TOWN OF CHESHIRE, MA

DRAFT HAZARD MITIGATION AND CLIMATE ADAPTATION PLAN

October 2023

[Place on Cheshire, MA Letterhead]

CERTIFICATE OF ADOPTION

Town of Cheshire, Massachusetts

SELECT BOARD

A RESOLUTION ADOPTING

The Town of Cheshire Hazard Mitigation and Climate Adaptation Plan

WHEREAS the Town of Cheshire recognizes the threat that natural hazards and climate change pose to people and property within the Town of Cheshire; and

WHEREAS the Town of Cheshire prepared the 2023 hazard mitigation plan, hereby known as the Cheshire Hazard Mitigation and Climate Adaptation Plan; and

WHEREAS the Cheshire Hazard Mitigation and Climate Adaptation Plan identifies mitigation goals and actions to mitigate potential impacts from natural hazards in the Town of Cheshire; and

WHEREAS, a duly-noticed public meeting was held by the Cheshire Board of Selectmen on Date ________________; and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Cheshire Board of Selectmen adopts the 2022 Cheshire Hazard Mitigation and Climate Adaptation Plan, in accordance with M.G.L Ch. 40.

ADOPTED by a vote of __ in favor and __ against, and __ abstaining, this day___________.

____
[Select Board Chair Name]
Chair, Cheshire Board of Selectmen

____
Date

ACKNOWLEDGEMENTS

The development of this *Cheshire Hazard Mitigation and Climate Adaptation Plan* has been made possible with financial support from a Municipal Vulnerability Preparedness (MVP) planning grant provided by Massachusetts Executive Office of Energy & Environmental Affairs (EOEEA). The Town would like to thank the support and guidance provided by EOEEA's MVP staff throughout this planning process.

The Town of Cheshire would like to thank the members of the Cheshire Hazard Mitigation & Municipal Vulnerability Preparedness Committee, who served as the advisory committee for this planning effort.

The Berkshire Regional Planning Commission provided technical assistance to the Town and HM/MVP Committee throughout the planning and approval processes.

This plan is dedicated to Bill Lewis who passed away during the planning process. Bill was an integral member of Cheshire community. Bill was serving as Harbormaster, present on the Lake Hoosac Prudential Committee, and a volunteer Emergency Responder for Cheshire's Fire Department. He was dedicated to making Cheshire a better place.

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CHAPTER 1: INTRODUCTION

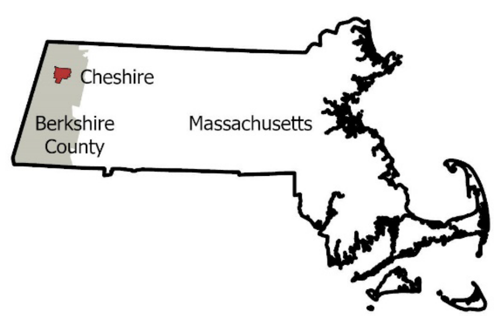
Purpose

The purpose of hazard mitigation planning is to reduce or eliminate the need to respond to hazardous conditions that threaten human life and property. As noted in the 2018 *Massachusetts State Hazard Mitigation and Climate Adaptation Plan* (SHMCAP, 2018), Natural Hazards are natural events that threaten lives, property, and other assets. Often, natural hazards can be predicted and tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.[1] Hazard Mitigation is a term that describes an action taken to reduce the harm that natural disasters have on people and property – it is the up-front work to mitigate or reduce the impacts of a disaster when it strikes. The mitigation action is pro-active, rather than reactive, and is an action taken to solve a problem on a permanent, long-term basis. Climate Adaptation is an adjustment in natural or human systems that respond to actual or expected climatic stimuli or their effects (SHMCAP, 2018). In man-made systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment. Resilience is the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event or a changing climate in a timely and efficient manner - the ability to "bounce back" where mitigation may not work.

The Town of Cheshire Hazard Mitigation and Climate Adaptation Plan (HMCAP) was prepared to meet the requirements of the Code of Federal Regulations, Title 44 CFR § 201.6 pertaining to local hazard mitigation plans. This plan is designed as a Single-Jurisdiction plan. Title 44 CFR § 201.6(a)(1) states that "a local government must have a mitigation plan approved pursuant to this section in order to receive hazard mitigation project grants. A local government must have a mitigation plan approved pursuant to this section in order to apply for and receive mitigation project grants under all other mitigation grant programs." The Town's eligibility for FEMA's hazard mitigation grants is crucial.

This plan was also prepared to meet requirements of the Massachusetts Executive Office of Energy and Environmental Affair's (EEA) Municipal Vulnerability Preparedness (MVP) Planning Grant, which enabled Cheshire to complete this plan, and to integrate local effects of climate change into their hazard mitigation action plan. By completing the Community Resilience Building (CRB) process, Cheshire will be an MVP community eligible for MVP Action Grants to adapt to the impacts of climate change on the community.

Figure 1.1. Location of Cheshire within Massachusetts



The defined mission for the Town of Cheshire Hazard Mitigation and Climate Adaptation Plan is to "Reduce the loss of life, property, and infrastructure, and environmental and cultural resources from disasters and the impacts of climate change through a comprehensive mitigation program that includes planning, prevention and preparedness strategies." In accordance with Title 44 CFR § 201.6 the local mitigation plan is the representation of the Town's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards.

[1] *SHMCAP, 2018. EOEEA & MEMA, Boston, MA.*

Additionally, the HMCAP is meant to serve as the basis for the Commonwealth of Massachusetts to provide technical assistance and to prioritize project funding.

Background

The Town of Cheshire covers an area of 27.5 square miles. According to the 2020 census the town's population is 3,138, giving a density of approximately 115 people per square mile. There are 1,556 households, resulting in a household size of approximately 2 people per household (US Census Bureau, 2020). According to MassGIS land use data, the predominate land uses in town are forest (68.7%), agriculture (12.4%), residential (7.1%), and open water and wetland (6.3%) (MassGIS, 2016). Development is concentrated around the main corridor Route 8 and the Hoosic River, located a number of businesses, critical facilities, and households in the Hoosic River floodplain. Agricultural operations are often located outside town in the northeast area of Cheshire. To the northwest and southeast are popular hiking areas and protected forest land. See Image 3.X for Land Use map.

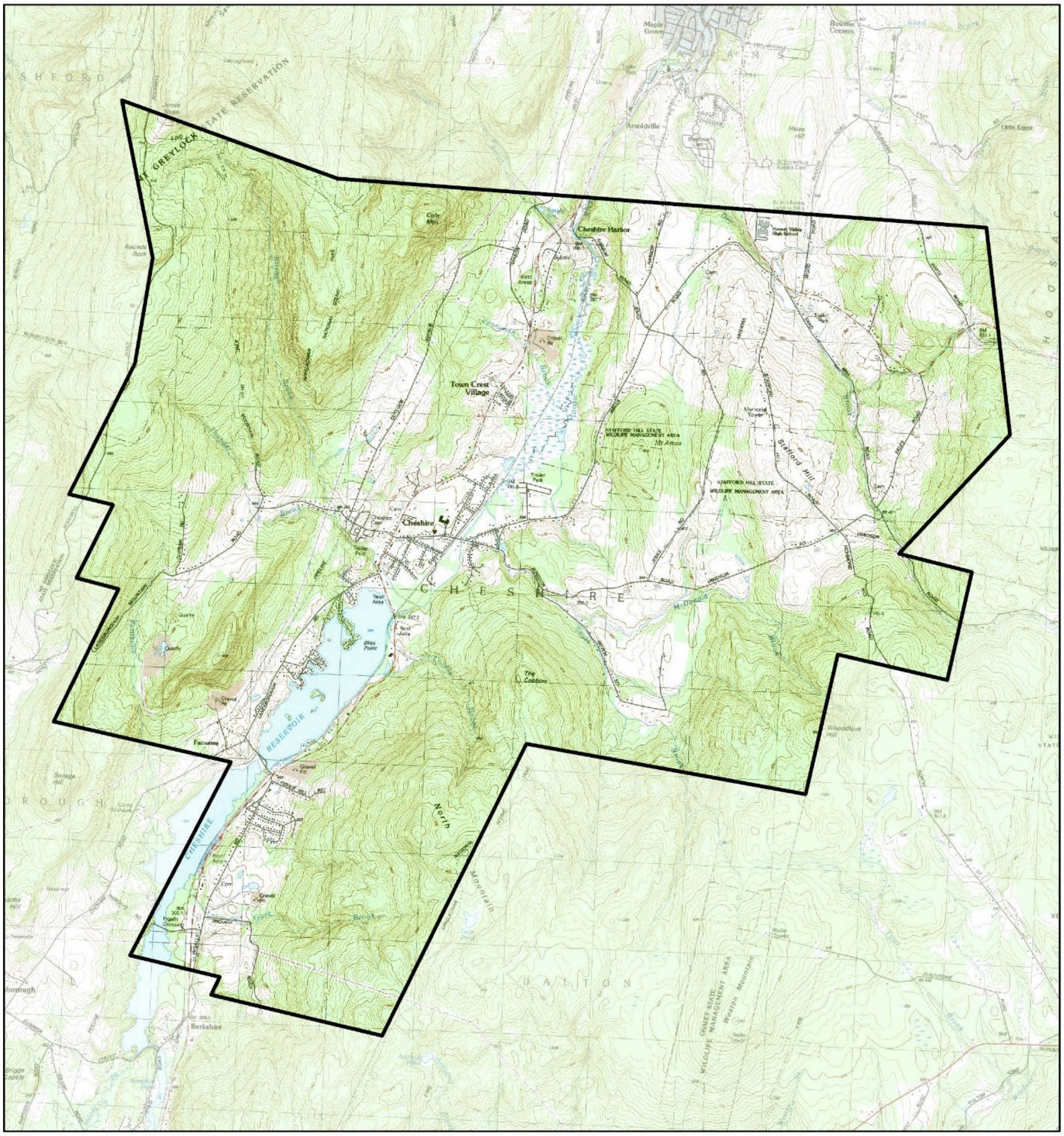
The Town of Cheshire is nestled in the valley of the South Branch Hoosic River. Most of the center of Town is built around this river and its tributaries. Mount Greylock rises to the west of town which contains parts of Mount Greylock State Reservation. To the southeast the Appalachian Trail crosses through North Mountain of the Hoosac Range and continues the center of town toward Mount Greylock. Cheshire shares borders with six Berkshire towns. Mainly Adams and Savoy to the north and northeast respectively, Dalton to the southeast, and Lanesborough to the southwest with which Cheshire also shares Cheshire Reservoir's middle basin. To the northwest Cheshire borders New Ashford and to the west, Windsor.

Cheshire is home to the regional Hoosac Valley School District which captures 1,035 students from Cheshire and Adams. The District has three buildings Elementary, Middle and High School. The latter two are the newest as construction was completed in 2012. Whereas school buildings have been constructed in upland areas, the majority of Cheshire Critical Facilities including its Police and Fire, Town Hall, and Highway Garage, are located in the flat lands within or close to the Hoosic River floodplain.

Mitigation Planning History

This is the Town of Cheshire's first Hazard Mitigation and MVP planning effort.

Figure 1.2. Topographical Map of Cheshire



N

0 0.5 1 Miles

This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the

Source: BRPC, 2022.

CHAPTER 2: PLANNING PROCESS

44 CFR § 201.6(b) & 44 CFR § 201.6(c)(1)

Introduction

This chapter outlines the development of the Town of Cheshire Hazard Mitigation and Climate Adaptation Plan (HMCAP). It identifies who was involved in the process, how they were involved, and the methods of public participation that were employed. An open public involvement process during the drafting stage was essential to the development of the HMCAP. A discussion of how the community will continue public participation in the plan maintenance process (44 CFR § 201.6(c)(4)(iii)) will be discussed in Chapter 4.

The Town retained the Berkshire Regional Planning Commission (BRPC) to aid them in developing the HMCAP and the MVP Plan. The Cheshire HMCAP is a compilation of data collected by BRPC, information gathered from the Cheshire Hazard Mitigation and Municipal Vulnerability Preparedness Committee (the HMP/MVP Committee) during meetings, and interviews conducted with key stakeholders outside of working meetings. The Cheshire HMCAP reflects comments provided by participants and the public through the MVP planning process, the Planning Committee, local officials and citizens, neighboring towns, and ultimately MVP, MEMA, and FEMA.

Planning Meetings and Participation

44 CFR § 201.6(c)(1)

During the HMCAP planning process there was opportunity for public comment by town residents as well as the neighboring communities of Adams, Lanesborough, Dalton, Savoy, Windsor, and New Ashford, MA; local and regional agencies; partners involved in hazard mitigation activities; and agencies that have the authority to regulate development. The Cheshire Planning Board is the primary town agency responsible for regulating development in the town. Feedback from the Planning Board was ensured through a presentation of this plan to the Planning Board during draft review. Making the document available to the public for review meets requirements of 44 CFR § 201.6(b)(1), and solicitation of comment from neighboring towns meets requirements of 44 CFR § 201.6(b)(2), pertaining to involvement of regional partners in the planning process. See Appendices for documentation.

