile accidents, exhaustion, and exposure; and these situations are exacerbated due to physical isolation of communities caused by falling debris. • Debris impedes emergency services from reaching populations in need, such as the elderly or homeless. • Falling trees/branches can also damage power lines, causing communication isolation among communities. • According to the National Oceanic and Atmospheric Agency's National Severe Storms Laboratory, winter weather indirectly and deceptively kills hundreds of people in the United States every year, primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds, creating blizzard	• Assess municipal structures for susceptibility to snow loads. • Improve drainage structure; for example, by maintaining culverts and trenches. • Coordinate debris management with Regional Emergency Planning Committees.

Hazard	Common Vulnerabilities	Actions and Mitigation Strategies
	conditions with blinding wind-driven snow, drifting snow, and extreme cold temperatures with dangerous wind chills. These storms are considered deceptive killers, because most deaths and other impacts or losses are indirectly related to the storm. Injuries and fatalities may occur due to traffic accidents on icy roads, heart attacks while shoveling snow, or hypothermia from prolonged exposure to cold. Heavy snow can immobilize a region and paralyze a town, shutting down its transportation network, stopping the flow of supplies, and disrupting medical and emergency services. The elderly are considered most susceptible due to their increased risk of injury and death from falls and overexertion, and/or hypothermia from attempts to clear snow and ice, or related to power failures. In addition, severe winter weather events can reduce the ability of these populations to access emergency services. Residents with low incomes may not have access to housing, or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). • The conditions created by freezing rain can make driving particularly dangerous, and emergency response more difficult. The weight of ice on tree branches can also lead to falling branches damaging electric lines.	
Tornadoes	• High winds are capable of launching debris, which can lead to loss of life if proper shelter is not taken. • High winds can impede emergency response agencies from responding to those affected by the natural disaster.	• Coordinate with other agencies prior to the severe weather to determine a “debris management plan.” • Identify staffing protocol to ensure the facility is always able to offer their services.
Other Severe Weather	• High winds are capable of launching debris, which can lead to loss of life if proper shelter is not taken. • High winds can impede emergency response agencies from responding to those affected by the natural disaster. • The entire population of Massachusetts is exposed to severe weather events. Residents may be displaced, or require temporary to long-term sheltering due to severe weather events. In addition, downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors, including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing. In general, vulnerable populations include the elderly, low-income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life-threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure	• Coordinate debris management with Regional Emergency Planning Committees. A debris management plan would include information on the amount, type, and disposal of demolition debris, storm debris, and hazardous waste,; and identify sites for sorting, chipping, and transporting the debris after the hazard event. • Trim trees.

Hazard	Common Vulnerabilities	Actions and Mitigation Strategies
	during severe weather events, and could suffer more secondary effects of the hazard. • Tree damage during high winds has the potential to be a significant hazard in Sharon. Trees can knock out power lines and block major roadways, which hinders emergency response.	
Earthquake	• The entire population of Massachusetts is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of dwelling structures, soil types in which homes are constructed, and proximity to fault locations. Furthermore, the time of day also exposes different sectors of the community to the hazard. • Earthquakes are a hazard with multiple impacts beyond the obvious building collapse. Buildings may suffer structural damage that may or may not be readily apparent. Earthquakes can cause major damage to roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Another potential vulnerability is equipment inside structures. For example, a hospital may be structurally engineered to withstand an earthquake, but if the equipment inside the building is not properly secured, the operations at the hospital could be severely impacted during an earthquake. Earthquakes can also trigger landslides. • Earthquakes have the capacity to affect the entire Commonwealth, but can have varying effects depending on each region. • Structural damage is an imminent hazard, because it can cause serious injury and loss of life. • Other vulnerabilities include damage to equipment in hospitals and other major facilities that are in constant demand. • Damage to hospital equipment can both hinder medical professionals' ability to serve the needed populations, as well slow emergency response medical attention in off-site areas.	• Assess public buildings for earthquake resistance. • Properly manage and protect crucial equipment. • Provide education about what to do in the event of an earthquake. • Assess public buildings for earthquake resistance. • Coordinate debris management with Regional Emergency Planning Committees. A debris management plan would include information on the amount, type, and disposal of demolition debris and hazardous waste; and identify sites for sorting, chipping, and transporting the debris after the hazard event.