In August 2021 Cheshire formed the Hazard Mitigation and Municipal Vulnerability Preparedness Committee (the HMP/MVP Committee) to steer the process. Members of the HMP/MVP Committee include town department heads, Town Boards, and representative residents. The Planning Committee members are listed in Table 2.1.

The HMP/MVP Committee held a series of meetings to assemble data on the Town's infrastructure, identify known hazards to residents, including visitors and seasonal residents, and review existing plans, procedures, bylaws and protections already in place. The Committee met 15 times between August 2021 and April 2023. On June 3rd, 2022, the Committee held a full-day workshop. Twenty-two people attended consisting of town officials, residents, community groups, stakeholder organizations, and emergency responders. Cheshire utilized the Community Resilience Building Workshop model to collect input from as diverse a group of community members and stakeholders as possible with particular outreach to climate vulnerable populations such as the elderly. As noted by its developers, "the Community Resilience Building Workshop employs a unique community-driven process, rich with information, experience, and dialogue, where the participants identify top hazards, current challenges, and strengths and then develop and prioritize actions to improve their community's resilience to all natural and climate-related hazards today, and in the future. The core directive of the Workshop is to foster collaboration with and among community stakeholders that will advance the education, planning and ultimately implementation of priority actions."[2] Invitations were sent to residents and stakeholders through emails, phone-calls, flyers, and online postings. Core team members contacted invitees directly to encourage participation and ensure receipt of an invitation. Workshop participants are listed in table 2.1.

Table 2.1: Workshop Attendee List

Name	Affiliation
Facilitators	
Courteny Morehouse	Berkshire Regional Planning Commission – Project Coordinator
Lauren Gaherty	Berkshire Regional Planning Commission
Justin Gilmore	Berkshire Regional Planning Commission
Mark Maloy	Berkshire Regional Planning Commission
HM/MVP Committee	
Jennifer Morse	Cheshire Town Administrator
Michael Alibozek	Cheshire Chief of Police
Thomas Francesconi	Cheshire Fire Chief
Robert Navin	Cheshire Highway Supervisor
Corey Swistak	Cheshire Acting EMD and Assistant Fire Chief
Liseann Karandisecky	Hoosac Lake District Prudential Committee
Workshop Attendees	
Sean Sanderson	Adams Ambulance, General Manager
Aaron Dean	Hoosic Valley School District, Superintendent
John Tremblay	Cheshire Finance Committee, Chair
Ronald DeAngelis	Cheshire Conservation Commission & Select Board
Michelle Francesconi	Cheshire Select Board, Chair & St. Mary of the Assumption, Business Manager
Travis Delratez	Cheshire Water Department, Superintendent
Barry Emery	Town Historian & Resident
Stephan Marko	Cheshire Zoning Board of Appeals, Chairman
Peter Traub	Cheshire Planning Board, Chair
Francis Willett	Hoosac Lake District Prudential Committee
Shawn McGrath	Cheshire Select Board & Lake Hoosac District

Public Outreach Methods

The Town of Cheshire worked to engage residents, Cheshire community leaders, and the six neighboring communities (Lanesborough, Windsor, Dalton, New Ashford, Adams, and Savoy). Meetings related to plan development and opportunities for input were posted on the town calendars. A special effort was made to engage vulnerable residents namely, low-income, elderly, and youth. There were two presentations made at the Council on Aging Senior Center during Senior Lunch Hour. An invitation was sent to the manager of one of the town's mobile home parks to include the neighborhood's participation, and the Superintendent of Hoosac Valley Schools attended the Hazard Mitigation Action Workshop. More generally, committee members emailed community leaders in town including the Lake

[2] *Community Resilience Building, date unknown*.

Hoosac Prudential Committee, heads of Town departments, church leaders, and major business owners. Flyers were distributed at Town Hall and through the posted at the Transfer Station.

In an effort to reach as many residents as possible, the Town issued a public survey that asked respondents to describe the natural hazards they had experienced and the concerns that worry them most about hazard events, including climate change impacts. The survey, was available online and in paper form for three months, during which the Town received a total of 94 responses. The Town promoted the survey and the planning process by placing notices on the Town's main web page, through full-page color flyers posted at Town Hall and the Town Transfer Station, announcements during Select Board meetings and a public information session.

The Town hosted four public presentations to inform community members and stakeholders of the planning process, gather information, and present of the major findings. Two meetings were held at the Council on Aging Center first during March 9, 2022 and another once with completed plan results on September 14, 2022. In addition, online sessions were held after work hours on March 14, 2022 and September 21, 2022. The presentations were held in accordance with the Massachusetts Open Meeting Law and promoted through the same channels as the public survey, via the town's web page, announcements, direct email blasts, and through flyers at public places. During the presentation the public was invited to provide feedback on the major findings and to review the materials posted on the Town's website. See Appendix XX for examples of outreach.

Public Comment on the Draft MVP Plan and HMCAP

The Draft HMCAP, was posted on the Town of Cheshire website on October 20th, 2023. Emails to review and comment on the draft plan were sent directly to individual respondents of the public survey who requested that they be kept apprised of milestones during the hazard mitigation project. The plan's posting was also announced at Cheshire Select Board meetings on November 14th, 2023. Neighboring towns of Windsor, Dalton, Lanesborough, New Ashford, Adams, and Savoy as well as local nonprofits, community groups, and the Norther Berkshire Regional Planning Committee (REPC) were formally invited to review and comment on the draft plan. See Appendix A for more details.

Comments received during the public comment period and MEMA review were incorporated into the final draft plan submitted to FEMA.

Environmental Justice Populations

According to information provided by the Executive Office of Energy and Environmental Affairs (EEA), in Massachusetts an environmental justice population is a neighborhood where one or more of the following criteria are true:

- the annual median household income is 65 percent or less of the statewide annual median household income;
- minorities make up 40 percent or more of the population;
- 25 percent or more of households identify as speaking English less than "very well";
- minorities make up 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.[3]

[3] *https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts*

According to EEA and using 2020 U.S. Census data (as of autumn 2023), there are no environmental justice populations located within the Town of Cheshire using the state's criteria. There are no public housing projects or developments in the Town, and therefore any residents meeting any of the EJ criteria will be scattered throughout the Town. Residents of Cheshire's mobile home parks and seniors on fixed incomes are likely the largest segment of the population being cost burdened.

Municipal Vulnerability Preparedness (MVP) Workshop

The central objective of the workshop was to review regional weather events from the past and climate change data and projections, then collect local data from attendees to help:

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

Categories of Concerns and Challenges

Overwhelmingly, flooding was the concern that came up repeatedly through public outreach and at the MVP Workshop. Other concerns that rose to the top included extreme weather/high winds, winter/ice storms – freeze/thaw cycles, and drought/wildfire. Flooding concerns include extreme precipitation, increased erosion and sedimentation due to runoff, and damage to local roadways in part due to undersized culverts and outdated drainage systems. Extreme weather/high winds encompass hurricanes and other high wind events. Winter/ice storms – freeze/thaw cycles encompass ice storms, ice jams, snowstorms, severe winter storms such as nor'easters, and the degradation of local roadways, especially dirt roads, that become muddy and rutted due to increased fluctuations of cold and warm weather during winter. Drought/wildfire concerns for Cheshire are more general yet expose vulnerabilities the town will need to prepare for.

A couple of specific storms were brought up repeatedly during the planning process, namely Hurricane Irene in 2011 and a microburst isolated to Cheshire and Dalton, MA in 2016. More on specific storms can be found in Chapter 3 Hazards section later. Outlined here are the major concerns examined during the MVP workshop.

Emergency Shelter

Designating a new emergency shelter location was a topic of much discussion. Currently, the town's main shelter has been identified as the Hoosic Valley High/Middle School. However, there is no formal agreement between the Town and the School District. It was determined during the CRB Workshop that the Town was going to work with the School Superintendent on an agreement to formalize this location as an emergency shelter while a second location is developed. This plan will include emergency action plan, where to store materials and equipment, etc. As a long-term solution, there are some concerns about the locality of Hoosic Valley High as a shelter since it is not central to many of the town residents and up a relatively steep and curvy road which may be difficult to access during severe winter events. Participants suggested the town identify a new emergency shelter location that is easily accessible for all or most residents and can provide accommodations for evacuees (kitchen, sleeping arrangements, bathrooms, showers, back-up generator, stockpiles of supplies and other necessary equipment). Some participants suggested going back to using the old elementary school as an emergency shelter location, which would require some upgrades and a new generator. It was also suggested that the old St. Mary's building be considered for an emergency shelter location.

Lack of Emergency Services Personnel/Volunteers

Another major topic of concern was the town's inability to recruit and retain staff and volunteers that provide emergency services (EMS, fire department, etc.). As with many rural towns, Cheshire struggles to recruit and retain long-term emergency services personnel and volunteers. Workshop participants recommended the town explore avenues to better recruit and retain emergency workers and volunteer staff. Potentially offering a stipend might help to attract additional long-term volunteers. Another suggestion was to develop an emergency services pathway at the high school, with EMT and junior firefighter opportunities, to introduce youth to these professions.

Directly related to this topic is the issue of providing ambulance services. According to our EMS stakeholder involved in the workshop, ambulance services come from the Town of Adams and are provided by a private company that assumes a lot of financial risk as a result of low federal reimbursement rates. Suggestions for alleviating this financial burden such as regionalizing and increasing municipal payments for ambulance services along with advocating to congress the need to increase Medicare/Medicaid reimbursement rates was mentioned.

Roadway Maintenance, Drainage, and Catch Basins

Cheshire's roadway network is made up of paved roads, gravel roads, and dirt roads. A common theme that emerged among workshop participants was the desire to address drainage issues along local roadways and particularly, preventing dirt roads from turning to mud roads after rainstorms or after thawing from being frozen. Workshop participants identified the importance of developing a comprehensive plan to manage roadways. A major component of the comprehensive plan would be a prioritization plan for addressing roads most in need of repair, particularly gravel roads that need repair or need to accommodate high levels of throughput. Richmond Hill Road was identified as needing maintenance. Wells Road and Savoy Road (Route 116) were both identified as having issues related to erosion. In the future, it may behoove the town to explore the Winter Recovery Assistance program[4] which provides supplemental funding to municipalities to improve their transportation network in response to harsh winter weather.

Workshop attendees highlighted the town's Gravel Road program, which seeks to maintain Cheshire's gravel roads in a state of good repair. This program is perceived to be successful, and participants suggested continuing to support the program and identify pathways to augment it where possible. Related to drainage, workshop participants suggested the town assess its stormwater system (town wide) to document any issues related to flooding, sedimentation, and/or illicit discharge. These efforts are currently underway.

Lastly, workshop participants mentioned that the town currently has a robust protocol for annual cleaning of catch basins. According to one participant, the town currently hires a contractor to perform catch basin cleaning and related work. It was suggested that the town explore funding/equipment procurement options to allow the town's DPW to perform scheduled catch basin cleaning. The purchase of a backhoe for the town's DPW was mentioned as a solution for debris clearing and related work and was mentioned as something the town should explore.

[4] https://www.mass.gov/winter-recovery-assistance-program-wrap

Culverts and Bridges

Directly related to roadway degradation and flooding is the topic of culverts and bridges. Culverts typically consist of a metal or plastic pipe, with varying dimensions, that allow water (a stream) to flow underneath the roadway from one side to the other. Culverts generally have short spans and are usually embedded in the soil. When culverts are undersized, they pose a barrier to aquatic organism movement and passage (such as a brook trout headed upstream to spawn) and often contribute to flooding issues. Bridges, which have a higher degree of engineering, are structures built to span a physical obstacle without blocking the way underneath. In Massachusetts, a bridge is defined as a crossing structure with a span length of 10' (feet) or greater.

Of all the regions in the U.S., the Northeast has seen the most dramatic increase in the intensity of rainfall events. The U.S. National Climate Assessment reports that between 1958 and 2010, the Northeast saw more than a 55% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events). With an increase in the frequency and intensity of precipitation events, the need to replace problem bridges and upsize culverts to accommodate higher water levels and flow rates was identified as an important resiliency strategy.

As such, the town has identified the need to develop a plan for assessing and prioritizing the replacement of (undersized) culverts and bridges. Workshop attendees suggested structure replacements could be incorporated as an element of the town's updated Capital Improvement Plan. It was mentioned that the culvert located along Savoy Road (Route 116) headed west, just prior to Fales Road, causes floodings issues. Another culvert located along the same stretch of road, around the intersection of Henry Woods Road, also poses flooding issues.

Related to bridges, workshop participants felt it important to develop a plan to assess all bridges for deficiencies, to compile bridge reports, and to seek funding alternatives (such as grant programs) to repair bridges in need. There were several problem bridges identified during the workshop.
The bridge spanning Kitchen Brook on Route 8 has repetitive problems related to flooding and requires work. It was noted that this bridge (referred to as the Kitchen Brook bridge) allows Route 8 to provide critical north/south county access, including access to the regional hospital and other emergency services. During freeze/thaw events, this bridge is often the pinch point for large blocks of ice as they mobilize downstream. As a result, ice jams cause winter flooding across Route 8 about once a year, causing the main north/south route to be diverted. If the Kitchen Brook bridge were to fail entirely, there are few good alternatives that could be used to provide north/south county access. Since the Kitchen Brook bridge is owned by MassDOT, the town should work with the state to replace/enlarge it.

The bridge along Main Street also encounters issues, is undersized and nearly failed during Hurricane Irene. Moreover, this bridge contributes to the flooding of Berkshire Village mobile home park. It was suggested that this bridge be replaced and/or raised. There is a bridge located along Notch Road that is also susceptible to flooding. When flooding in this area does occur, Notch Road and its residents are effectively cut off from the rest of town. In addition to regularly reviewing this bridge's status, it was suggested that bank stabilization interventions occur at this intersection of Windsor and Notch Road. Lastly, the town has applied for funding to support engineering redesigns for the bridge located along West Mountain Road. The bridge located along Sandmill Road, also an issue, is scheduled to be replaced soon.

Aging Infrastructure

Another theme to emerge from the CRB workshop was the topic of aging town-owned infrastructure. Specifically, workshop participants identified town buildings, DPW equipment, water mains, and fire hydrants as all needing upgrades. Town buildings such as the town hall, police station, fire station, and the old elementary school are all, in one form or another, outdated. Participants suggested the town undertake more frequent maintenance of town-owned buildings, and recommended the town develop a maintenance program and replacement plan.

With respect to aging DWP equipment, participants felt it prudent for the town to explore funding options to further maintain and replace old equipment. Specifically, this includes all equipment that is vital to DPW personnel to perform necessary work that facilitates safe travel of the town's roads. The purchase of a new backhoe was also noted as a piece of equipment the DPW could desperately use – as this piece of equipment would allow for the efficient removal of debris and ice – from downed trees on roads, to a clogged culvert inlet, to shoring up riparian zones suffering from erosion issues.

Lastly, scattered throughout town are several water mains that are outdated and/or are crumbling along with fire hydrants that simply do not work. Workshop attendees suggested that the town assess funding options for replacing old water mains and non-functional fire hydrants. Additionally, the electronic systems that monitor water levels (private wells, groundwater, fresh water) along with the generators and pumps that supply drinking water all need to be upgraded. Participants suggested that the town conduct a study to determine water table and private well vulnerability under different climate scenarios. Related to this, the town is currently exploring a back-up water supply that would be made available through an interconnection with the Town of Adams. Participants asserted that these efforts should continue and be supported.

Cheshire Reservoir Dam

The Cheshire Reservoir Dam, also referred to as the dam at Hoosac Lake, was a topic of much discussion. The dam is classified as a significant hazard and is in fair condition. According to workshop participants, dam maintenance and operations are monitored by volunteers with little to no coordination or cooperation from the state, which is the owner of the dam. A much needed first step is to get the MA Department of Conservation and Recreation (DCR) and the Office of Dam Safety at the same table to discuss dam operations and ensure public safety. Moreover, the town should confirm the hazard classification, condition, and size of the dam. Additionally, volunteer dam monitors requested more training opportunities to recruit more volunteers to monitor the dam. It was also suggested that the town try to change the agreement on dam operation to have the state take over maintenance and operations. Lastly, participants recommended that all homeowners within the surrounding area (specifically in the inundation area) should be automatically signed up to received CodeRED alerts.

Cheshire Reservoir/Hoosac Lake

Aside from the dam, two other vulnerabilities associated with the Cheshire Reservoir / Hoosac Lake were identified by workshop participants. First, it was noted that several private septic tanks located on properties surrounding the lake tend to fail when the water levels are 'too high'. It was suggested that the town raise awareness of the environmental impacts of septic failure and provide information on available financial aid that could be used to address failing systems. Another suggestion grouped into this category related to the desire to have a Needs and Cost/Benefit Analysis conducted for the Adams Wastewater Treatment Plant (WWTP) – which was classified as being 'under capacity' – and which could serve as an alternative to individual septic systems.

Another issue mentioned relates to sedimentation, water quality, and extreme growth of aquatic invasives in the lake. Sedimentation of the lake comes from surrounding dirt roads – most of which were identified as being privately owned. Sedimentation in partnership with other runoff and failing septic systems contribute to phosphorus and nitrogen nutrients that in turn feed plant growth. The Hoosac Lake Recreation and Preservation District has an active Notice of Intent with Cheshire's Conservation Commission to manage aquatic invasives through in-lake herbicide treatment. There are concerns as to the effectives of this program and participants suggested applying for a Non-Point Source (NPS) pollution study to identify the amount of and sources of nutrient input and bacteria growth. Doing this will lay the groundwork for Lake stakeholders to address nutrient and bacteria sources, reduce inputs and better control invasives growth at the source. The town should consider partnering with surrounding communities and the District's Prudential Committee to secure funding to conduct an NPS study and general water quality testing.

Invasive Species and Novel Wildlife

According to workshop participants, Cheshire has recently seen an increase in encounters with rattle snakes and invasive species such as Emerald ash borer. While no rattlesnake encounters to date have resulted in injury or death, participants recommended that town staff/emergency services within the town are prepared and have training to treat snake bites and can mitigate other dangerous human/wildlife interactions.

With respect to invasives, such as the Emerald ash borer or invasive weeds that spring up along the shoreline of Cheshire Reservoir, workshop participants recommended the town work with DCR on invasives management and attempt to secure recurring state funds to continue to treat invasives along the lake's shoreline in addition to the nutrient study described above. A component of these efforts would also look to assess various locations for different invasives, particularly forested areas, and to use this information to develop an invasive species management plan. Locations identified by participants as having issues related to invasives include the lake, the Cobbles, Coolidge highway area, and town wide more generally. Additionally, the town should conduct an educational campaign to educate residents on invasive species management control which will further augment management efforts.

Incorporation of Existing Information

44 CFR § 201.6(b)(3)

No plan should be created in a silo, particularly a hazard mitigation plan because of its applicability to land use, municipal and emergency services, and vulnerable people. This is especially important for small towns like Cheshire who work closely with their neighbors to address issues on a larger, regional scale. This HMCAP update incorporates relevant data and information from existing plans, plans in development, studies, reports and technical information. Main data sources and local plans include:

- Berkshire County Hazard Mitigation Plan, 2012
- Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), 2018
- Dalton Multi-Hazard Mitigation Plan Update, 2018
- Adams Multi-Hazard Mitigation Plan, 2019
- Lanesborough Multi-Hazard Mitigation Plan, 2019
- Windsor Hazard Mitigation and Climate Adaptation Plan, 2020
- Massachusetts State Climate Assessment Report, 2022

This plan should be used in conjunction with other local and regional plans, specifically transportation and capital improvement programs, Comprehensive/Master Plan, lake management plans and emergency preparedness planning.

Plan Structure

The next chapter of this plan will analyze risk, profiling each hazard with potential to affect the Town of Cheshire. After a general profile of the Town's assets and vulnerabilities, each hazard analyzed includes a hazard profile and vulnerability assessment. Hazard profiles consist of likely severity, probability, geographic areas likely impacted, and historic data.

The Risk Assessment discusses hazard effects on people including vulnerable groups, the built environment including infrastructure, the natural environment, the economy, and future conditions to the extent reasonably foreseen in consideration of climate change. Table 3.2 illustrates part of the process of prioritizing hazard mitigation actions in addition to the profiling of local impacts during the risk assessment. The method of prioritization meets requirements of 44 CFR § 201.6(c)(3)(iii).

Hazard Mitigation Goals

In developing this plan, the Town of Cheshire is taking action to reduce or avoid long-term vulnerabilities to the hazard identified in the following chapter. The following are the Town's goals for this hazard mitigation plan:

1. Reduce the risk of flood damage
2. Ensure road security
3. Increase accessibility of emergency services
4. Manage invasive species

CHAPTER 3: RISK ASSESSMENT

44 CFR § 201.6(c)(2)

FEMA Requirements

In accordance with 44 CFR § 201.6 (c)(2), this risk assessment provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. The risk assessment is an analysis of the hazards and risks facing the Town of Cheshire and contains hazard profiles and loss estimates to serve as the scientific and technical basis for mitigation actions. This chapter also describes the decision-making and prioritization processes to demonstrate that the information analyzed in the risk assessment enabled the Town to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. This section also provides information on previous occurrences of hazard events and on the probability of future hazard events with consideration to climate change (44 CFR § 201.6(c)(2)(i).

This plan also includes a section on Invasive Species and Vector-borne illnesses because this is a growing threat that could disable critical facilities and the essential services they provide to the community.

People

The total population according to the 2020 United States Census is 3,138, with an average of approximately 114 people per square mile. There are 1,556 households in Cheshire, with an average of 2.01 persons per household. According to the American Community Survey, the median age of the population is 52.3 years, 10 years higher than Berkshire County median age of 47.2 and 12.7 years higher than Massachusetts (which has a median age of 39.6 years). Median household income for Cheshire residents is $94,167, which is over $12,000 higher than the median income for Berkshire County ($81,787) and is approximately 78% of the median household income for Massachusetts (which is $120,626). Approximately 5.39% of persons live in poverty, nearly half the poverty rate in Berkshire County as a whole, which is 10.9%.[5]

Cheshire is a bedroom community, where most residents commute to employment centers in Pittsfield and North Adams. With easy access to Route 8 – a major thoroughfare of Berkshire County, average commute is 16 minutes. Of those that do commute, 87.8% work in Berkshire County and 11% work in nearby Connecticut or New York. Approximately 51% of the housing units are seasonally occupied, with landowners coming primarily from New York City and other northeast metropolitan areas.

Cheshire has three identified vulnerable populations. Twenty percent of the population are school-aged children. Students almost exclusively attend Hoosac Valley School District located in Cheshire's northeast section of towns – high on a hill. One quarter of the population (25.3%) are seniors. Cheshire has two mobile home neighborhoods – Kitchen Brook Mobile Home Park and Berkshire Village (formerly Pine Valley) Mobile Home Park. Although Cheshire has no formally-designated Environmental Justice populations (using EEA Criteria and 2020 U.S. Census data), these neighborhoods and pockets of households in the downtown area are likely where the highest concentrations of cost-burdened residents are located.

[5] *U.S. Census Bureau (2020). American Community Survey 5-year estimates. Retrieved from Census Reporter Profile page for Cheshire, Berkshire County, MA*

Recreation revolves primarily around the Ashuwillticook Trail, Lake Hoosac (also known as the Upper Basin of Cheshire Reservoir) and the Appalachian Trail that runs from the southern border with Dalton through "The Cobbles", along the western edge of town, and north to Mount Greylock via New Ashford, MA. In 2018 Cheshire elected to become one of three designated Appalachian Trail Communities in the Berkshires, and most recently opened up the Father Tom campsite for hikers.[6] Cheshire Reservoir is accessible by kayak/canoe boat launch at parking along Route 8 and fishing along Farnams Road which separates the Upper and Middle Reservoirs. The Ashuwillticook Trail is a mostly paved multi-use trail running along Cheshire Reservoir/Lake Hoosac connecting to points south as far as Pittsfield to points north in North Adams.

Economy

The Town's total FY22 budget was $6.46 million. The majority of revenue is from local taxes which make up 82% of the budget. The remaining 18% consists of state revenue and grants (14%), service charges (1.6%) and a small mix of licenses, permits, and federal ARPA funds.[7] The largest employer in Cheshire is the Hoosac Valley School District which houses a regional Elementary, Middle and High School. Nearly equally prevalent is the retail industry which employs over 1/3 of Cheshire residents. Other notable industries are Utilities, Construction, Manufacturing, Healthcare, and Agriculture.[8]

Natural Environment

The predominant habitats in Cheshire are forest (71%), open water and wetlands (6%), and a mix of scrub/shrub and grassland (4%). Twelve percent of land use is agricultural, primarily hay/pasture. Residential, commercial, and industrial lands combined make up about 3% of town land use.[9] See Image 3.1 for reference.

The majority of protected natural spaces follow the Appalachian Trail with two significant areas around the Cobbles in the Southeast portion of town and the foothill of Mount Greylock in the Northwest corner. These two areas contain over 4,800 acres of core forest (that is protected forest of at minimum 200 acres). These areas are home to vernal pools (1,360 acres), and rare species core habitat.

Rare species are also present around water resources namely Lake Hoosac, also known as Cheshire Reservoir Upper Basin, probably the most developed area where rare species core habitat is in the Town. Wetlands make up about 224 acres the biggest track of which is just east of northern sections of Route 8 down to and surrounding Berkshire Village, a mobile home park.[10] This area is particularly friendly to beavers which have established an abundant population. While good for the habitat, this also conflicts with Town infrastructure in housing as the beaver dams tend to cause flooding, especially when they break. This has occurred at least once along Route 116, washing out a culvert, road, and requiring significant emergency repairs.