10.5 Ecosystem Scale Planning for Nature-Based Solutions

Effective hazard mitigation and climate adaptation planning and implementation need to be done at a larger, regional scale. Nature-based solutions (NBS) in particular should be considered at an ecosystem scale to prioritize the most effective solutions and locations. For example, flooding is best considered at a watershed scale, while land protection priorities can be considered at a regional or watershed level. Ecosystem scales do not align with municipal boundaries, and regionalization among communities should be encouraged. There are several groups that can be employed to assist municipalities in improving resilience. This section helps define the roles and responsibilities for local and regional governments and groups.

10.5.1 Municipal Roles and Responsibilities

Municipal governments have primary control over their local land use, which has an enormous effect on the amount of impervious surfaces; which in turn affects local temperature, stormwater runoff, flooding, and drought. To improve local resilience, communities can take certain actions to encourage NBS and focus on smart growth that balances the needs of both development and conservation in their planning boards, conservation commissions, open space committees, public works departments, and others.

As described in *Chapter 6: State Capability and Adaptive Capacity Analysis*, municipalities should consider changing local land use planning tools such as zoning bylaws and ordinances and subdivision rules and regulations that encourage NBS that manage stormwater and reduce urban heat island effects while providing additional co-benefits. Communities can use a bylaw review tool developed by Mass Audubon to comprehensively consider how to do this, based on the State's smart growth toolkit and other tools.

Similarly, while updating zoning and codes, communities should consider updating their development standards in terms of anticipated increased precipitation, and in terms of how they describe and plan around floodplains. Although the 100-year floodplain has historically been used to consider hazards, and mostly does not consider the 500-year floodplain, changes in precipitation and storm events have altered the frequency of 100-year events, so that they have become more frequent. By adjusting planning guidance to consider use of the 500-year floodplain, communities can be more proactive about not siting infrastructure in a frequently flooded area.

10.5.2 Regional Roles and Responsibilities

Communities perform much of their larger-scale planning through RPAs. These organizations assist communities to consider regional priorities and actions, such as through technical assistance or through the MVP program (described earlier). Additionally, watershed associations,

land trusts, and other nonprofit organizations that work at state and regional levels may assist communities to prioritize NBS to optimize resilience and benefits at multiple scales.

10.5.3 Private-Sector Roles and Responsibilities

The private sector has a need for general technical assistance, as well as help with conducting vulnerability assessments, adopting resilience standards, and developing action plans—all of which should incorporate current climate change projections. Finance, insurance, and real estate industry associations should promote information about risks and vulnerability, and also resilient building techniques and the establishment of standards. Finance and insurance sectors should monetize the value of investments by responding, for example, to resilience investments with adjusted rates.

The private sector should collaborate with policymakers to encourage a series of voluntary actions and policy and code changes. Collaboration should also advance resilience in the private sector by providing a suite of tools that includes science, standards, technical assistance, public funding, and regulations (and associated compliance and enforcement).

The private sector should promote awareness among developers, realtors, property owners, and tenants; leverage support from the financial and insurance sectors; and monetize economic externalities for which the private sector is not accounting.

10.6 Concluding Statement

This chapter concludes the 2018 SHMCAP, which has identified risks and vulnerabilities associated with natural disasters and climate change, and presented long-term strategies for protecting people and property from future hazard events and climate change impacts. The plan is intended to help the Commonwealth and its residents to better understand when, where, why, and how natural hazards occur; how natural hazards are expected to be affected by climate change; how to reduce the cost of recovery and rebuilding through making a more resilient Commonwealth; and how preparedness and adaptation planning can reduce health impacts.

As stated elsewhere, this plan is a living document that will reside on the Massachusetts Climate Change Clearinghouse (resilientma.org), and be operationalized through the continuous implementation of actions identified in the plan. The plan will also be improved as needed through routine maintenance procedures that help to ensure the plan is reviewed, updated, and enhanced as conditions change, and with input from stakeholders.