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[6] iBerkshires articles on Cheshire Town Website: https://www.cheshire-ma.gov/about/pages/appalachian-trail-community%E2%84%A2-program

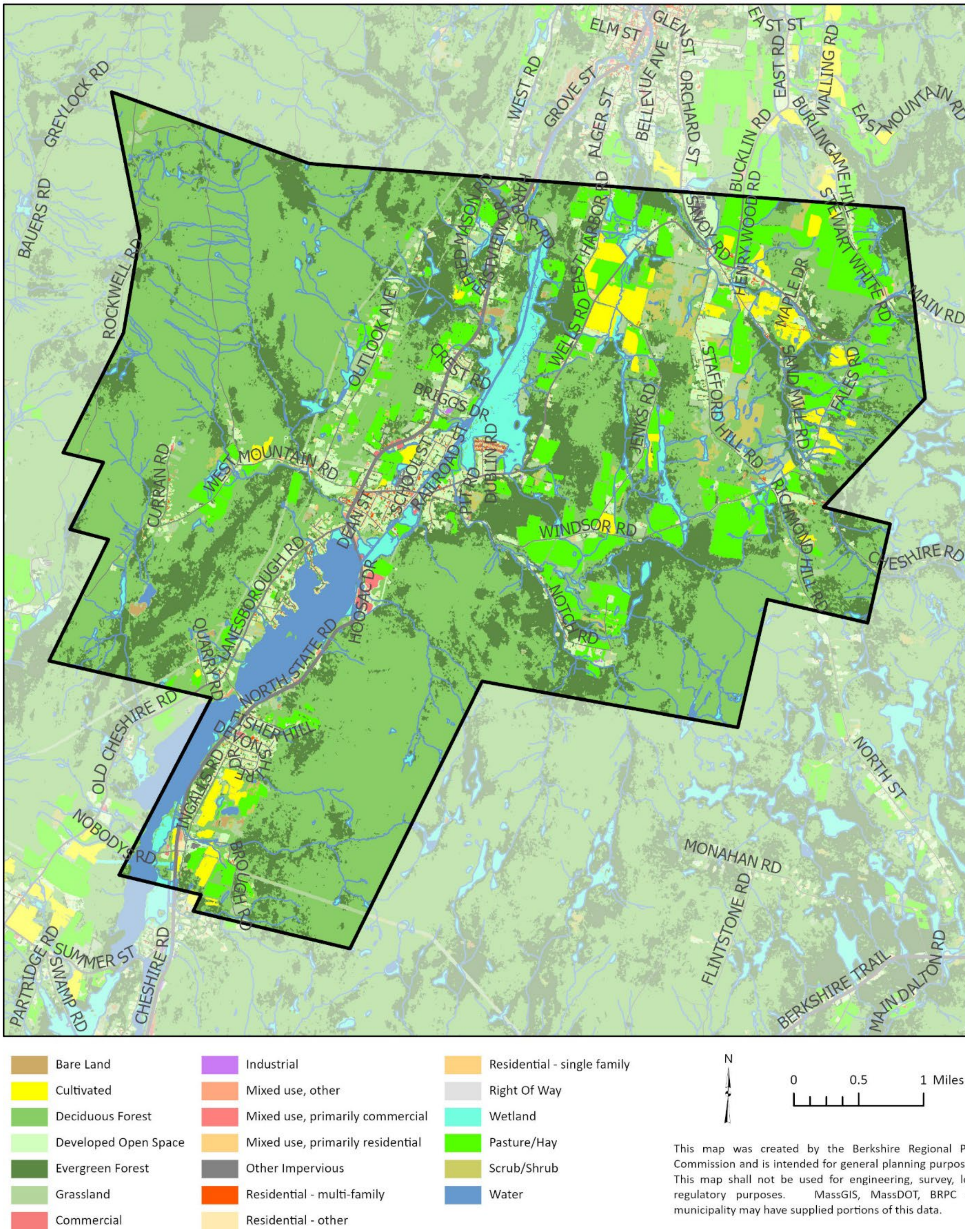
[7] MA Dept. of Revenue 2023 Schedule A General Fund (state.ma.us)

[8] Census Bureau American Community 5 year Survey 2020

[9] MassGIS 2016 Data

[10] BioMap 2 2022, The Nature Conservancy and MA Fish and Wildlife

Figure 3.1. Town of Cheshire Land Use 2016



This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the municipality may have supplied portions of this data.

Built Environment

A list of the critical facilities within the community is shown in Table 3.1. These facilities were digitized into GIS and used for determining vulnerability to the various hazards.

Table 3.1. Cheshire Critical Facilities

Facility and Function	Address
Town Hall: Town Offices, Public Meeting Space, Police Station, Water Department	80 Church St.
Cheshire Fire Department: Emergency services & rescue equipment, Emergency Operations Center, Backup Emergency Shelter	29 South St.
Senior Center: Public Meeting Space, Senior Services, Council on Aging	119 School St.
Youth Center: Youth Services, Daycare Services, Summer Camp	191 Church St.
Hoosac Valley Middle & High School: Emergency Shelter, Mass Care Shelter, Public Meeting Space	125 Savoy Rd.
Library: Public Meeting Space	23 Depot St.
Town Garage: Highway Department, Transfer Station	6 Main St.

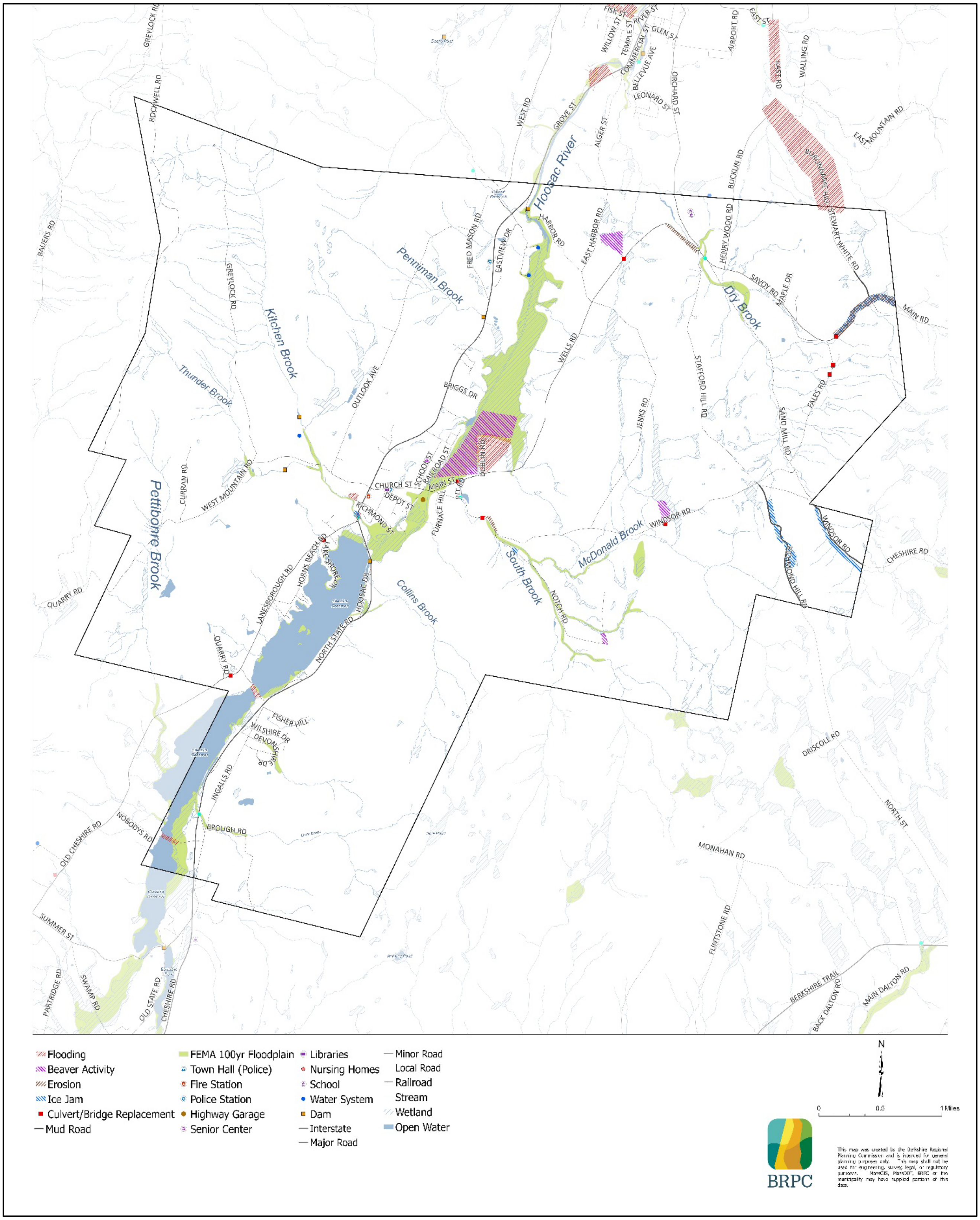
There are approximately 44 miles of roads in Cheshire. Route 8, also locally named South Street is a major North/South artery through the Berkshire owned and maintained by Massachusetts Department of Transportation (MassDOT).[11]

There is no public sanitary sewer system in Cheshire, all residents and businesses use on-site treatment systems aka septic systems. The majority of Cheshire residents have wells as their water supply. However, the downtown area is supplied by the Cheshire Water Department which services 570 households. The system infrastructure includes 53,710 feet of main and laterals as well as one pump out. Water is supplied by an underground aquifer at the base of Mount Greylock in the northwest area of town. For this reason, among others, water quality has been consistently excellent. The biggest challenge is that much of the infrastructure is old, having been originally constructed in the late 1800s /early 1900s. While the water department has replaced sections as opportunity and funding allows there are 2 miles of line that need to get replaced more immediately along North State Rd.

Cheshire is within the Pittsfield Urbanized Area and thus recently included in the Municipal Separate Storm Sewer System (MS4) 2018 General Permit. As such the town has done more extensive study and mapping of their stormwater sewer system than most municipalities of similar size. Cheshire's stormwater system is focused around the downtown area and Route 8. Stormwater infrastructure around Route 8 is maintained and owned by MassDOT. The Town maintains nearly 300 catchbasins and manholes and the associated sewer pipes.

[11] MassDOT Chapter 90 2021 Allocations

Figure 3.2. Town of Cheshire Critical Facilities and Areas of Concern



Hazard Identification and Risk Assessment Processes

In order to identify potential hazards that can affect the Town of Cheshire, a number of interviews of local Town staff and stakeholders were held. Surveys were conducted Town wide, and hazards described in neighboring town Hazard Mitigation Plans were included. Hazards were characterized further through a workshop of major stakeholders and research that included archival newspapers going as far back as 1930s. The hazards identified through these sources were Flooding, Dam Failure, Wildfire, Snow, High Wind, and Other Natural hazards (i.e. severe storms and tornadoes). To build on this list, the 2018 *Massachusetts State Hazard Mitigation and Climate Adaptation Plan* (SHMCAP) for the Commonwealth of Massachusetts was consulted. Accounting for the location, natural and built environments, history, and scientific studies of the area, it was determined that the Town of Cheshire must plan for the following hazards:

- Severe Winter Event (Ice Storm, Blizzard, Nor'easter)
- Hurricane & Tropical Storms
- Flooding (including Dams, Ice Jam, Beaver Activity)
- Severe Storms (High Wind, Thunderstorms,)
- Drought
- Invasive Species
- Annual / Extreme Temperatures
- Tornado
- Wildfire
- Landslide
- Earthquake
- Vector-borne Diseases

The Core Team reviewed and omitted the following natural hazards:

- Coastal hazards
- Coastal erosion
- Sea level rise
- Tsunamis
- Cybersecurity Threats

These hazards were left out because Cheshire is too far inland to be impacted directly by coastal related hazards and the Town recently upgrades it's cybersecurity measures.

Prioritization and Hazard Profiles

Table 3.2 illustrates the first step in the process of prioritizing hazard mitigation actions in addition to the profiling of local impacts during the risk assessment. The method of prioritization meets requirements of 44 CFR § 201.6(c)(3)(iii). In addition to reviewing existing data, the Town decided to consider changing weather patterns expected due to climate change through a Massachusetts Municipal Vulnerability Preparedness grant. Prioritization also considered public input that residents provided to the Committee through a town-wide survey. Hazards other than flooding are difficult to prioritize without this or a similar ranking system.

Table 3.2. Hazard Prioritization for the Town of Cheshire

Hazard	Area of Impact Rate	Frequency of Occurrence Rate	Magnitude / Severity Rate	Hazard Ranking
	1=small 2=medium 3=large	0 = Very low frequency 1 = Low 2 = Medium 3 = High Frequency	1=limited 2=significant 3=critical 4=catastrophic	
Dam Failure	2	1	2.5	**5.5**
Flooding (include Ice Jam, Beaver Activity)	2.5	3	3	**8.5**
Severe Winter Event (Ice Storm, Blizzard, Nor'easter)	3	3	1	**7**
Severe Storms (High Wind, Thunderstorms, Hail)	2	3	1	**6**
Hurricane & Tropical Storms	2	1	2	**5**
Drought	3	2	1	**6**
Tornado	1	1	2	**4**
Earthquake	3	0	1	**4**
Wildfire	1	1	1	**3**
Landslide	2	3	1	**6**
Change in Average/Extreme Temperature	3	0	1	**4**
Invasive Species	1	3	2	**6**
Vector-borne Diseases	3	3	2.5-3	**8.5 - 9**

Area of Impact	
1=small	isolated to a specific area of town during one event
2=medium	occurring in multiple areas across town during one event
3=large	affecting a significant portion of town during one event

Frequency of Occurrence	
0=Very low frequency	events that have not occurred in recorded history of the town, or that occur less than once in 1,000 years (less than 0.1% per year0
1=Low frequency	events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year)
2=Medium frequency	events that occur from once in 10 years to once in 100 years (1% to 10% per year)
3=High frequency	events that occur more frequently than once in 10 years (greater than 10% per year)

Magnitude/Severity	
1=limited	injuries and/or illnesses are treatable with first aid; minor" quality or life" loss; shutdown of critical facilities and services for 24 hours or less; property severely damaged < 10%
2=significant	injuries and/or illnesses do not result in permanent disability; shutdown of several critical facilities and services for more than one week; property severely damaged < 25% and > 10%
3=critical	injuries and/or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged < 50% and > 25%
4=catastrophic	multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged> 50%

Severe Winter Storms (Ice Storms, Nor'easters, Blizzards)

Hazard Profile

Snow and other winter precipitation occur very frequently across the entire Commonwealth. According to the 2018 SHMCAP, the average annual snowfall for the snowiest municipality in each of four regions are:

- Chatham (Cape Cod and Islands): 28.9 inches
- Milton (Eastern MA): 62.7 inches
- East Brimfield (Central MA): 59.0 inches
- Worthington (Western MA): 79.7 inches

Severe winter storms in Cheshire typically include heavy snow, blizzards, Nor'easters, and ice storms. Due to elevation changes, the Town can vary slightly in terms of which areas receive more snow – higher elevations outside of the Town center typically have icier roads and slightly more snow.

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

A Nor'easter is typically a large counterclockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain. Strong areas of low pressure often form off the southern east coast of the U.S, moving northward with heavy moisture and colliding with cooler winter inland temperatures. Sustained wind speeds of 20-40 mph are common during a nor'easter, with short-term wind speeds gusting up to 50-60 mph or even to hurricane force winds (MEMA & EOEEA, 2018).

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 criteria 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 pulling down of power lines and trees. (MEMA & EOEEA, 2018)

Likely Severity

Periodically, a storm will occur which is a true disaster, and necessitates intense, large-scale emergency response. The main impacts of severe winter storms in the Berkshires are deep snow depths, heavy ice accumulations, high winds and reduced visibility, potentially resulting in the closing of schools, businesses, some governmental operations and public gatherings. Loss of electric power and possible closure of roads can occur during the more severe storms events. The magnitude or severity of a severe winter storm depends on several factors including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day (e.g., weekday versus weekend), and time of season (MEMA & EOEEA, 2018).

NOAA's National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the U.S. The RSI ranks snowstorm impacts on a scale from one to five. RSI is based on the spatial extent of the storm, the amount of snowfall, and the combination of the extent and snowfall totals with population. Data beginning in 1900 is used to give a historic perspective (MEMA 2013, NOAA 2018).

Table 3.3. Regional Snowfall Index Ranking Categories

Category	Description	RSI-Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18+

Source: MEMA 2013.

Of the 12 recent winter storm disaster declarations that included Berkshire County, only two events were ranked as Extreme (EM-3103 in 1993 and DR-1090 in 1996), one was ranked Crippling (IM-3175 in 2003) and two were ranked as Major (EM-3191 in 2003 and DR-4110 in 2013). It should be noted that because population is used as a criteria, the storms that rank higher will be those that impact densely populated areas and regions such as Boston and other large cities and, as such, might not necessarily reflect the storms that impact lightly populated areas like the Berkshires. For example, one of the most famous storms in the Commonwealth in modern history was the Blizzard of '78, which dropped over two feet of snow in the Boston area during 65 mph winds that created enormous drifts and stranded hundreds of people on local highways. The storm hit the snow-weary city that was still digging out of a similar two-foot snowstorm 17 days earlier. On the Berkshires, things were not that severe, with 11-19 inches of snow falling in the county over the course of the 33-hour storm. Winds of up to 50 mph and dropped visibility to zero. Berkshire County was not listed in the disaster declaration.

The Northeast States Consortium has been tracking one- and three-day record snowfall totals. According to their data, 99% of the one-day record snowfall events in the region typically yield snow depths in the range of 12”-24”, while the majority of three-day record snowfall events yield snow depths of 24”-36” (Table 3.4).

Table 3.4. Record Snowfall Events and Snow Depths for Berkshire County

Record Snowfall Event	Snowfall 12”–24”	Snowfall 24”–36”
1-Day Record	99%	1%
3-Day Record	36%	64%

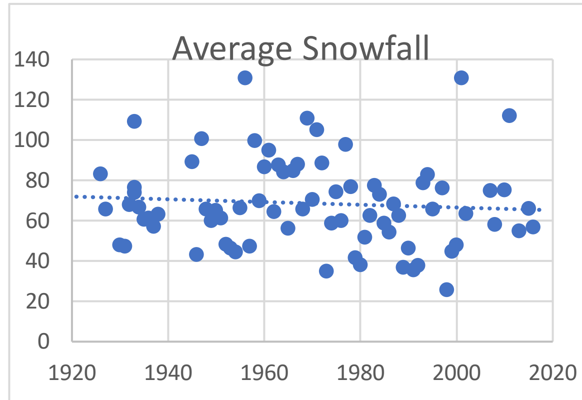
Source: Northeast States Consortium, 2017.

One of the most serious storms to impact communities in the Berkshires was the Ice Storm of December 11, 2008. The storm created widespread downed trees and power outages across New York State, Massachusetts and New Hampshire. Over one million customers were without electricity, with 800,000 without power three days later and some without power weeks later. This storm severely impacted the hilltowns in central and northern Berkshire County, including Cheshire.

While severe winter weather declarations became more prominent starting in the 1990s, it is not believed that this reflects more severe weather conditions than the Berkshires experienced in the 40+

years prior to the 1990s. Respected elders across Berkshire County comment that snow depths prior to the 1990s were consistently deeper than what currently occurs in the 2010-20s.

Figure 3.3. Average Snowfall in Berkshire County



Source: NOAA, 2017.

Probability

The majority of blizzards and ice storms are viewed by people in the region as part of life in the Berkshires, an inconvenience and drain on municipal budgets. Residents and municipal staff expect to deal with several snowstorms and a few Nor'easters each winter. According to the FEMA, Berkshire County has had ten FEMA Declared Winter Storm disasters and 59 "notable" winter storms in the Northeast Urban corridor (MEMA & EOEEA, 2018)

Using history as a guide for future severe winter storms, it is estimated that Cheshire will be at risk for approximately 1-2 days with 5 inches of snow or more per winter, and 3-5 days in the higher elevations of Town (MEMA & EOEEA, 2018). However, with climate change the amount of winter precipitation and frequency of storms is expected to increase (MEMA & EOEEA, 2018). The highest risk of these storms occurs in January with significant risk also occurring in December through March. In general, the region is receiving less snowfall than in previous decades, with climate change projections indicating that warmer winter temperatures will result in higher percentages of winter precipitation falling as rain and/or sleet. This does not mean that the County will not experience years with high snowfall amounts, as the 2010-11 winter experienced more than 100 inches. It should be noted that although total snow depths may be reduced in the future, warmer winter temperatures will likely increase the number and severity of storms with heavy, wet snow or ice, which can bring concerns for road travel, human injuries, and risk of roof failures.

Geographic Areas Likely Impacted

Severe winter storm events generally occur across the entire area of Cheshire. In general, most development is concentrated in the downtown area around the Hoosic River and Cheshire Reservoir. These areas are the first to get plowed and serviced and Route 8 received regular plowing and salting from MassDOT. Areas on the outskirts of Towns are likely to experience the most problem during winter storms. These areas are higher in elevation, may receive slightly more snow or ice, and are more isolated on windy, steep hills. Keeping the main routes open such as Route 116 is important so that residents in these low-density areas can access Route 8 and neighboring communities for resources.

Figure 3.4. Jan. 2018 Ice Jam Across Route 8, Cheshire, MA

Source: Fire Chief Tom Francesconi

The Downtown area is vulnerable to winter flooding during rain-on-snow events, winter rainstorms, and freeze/thaw cycles. The drainage system connects to Hoosic River watershed which can become backed up especially in areas close to the floodplain. This includes Main Street, Railroad Street, Dublin Street, and most notably Route 8 near Lanesborough Road (next to Kitchen Brook).

This is exacerbated by the increase of fluctuating temperatures that have cause ice jams across Route 8 at Kitchen Brook such as the one that occurred in January 2018 (see Image 3.5). According to local emergency personnel, ice jams and subsequent flooding occurs about once a year, during which the Town along with State Police deploy officers for traffic direction, Fire Department for vehicle rescues, and Highway Department to breakup ice so that it can pass through the Kitchen Brook road-stream crossing.

Historic Data

Although the entire community is at risk from severe winter storms, the higher terrains in the county tend to receive higher snowfall amounts, and these same areas may receive snow when the lower elevations received mixed snow/rain or just rain. Snow and other winter precipitation occur very frequently across the entire region. Snowfall in the region can vary between 26 and 131 inches a year, however it averages around 65 inches a year, down from around 75 inches a year in 1920. As can be seen in Image 3.3, the average snowfall levels are trending downward.

The National Climatic Data Center, a division of NOAA, reports statistics on severe winter storms from 1993 through 2017. During this 24-year span, Berkshire County experienced 151 severe winter storms, an average of six per winter. This number varies each winter, ranging from one during 2006 to 18 during 2008.

In Berkshire County, there are several notable blizzards and Nor'easters that have buried the region in historic snow depths. According to a recent feature in the *Berkshire Eagle* newspaper that summarized historical news articles, there have been several notable winter storms. The Blizzard of 1888, dubbed "The Great White Hurricane" began the evening of March 11 and lasted three days. Reported snow totals vary from 36 to 42 inches. What made the storm so memorable was the huge snowdrifts that came with it and the aftermath. Farmers reportedly spent days in their barns because they were unable to get to their houses.

In March 1916 a cold spell and a series of storms would cut travel between towns and keep supplies from reaching the hinterlands. Although the two-day storm March 8 and 9 only brought 20" of snow, the county would receive an additional 44" by the end of the month. With no break in the cold temperatures, snowdrifts reaching upward of 20' became common, making roads impassable. On

March 23, the *Berkshire Eagle* newspaper reported that the closure of the Lee-Otis line for the past two weeks had created a kerosene shortage in Otis. Residents had resorted to killing a "community steer" and its tallow was divided among the town's residents for candle-making. Again, farmers dug in deep, many taking up residence in their barns alongside their livestock, where they oversaw the arrival of lambs and calves. Trolley service came to a standstill for more than three weeks in some areas. The 22-foot drifts still remained when the Berkshire Street Railway Co. was finally able to break through April 12.

Figure 3.5. Trolley service stuck at Brennan's Cut between Lanesborough and Cheshire, April 12, 1916

Source: Berkshire Eagle

A storm in March 1932 caused 4-12-foot snow drifts that blocked Cheshire roads and brough down a tree on Broad Acres taking with it a telephone pole and electrical lines. The following year in April, Cheshire was hit again causing local highways blocked with heavy snow. Telephone and electric outages lasted 6 hours. And again, in February 1934 dropped 2-3' of snow across the county, creating 12' snow drifts in Savoy and closing three major highways. Horses and a fire sleigh were brought back into service in North Adams and postal carriers donned snowshoes to deliver the mail. A storm that lasted 16 days in February-March of 1947 left more than 45" of snow across the county, with a one-day total of 16" falling on March 3. A two-day "Holiday special" arrived on Christmas day 1969 that left 23 inches of snow across the county. State police on snowshoes waded through 5-6-foot snow drifts to reach a woman with severe frostbite who was stranded on Route 116 in Cheshire. Another two-day snowstorm on Thanksgiving 1971 brought 22.5 inches and stranded many holiday travelers.

Additional notable storms through 2011, which were recorded in local news but not included as part of disaster declarations are listed in Table 3.7.

Table 3.5. Memorable Undeclared Winter Storms in Cheshire, MA

Year	Event Description
March 1888	"The Great White Hurricane" A three-day blizzard leaves 42 inches of snow in the Berkshires. Fifteen-foot drifts are reported on North Street in Pittsfield. Farmers reportedly spend days in their barns because they are unable to get to their houses. (Berkshire Eagle Archives 2016)
March 1916	A two-day storm brought 20 inches of snow, the county would receive an additional 44 inches by the end of the month. Snowdrifts reached upward of 20 feet became common, making roads impassable (Berkshire Eagle Online, 2022).
March 1932	Cheshire roads blocked with drifts 4 -12 feet high; fallen tree on Broad Acres with telephone and electrical lines down.
April 1933	Cheshire - Local highways were partly blocked by heavy snow fall with telephone and electric outages for 6 hours (Berkshire Eagle 1933).

Year	Event Description
Feb - March 1947	A snowstorm that lasts for 16 days drops more than 45 inches on the Berkshires. The greatest one-day snowfall occurs on March 3, when 16 inches fall. (Berkshire Eagle Archives 2016)
Dec 1969	A two-day storm that begins on Christmas Day leaves 23 inches of snow in Berkshire County. State police on snowshoes wade through 5- to 6-foot snow drifts to reach a woman with severe frostbite who is stranded off Route 116 in Cheshire. (Berkshire Eagle 2016).
Nov 1971	2 day snowstorm brought 22.5 inches on Thanksgiving stranding many travelers. This storm was the greatest November snowstorm on record at the time (Berkshire Eagle Online 2022).
Feb 1976	Rainy conditions switched to flash freezing during a 30-degree drop in the few hours. Rain changed to snow and winds increased to 50 MPH with gusts to 67 MPH to produce blizzard conditions. (Berkshire Eagle Online 2022).
Dec 1978	Snowstorm brought widespread power outages throughout Cheshire (North Adams Transcript, 1978).
April 1982	Considered the worst April snowstorm in local history. The snowstorm was accompanied by heavy snowfall, high winds, blizzard conditions, and most notably; extensive thunderstorm activity. Most areas saw one to two feet of snow. Gusts of 70 to 80 MPH were observed (Berkshire Eagle Online 2022).
Oct 1987	An early snowstorm brings 18 inches across the county, causing power outages and hazardous driving. It cancels the Northern Berkshire Fall Foliage Parade, the only time in its history.
March 2003	A nor'easter dumps 22 inches of snow in 24 hours. The storm packs winds of up to 70 mph, which help create 10-foot snowdrifts. State of Emergency Declared.
Dec 2002–Jan 2003	Unprecedented back-to-back snowstorms buried parts of the Northeast during the Christmas and New Year 2002-2003 holiday season. Both storms produced over 20 inches of snow. The first storm on Christmas Day was the biggest snowstorm since the "Superstorm" of 1993. 6-16 inches in western New England and considerable blowing and drifting. The second storm produced 20.8 inches of snow. It was the first time since 1887-88 that two storms of more than 20 inches were recorded. The second storm combined with ice left on trees from an ice storm that occurred January 1-2 to bring down numerous trees and bring many power outages.
March 2017	Nor'easter, Pi Day Blizzard, was a significant storm that dumped 1 to 3 feet of snow. Across the Berkshires, winds gusted as high as 74 mph. The winds brought considerable blowing and drifting of snow. State of Emergency was declared. (NWS, 2017)
Jan 2018	Massachusetts was hit by a "bomb cyclone," a meteorological expression referring to a rapidly intensifying low-pressure system. The storm resulted in 10 to 18 inches of snowfall across the region. The most notable aspect of the storm was the intense winds it brought to Massachusetts (Boston Globe 2018).

Source: Berkshire Eagle Archives unless otherwise noted

Since 2000, two severe ice storm events have occurred in the region. The storms within that period occurred in December and January, but ice storms of lesser magnitudes may impact the region from October to April, and on at least an annual basis.

Based on all sources researched, known winter weather events that have affected Massachusetts and were declared a FEMA disaster are identified in the following sections. Of the 18 federally declared winter storm-related disaster declarations in Massachusetts between 1954 to 2022, Berkshire County has been included in 13 of those disasters. None have been declared in for the county since 2015, although routine severe storms continue to impact Cheshire.

Table 3.6. Severe Winter Weather – Declared Disasters that included Berkshire County 1992-2023

Incident Period	Description	Declaration Number
12/11/92-12/13/92	Nor'easter with snow 4'+ in higher elevations of Berkshires, with 48" reported in Becket & Peru; snow drifts of 12'+; 135,000 without power across MA.	DR-975
03/13/93-03/17/93	High winds & heavy snow; generally 20-30" in Berkshires; blizzard conditions lasting 3-6 hrs; Pittsfield receives 22" in 24 hrs; snowdrifts of 10' across county.*	EM-3103
01/07/96-01/08/96	Blizzard of 30+" in Berkshires, with strong to gale-force northeast winds; MEMA reported claims of approx. $32 million from 350 communities for snow removal	DR-1090
03/05/01-03/06/01	Heavy snow across eastern Berkshires to Worcester County; several roof collapses reported; $21 million from FEMA	EM-3165
02/17/03-02/18/03	"President's Day" Winter storm with snow of 12-24", with higher totals in eastern Berkshires to northern Worcester County; $28+ million from FEMA	EM-3175
12/06/03-12/07/03	Winter Storm with 1'-2' across state: $35 million from FEMA	EM-3191
01/22/05-01/23/05	Blizzard with heavy snow, winds and coastal flooding; highest snow falls in eastern Mass.; $49 million from FEMA	EM-3201
04/15/07-04/16/07	Severe Storm and Flooding; wet snow, sleet and rain added to snowmelt to cause flooding; higher elevations received heavy snow and ice; $8 million from FEMA	DR-1701
12/11/08-12/12/08	Major ice storm across eastern Berkshires & Worcester hills; at least ½" of ice accreted on exposed surfaces, downing trees, branches and power lines; 300,000+ customers without power in state, some for up to 3 wks.; $49+ million from FEMA	DR-1813
01/11/11-01/12/11	Nor'easter with up to 2' within 24 hrs.; $25+ million received from FEMA; Savoy received 40.5" and N. Adams received 33"*	DR-1959
10/29/11-10/30/11	"Snowtober" Severe storm and Nor'easter with 1'-2' common; at peak 665,000 residents state-wide without power; 2,000 people in shelters statewide; $70+ million from FEMA statewide; Peru received 32" and Pittsfield received 18" *	DR-4051
02/08/13-02/09/13	Severe Winter Snowstorm and Flooding; $65+ million from FEMA statewide; Boston received almost 15" of snow.	DR-4110
1/26/15-1/27/15	Winter storm	NA

Source: FEMA, MEMA 2023, unless otherwise noted.
** Berkshire Eagle, 2-2-19. "Memorable blizzards, nor'easters from 1888 to the present in the Berkshires."*

Vulnerability Assessment

People

Many long-term residents of Cheshire pride themselves on being independent and self-sufficient during severe winter events. Emergency personnel tell stories in which they will go to check on residents who may need assistance only to find they are well prepared with wood stoves and water on hand. There is some concern however, especially among more vulnerable populations. Winter storms ranked third most worrying out of 13 hazards during a public survey. The highest reason for concern was loss of electricity during blizzards and high winds.

According to the NOAA National Severe Storms Laboratory, every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow, and extreme cold temperatures with dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. Injuries and deaths may occur due to traffic accidents on icy roads, heart attacks while shoveling snow, or hypothermia from prolonged exposure to cold (MEMA & EOEEA, 2018).

Vulnerable populations include the elderly living alone, who are susceptible to winter hazards due to their increased risk of injury and death from falls, overexertion, and/or hypothermia from attempts to clear snow and ice, or injury and death related to power failures. The population over the age of 65, individuals with disabilities, and people with mobility limitations or who lack transportation are also more vulnerable because they are more likely to seek or need medical attention, which may not be available due to isolation during a storm event. The senior population is most at risk in Cheshire, and during forums hosted at the Council on Aging, the threat of cold weather was indicated as a top concern. This is exacerbated as Cheshire had to close their elementary school which hosted the Town Emergency Shelter. The ability of emergency responders to respond to calls may be impaired by heavy snowfall, icy roads, and downed trees (MEMA & EOEEA, 2018). In extreme storms 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.

In Cheshire, winter conditions can make roads dangerous to travel, particularly in areas outside of downtown, where roads climb in elevation and often follow the streams, winding their way up the hills. Vehicles that may not be equipped to handle snowy, icy conditions are particularly at risk.

Built Environment

Severe winter storms can damage the built environment by collapsing roofs under the weight of snow, making roads impassable due to snow or ice, damaging roads by freezing or unintended damage due to snowplows, freezing and bursting pipes, downing trees and power lines, and the flooding damages that result from melting snow. Utility power line systems are especially vulnerable due to heavy snows and high winds that can accompany severe winter storms. In Cheshire, maintaining safe travel along Route 8 is critical to connecting residents to key services (shops, fuel, doctors and hospitals, schools, etc.).

Figure 3.6. Ice block on Rt. 8 Jan. 2018.

Source: Courtesy of iBerkshires

Natural environment

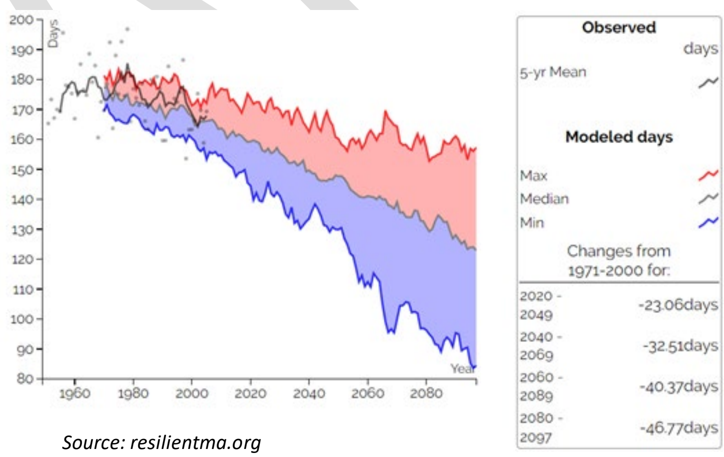
Winter storms are a natural part of the Massachusetts climate, and native ecosystems and species are well adapted to these events. However, changes in the frequency or severity of winter storms could increase their environmental impacts. Environmental impacts of severe winter storms can include direct mortality of individual plants and animals and felling of trees, the latter of which can alter the physical structure of the ecosystem. These impacts can include direct damage to species and ecosystems, habitat destruction, and the distribution of contaminants and hazardous materials throughout the environment (MEMA & EOEEA, 2018).

Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain municipal and state financial resources due to the cost of staff overtime, snow removal and wear on equipment. Heavy accumulation of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers making travel more difficult. Loss of utilities, interruption of transportation corridors, loss of business function and loss of income during business closures all have impacts on local economy especially retail businesses[12] – a major employer of Cheshire residents[13].

Severe winter weather can lead to flooding in low-lying areas. Ice that accumulates on branches in orchards and forests can cause branches to break, while the combination of ice and wind can fell trees. These damages can stress trees and reduce the quality of the trees in forests that are being managed for timber (MEMA & EOEEA, 2018).

Figure 3.7. Predicted Annual Days with Minimum Temperature Below 32°F in Berkshire County, MA



Source: resilientma.org

Future Conditions

Berkshire winters are expected to be most heavily impacted by climate change when compared to other seasons. According to Northeast Climate Center, the Berkshires is expected to lose nearly 47 days below freezing annually by the end of the century. Freeze-thaw cycles are expected to become more common and winter precipitation is predicted to more often be in the form of heavy, wet snow, ice or rain rather than the fluffier snow that has been more typical for the region (Figure 3.7).

Freeze-thaw cycles have two impacts in Cheshire. Dirt roads will require more maintenance and rut more easily during thawonly to then freeze making them more difficult to use. Dirt roads may need to rebuilt with a stronger base such as a geotextile to accommodate the sink and spread of gravel. As mentioned before, free-thaw causes ice jam flooding common to the Kitchen Brook area along Route 8.

[12] *MEMA, 2018 Hazard Mitigation Plan*
[13] *US Census 2022 ACS Data*

The winter precipitation change has implications for how roads and utility line infrastructure will be maintained. Wetter snow and ice formation may result in greater weight loading designs on buildings and infrastructure and possibly increase risk of frozen pipes. Decreased snow pack can result in less groundwater recharge and dryer springs.

Hurricanes/Tropical Storms

Hazard Profile

Likely Severity

Tropical cyclones (tropical depressions, tropical storms, and hurricanes) form over the warm, moist waters of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico:

- A tropical depression is declared when there is a low-pressure center in the tropics with sustained winds of 25 to 33 mph.
- A tropical storm (T.S.) is a named event defined as having sustained winds from 34 to 73 mph.
- A hurricane is a storm with sustained winds reaching 74 mph or greater. The hurricanes are categorized based on sustained winds; wind gusts associated with hurricanes may exceed the sustained winds and cause more severe localized damage.

When water temperatures are at least 80°F, hurricanes can grow and thrive, generating enormous amounts of energy, which is released in the form of numerous thunderstorms, flooding, rainfall, and very damaging winds. The damaging winds help create a dangerous storm surge in which the water rises above the normal astronomical tide. In the lower latitudes, hurricanes tend to move from east to west. However, when a storm drifts further north, the westerly flow at the mid-latitudes tends to cause the storm to curve toward the north and east. When this occurs, the storm may accelerate its forward speed. This is one of the reasons why some of the strongest hurricanes of record have reached New England (MEMA & EOEEA, 2018).

The severity of a hurricane is categorized by the Saffir-Simpson Hurricane Scale. This scale ranks hurricanes based on sustained wind speeds—from Category 1 (74 - 95 mph, minimal intensity) to Category 5 (156 mph or more, catastrophic intensity). All winds are using the U.S. 1-minute average, meaning the highest wind that is sustained for one minute (MEMA, 2013). The Saffir/Simpson Scale described in Table 3.10 gives an overview of the wind speeds and range of damage caused by different hurricane categories. Category 3, 4, and 5 hurricanes are considered “major” hurricanes, where devastating and catastrophic damage will occur. The Commonwealth has not been impacted by any Category 4 or 5 hurricanes; however, Category 3 storms have historically caused widespread flooding. In Berkshire County flooding tends to be the impact of greatest concern because hurricane-force winds here occur less often.

Historical data show that most tropical storms and hurricanes that hit landfall in New England are seldom of hurricane force, and of those most are a Category 1 or 2 hurricanes. The category hurricanes that stand out are those from 1938, and 1954 (BRPC, 2012), and those resulted in devastating flooding. T. S. Irene in 2011 was the most destructive tropical storm in recent decades.

Table 3.7. Saffir/Simpson Scale

Scale No. (Category)	Winds (mph)	Potential Damage
Tropical Depression	< 38	NA
Tropical Storm	39-73	NA
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 is severe, there are extensive glass failures, and entire buildings could fail.

Source: BRPC, 2012

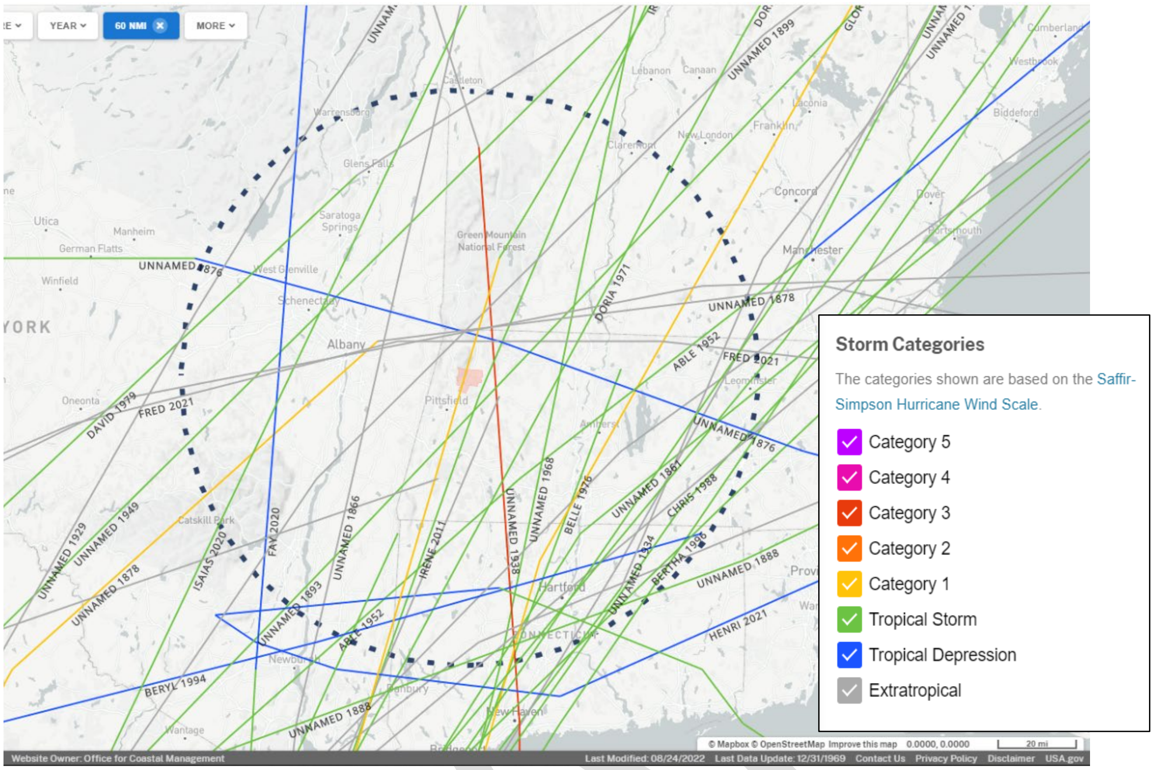
Probability

Based on past reported hurricane and tropical storm data, the region can expect a tropical depression, storm or hurricane to cross the region every 14.5 years. However, the community may also be impacted by a tropical event whose path is outside of the region every 0.75 years. Based on past storm events and given that the center of the county is approximately 85 miles to the Long Island Sound and 115 miles to Boston Harbor, the Berkshires will continue to be impacted by hurricanes and tropical storms. The recurrence rate will likely increase due to rising ocean temperatures.

The NOAA Hurricane Research Division published a series of maps showing the chance that a tropical storm or hurricane (of any intensity) will affect a given area during the hurricane season (June to November). This analysis was based on historical data from 1944 to 2020. Based on this analysis, the community has seen around 10 – 29 named storms per 100 years.[14] The official hurricane season runs from June 1 to November 30. In New England, these storms are most likely to occur in August and September. This is due in large part to the fact that it takes a considerable amount of time for the waters south of Long Island to warm to the temperature necessary to sustain the storms this far north. Also, as the region progresses into the fall months, the upper-level jet stream has more dips, meaning that the steering winds might flow from the Great Lakes southward to the Gulf States and then back northward up the eastern seaboard. This pattern would be conducive for capturing a tropical system over the Bahamas and accelerating it northward.

[14] NOAA (2020) Trypical Tropical Cyclone Occurrence Areas by Month, https://www.nhc.noaa.gov/climo/

Figure 3.8. Historical Hurricane Paths within 60 miles of Cheshire



Source: NOAA Historical Hurricane Tracks Online Tool, 2023

Geographic Areas Likely Impacted

The entire Town of Cheshire is vulnerable to hurricanes and tropical storms, depending on each storm's track. Inland areas, especially those in floodplains, near waterways, or isolated in the hills and mountains are at risk for flooding from heavy rain and wind damage. The majority of the damage following hurricanes and tropical storms often results from residual wind damage and inland flooding, as was demonstrated during recent tropical storms. Historic storm tracks can be seen in the NOAA graphic, Figure 3.8. The graphic shows tropical storm tracks that have traveled through Western Massachusetts.

Historic Data

The National Oceanic and Atmospheric Administration (NOAA) has been keeping records of hurricanes since 1842. From 1842 to 2022, there have been several tropical storms that passed directly through Berkshire County (see Figure 3.8 and Table 3.8). Although high winds are always of concern, it is the heavy rains and associated flooding that historically have caused the most injuries, deaths, and damage in the Berkshire County region.

The Great Hurricane of 1938 remains one of the most memorable historic storms, with almost seven inches of rain falling over a three-day period. Rainfall from this hurricane resulted in severe river flooding across sections of Western Massachusetts, with three to six inches falling in the region. The rainfall from the hurricane added to the amounts that had occurred with a frontal system several days before the hurricane struck. The combined effects from the frontal system and the hurricane produced rainfall of 10-17 inches across most of the Connecticut River Valley. In the Berkshires, 700 families were evacuated, two deaths occurred, many other people were injured, and 300 people were left homeless. Downtown North Adams and nearby Adams was flooded and martial law was declared in North Berkshire.

Table 3.8. Tropical Depressions, Storms and Hurricanes Impacting Berkshire County

Name	Category	Date
Not Named	Tropical Depression	8/17/1867
Unnamed	Tropical Storm	9/19/1876
Unnamed	Tropical Depression	10/24/1878
Unnamed	Category 1 Hurricane	8/24/1893
Unnamed	Tropical Storm	8/29/1893
Unnamed	Tropical Depression	11/1/1899
Unnamed	Tropical Depression	9/30/1924
Unnamed	Category 2 Hurricane	9/21/1938
Able	Tropical Storm	9/1/1952
Gracie	Tropical Depression	10/1/1959
Doria	Tropical Storm	8/28/1971
Irene	Tropical Storm	8/28/2011

Source: NOAA, MEMA & EOEEA, 2022.

Although unrecorded by NOAA, local memory and newspaper articles point out the impact of a Hurricane that hit Cheshire and Adams on September 1, 1954, bringing flooding and high winds. Losses were most acutely felt in Cheshire as 50-mph winds caused felled trees and a power outage that lasted 24 hours.

Hurricane Gloria caused extensive damage along the east coast of the U.S. and heavy rains and flooding in western Massachusetts in 1985. This event resulted in a federal disaster declaration (FEMA DR-751). In October 2005 the remnants of Tropical Storm Tammy followed by a subtropical depression produced significant rain and flooding across western Massachusetts. It was reported that between 9 and 11 inches of rain fell. The heavy rainfall washed out many roads in Hampshire and Franklin Counties and the Green River flooded a mobile home park in Greenfield, with at least 70 people left homeless. This series of storms resulted in a federal disaster declaration (FEMA DR-1614) and Massachusetts received over $13 million in individual and public assistance. (MEMA, 2013)

Tropical Storm Irene (August 27-29, 2011) produced significant amounts of rain, inland flooding, and wind damage across southern New England and much of the east coast U.S. The National Weather Service reported rainfall totals between 3 and 10 inches in northwestern Massachusetts. The NOAA's National Centers for Environmental Information recorded August 2011 as the second wettest August in Massachusetts in the past 117 years of precipitation records.[15] In western Massachusetts, the rainfall measured 11.21 inches, which was more than three times the average August rainfall of 3.41 inches, according to the Massachusetts DCR.[16] Before the arrival of Tropical Storm Irene, western Massachusetts was already experiencing saturation of its soils due to excessive rainfall, making it vulnerable to flash flooding (as stated by Bent and Olson, 2016). The storm resulted in $40 million worth

[15] NOAA, 2016a, Data tools— 1981–2010 accessed February 2, 2023, at https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

[16] *Massachusetts DER, 2011, Monthly precipitation composite accessed February 1, 2023, at http://www.mass.gov/ eea/agencies/dcr/water-res-protection/water-data-tracking/ rainfall-program.html*

of damages in Berkshire County. A presidential disaster was declared (FEMA DR-4028) and the Commonwealth received over $31 million in individual and public assistance from FEMA. (MEMA, 2013)

Regionally, T.S. Irene (DR-4028-MA) is one of most memorable storm event in recent history due to the flooding that occurred in northern Berkshire and Franklin Counties in Massachusetts, and in southern Vermont. It caused flood levels equal to or greater than a 100-year flood event in Williamstown and North Adams. Extensive flooding in the Deerfield River watershed caused, among other damages, the closing of Route 2 in Florida/Charlemont (due to collapse of the road and a landslide). Immediately after this even the USGS recorded flood levels and recalculated and red-delineated the boundaries for the 100-year floodplain for the Hoosic River as it flows through portions of North Adams and Williamstown. This is one of the very few areas in Berkshire County where floodplain maps have been updated since the 1980s. Cheshire experienced localized flooding, widespread power outages, and felled trees around Main Street, West Mountain Rd, and Flaherty Road. The Hoosic River overflowed the banks causing road closure on Main Street and nearly overtopped the Main Street bridge as seen in Image 3.13 Hurricane Irene was one of the two times in recent history that Cheshire opened up its emergency shelter. The other was for Hurricane Henri in 2021.

A year later, Hurricane Sandy was one of the largest storms to have hit New England. Fortunately, the Berkshires suffered very little damage compared to the coastal communities. Throughout the county, heavy winds toppled trees and power lines, closing roads and causing widespread power outages.

On a more local level, a microburst tore through a Cheshire's downtown residential area of Main Street, East Main Street, Mill Hill Road and Meadowbrook Drive on July 18, 2018. None were injured and private property damage was limited, however the thunderstorm winds were so strong that they took down multiple trees and utility lines leaving around 1,300 customers without power. National Grid and Verizon were able to quickly address the damage and restore power to all but 115 households within the day.

Vulnerability Assessment

People

It is believed that the only fatalities that occurred due to tropical storms in Berkshire County was during the hurricane of 1938, and those were from flooding, not high winds. High winds from tropical storms and hurricanes can knock down trees, limbs, and electric lines, can damage buildings, and send debris flying, leading to injury or loss of life. Economically distressed, elderly and other vulnerable populations are most susceptible, based on several factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Findings reveal that human behavior contributes to flood fatality occurrences, and this was seen during flooding of The Spruces in Williamstown when some residents only left their homes when forcibly removed by emergency personnel. Populations that live or work in proximity to facilities that use or store toxic substances are at greater risk of exposure to these substances during a flood event such as near the railroad tracks, town garage, or transfer station.

The most vulnerable include people with low socioeconomic status, people over the age of 65, people with medical needs, and those with low English language fluency. For example, people with low socioeconomic status are likely to consider the economic impacts of evacuation when deciding whether to evacuate. During and after an event, rescue workers and utility workers are vulnerable to impacts from high water, swift currents, rescues, and submerged debris. Vulnerable populations may also be less likely to have adequate resources to recover from the loss of their homes and jobs or to relocate from a damaged neighborhood (MEMA & EOEEA, 2018).

Built Environment

Hurricanes and tropical storms can destroy homes with wind, flooding, or even fire that results from the destructive forces of the storm. Critical facilities are mostly impacted during a hurricane by flooding, and these impacts are discussed in the flooding section of this plan. Wind-related damages from downed trees, limbs, electricity lines and communications systems would be at risk during high winds. Local and state-owned police and fire stations, other public safety buildings, and facilities that serve as emergency operation centers may experience direct loss (damage) during a hurricane or tropical storm. Emergency responders may also be exposed to hazardous situations when responding to calls. Road blockages caused by downed trees may impair travel. Heavy rains can lead to contamination of well water and can release contaminants from septic systems (DPH, 2014 as cited in MEMA & EOEEA, 2018). Additionally, hurricanes and tropical storms often result in power outages and contact with damaged power lines during and after a storm, which may result in electrocution.

Several residential, commercial and industrial buildings were destroyed during the floods of 1938, 1949 and 1955 in northern Berkshire County during tropical storm events. Most recently the full destruction and permanent removal of all homes in The Spruces mobile home park in Williamstown demonstrates the vulnerability of structures due to hurricane-related flooding.

Natural Environment

The environmental impacts of hurricanes and tropical storms are like those described for other hazards, including inland flooding, severe winter storms and other severe weather events. As the storm is occurring, flooding may disrupt normal ecosystem function, and wind may fell trees and other vegetation. High winds can impact forested areas in which trees have been weakened by disease and/or invasive species. For example, Emerald Ash Borer has left stands of dead ash trees throughout the County that are easily blown over by hurricane or tropical storm caused wind speeds. Trees that fall during the storm may represent lost habitat for local species, or they may decompose and provide nutrients for the growth of new vegetation. Additionally, wind-borne, or waterborne detritus can cause mortality to animals if they are struck or transported to a non-suitable habitat.

In the longer term, impacts to natural resources and the environment as a result of hurricanes and tropical storms are generally related to changes in the physical structure of ecosystems. For example, flooding may cause scour in riverbeds, modifying the river ecosystem and depositing the scoured sediment in another location. Invasive aquatic species and floodplain species such as knotweed are readily dispersed when plant fragments are transported by floodwaters. If the storm spreads pollutants into natural ecosystems, contamination can disrupt food and water supplies, causing widespread and long-term population impacts on species in the area.

Economy

Hurricane/tropical storm events can greatly impact the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Due to the wind and water damage, and transportation issues that result, the impact to the economy can potentially be very high. The Commonwealth received over $31 million in individual and public assistance from FEMA during presidential disaster declared (FEMA DR4028) for T.S. Irene in 2011 (MEMA & EOEEA, 2018). Regional storm impacts are discussed in more detail in the Inland Flooding section of this plan.

Future conditions

The Northeast has been experiencing more frequent days with temperatures above 90°F, increasing sea surface temperatures and sea levels, changes in precipitation patterns and amounts, and alterations in hydrological patterns. According to the Massachusetts Climate Change Adaptation Report, large storm events are becoming more frequent. Although there is still some level of uncertainty, research indicates the warming climate may double the frequency of Category 4 and 5 hurricanes by the end of the century and decrease the frequency of less severe hurricane events. Research from Florida State University found that since 1981, the maximum wind speed of the most powerful hurricanes has increased markedly because a warmer ocean provides more energy for storms (Kang and Elsner, 2015). These higher ocean temperatures may cause storm systems to become larger and longer in duration. Warmer global oceans could also expand the portions of the ocean in which conditions conducive to hurricane formation occur, potentially expanding the parts of the world susceptible to this hazard. Additionally, warmer air can hold more water vapor, which means the rate of rainfall will increase. One study found that hurricane rainfall rates were projected to rise 7 percent for every degree Celsius increase in tropical sea surface temperature (Wang et al., 2017).

The 2020 Atlantic hurricane season closed with a record-breaking 30 named storms and 12 landfalling storms in the continental United States. This was the fifth consecutive year with an above-normal Atlantic hurricane season, with 18 above-normal seasons out of the past 26. This increased hurricane activity is attributed to the warm phase of the Atlantic Multi-Decadal Oscillation — which began in 1995 — and has favored more, stronger, and longer-lasting storms since that time. Such active eras for Atlantic hurricanes have historically lasted about 25 to 40 years. [17]

In 2022, hurricanes season produced less storms – only 14 compared to 2020's 30, however those that did hit landfall were severe. As a Category 4, Hurricane Ian was ranked 5th strongest storm to hit landfall with wind speeds of 150 mph. This was followed by Hurricanes Nicole and Fiona, all of which had a major impact on Florida and Puerto Rico. [18]

[17] NOAA, 2021 at https://www.noaa.gov/media-release/record-breaking-atlantic-hurricane-season-draws-to-end
[18] NOAA, 2022 at https://www.noaa.gov/news-release/damaging-2022-atlantic-hurricane-season-draws-to-close

Inland Flooding, including Dam Impacts

Hazard Profile

Inland flooding is the result of moderate precipitation over several days, intense precipitation over a short period, or melting snowpack.[19] Common types of local or regional flooding are categorized as inland flooding including riverine, ground failures, ice jams, dam overtopping or failure, beaver activity (tree removal, dam construction, and dam failure), levee failure, and urban drainage. Overbank flooding occurs when water in rivers and streams flows into the surrounding floodplain or into "any area of land susceptible to being inundated by floodwaters from any source." (FEMA, 2011 as cited in MEMA & EOEEA, 2018). The hazards that produce these flooding events in the Berkshire County region include spring melt, hurricanes, tropical storms, heavy rain events, winter rain-on-snow, thunderstorms, and recovering beaver populations. This Inland Flooding section will focus on flood impacts due to severe precipitation events that result in impacts approaching the 100-year event or caused significant damages, and on potential dam failure risk. Hurricanes/tropical storms, winter-related flooding and thunderstorms are discussed in other sections of this plan.

Likely severity

In general, the severity level of flood damage is affected by flood depth and flood velocity. The deeper and faster flood flows become, the more power they have to carry heavy debris, erode banks and cause damage. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. (MEMA, 2013) However, flood damage to homes and buildings can occur even during shallow, low velocity flows that inundate the structure, its mechanical system and furnishings.

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in any given year. The 100-year flood elevation or discharge of a stream or river has a 1% chance of occurring or being exceeded in any given year. In this case the statistical recurrence interval would be 100 years between the storm events that meet the 100-year discharge/flow. Increases in precipitation and extreme storm events will result in increased inland flooding.

A dam is an artificial barrier that can impound water for the purpose of storage or flood control. There are six dams in Cheshire that have the potential to cause damage if they were to fail in some way. These are listed in Table 3.15 and their locations are shown on the Critical Facilities Map (Image 3.2). Size class may be determined by either volume of water stored or height, whichever gives the larger size classification. Small impoundments store between 15-50 acre-feet, Intermediate impoundments store 50-1,000 acre-feet, and Large impoundments store over 1,000 acre-feet. An acre-foot is defined as enough water to cover one acre of land one foot deep, which equals slightly less than 326,000 gallons.

The Hazard Potential Classification rating pertains to potential loss of human life or property damage in the event of failure or improper operation of the dam or appurtenant works. Low Hazard dams are those that are defined as being located where failure or mis-operation may cause minimal property damage to others, and loss of life is not expected. Significant dams are defined as being located where

[19] NOAA, 2017, US Climate Resilience Toolkit found at *climate.gov*

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 of relatively important facilities. There are no High Hazard dams in Cheshire.[20]

Probable future development of the area downstream from the dam that would be affected by its failure shall be considered in determining the classification. Even dams which, theoretically, pose little threat under normal circumstances can overspill or fail under the stress of a cataclysmic event such as an earthquake or sabotage. Dam owners are legally responsible for having their dams inspected on a regular basis.

Probability

Table 3.9. Dams with the Potential to Impact Cheshire

Name and Year Completed	Hazard Code	Size Class (Max. acre-feet storage)	Inspection Date & Condition	Owner
Cheshire Lake / Reservoir Dam, 1870	Significant	Large (5130)	2017, Fair	Mass DCR*
Bassett Pond, 1967	Significant	Intermediate (16)	2017, Good	Town of Adams
Kitchen Brook, 1910	Significant	Small (5)	1999, Fair	Town of Cheshire
Cheshire Harbor, 1890	Low	Small (Unknown)	1999, Poor	Private
J.H Daniels, ND	Low	Small (1)	1972, Unknown	Private

Source: Office of Dam Safety, 2004. Note: Some records may be out of date if procured by Office of Dam Safety in 2004.
**The Lake Hoosic Prudential Commission and Town of Cheshire has a shared management agreement of Cheshire Reservoir Dam along with Mass DCR.*

Table 3.10. Recurrence Intervals and Probabilities of Occurrences

Recurrence interval, in years	Probability of occurrence in any given year	Percent chance occurrence in any given year
500	1 in 500	0.2%
100	1 in 100	1%
50	1 in 50	2%
25	1 in 25	4%
10	1 in 10	10%
5	1 in 5	20%
2	1 in 2	50%

The extent of the area of flooding associated with a 1% annual probability of occurrence (the base flood or 100-year flood), most commonly termed the 100-year floodplain area, is a tool for assessing vulnerability and risk in flood-prone communities. Such a storm, with a 1% chance of occurrence, is commonly called the 100-year storm. Similarly, the 50-year storm has a statistical recurrence interval of 50 years or a 2% chance in any given year and an "annual flood" is the greatest flood event expected to occur in a typical year. It should be understood, however, that these measurements reflect statistical averages only; it is possible for two or more floods with a 100-year flood discharge to occur in a short time period. The 100-year flood boundary is used as the regulatory boundary by many agencies, including FEMA and MEMA. It is also the boundary used for most municipalities when regulating development within flood-prone areas. A structure located within a the 100-year floodplain on the NFIP maps has on average a

[20] DCR Office of Dam Safety, 2017 found at https://www.mass.gov/files/documents/2017/10/30/302cmr10.pdf

26% percent chance of suffering flood damage during the term of a 30-year mortgage (MEMA, 2013). Cheshire's NFIP maps were first created in 1974 and they enrolled in the NFIP in 1982.

Due to steep slopes and minimal soil cover, hilltowns such as Cheshire are particularly susceptible to flash flooding caused by rapid runoff that occurs during heavy precipitation in combination with spring snowmelt. These conditions contribute to riverine flooding and stream bank erosion. Frozen ground conditions can also contribute to low rainfall infiltration and high runoff events that may result in riverine flooding (MEMA, 2018). Berkshire County has frozen ground conditions for more of the year than most of Massachusetts.

Factors that contribute to dam failure include design flaw, age, over-capacity stress and lack of maintenance. There are two primary types of dam failure: catastrophic failure, characterized by the sudden, rapid, and uncontrolled release of impounded water, or design failure, which occurs as a result of minor overflow events. Dam overtopping is caused by floods that exceed the capacity of the dam, and it can occur as a result of inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors. Overtopping accounts for 34% of all dam failures in the U.S. (BRPC, 2012). In Massachusetts the Office of Dam Safety, within the DCR, is the regulating authority that oversees dam safety.

By state law, dam owners are legally responsible for maintaining their dams, inspecting them on a regular basis and liable for damages and loss of life that occur as a result of a dam failure. Significant Hazard dams must be inspected every five years and Low Hazard dams must be inspected every 10 years. Owners of Significant Hazard dams are required to develop Emergency Action Plans (EAP). This Plan would include a notification flow chart, list of response personnel and their responsibilities, a map of the inundation area that would be impacted, and a procedure for warning and evacuating local residents in the inundation area. The EAP would be filed with local and state emergency agencies.

The Town of Cheshire has two dams with a Significant Hazard Code. These dams both have current EAPs that are held by Town Administrator, Police and Fire Department as well as the EMD. The EAP for Bassett Pond is also held by Adams Water Department which manages the dam. Inspection reports are available for Bassett Pond and Cheshire Lake/ Reservoir Dam – both completed in 2017. Data for the, Kitchen Brook is unknown.

Historical Data

There have been dozens of severe precipitation events that caused flooding in the Berkshire County region, the more severe of which are listed with a brief description in Table 3.17. Between 1938 and August 2023, four flood events equaling or exceeding the 1% annual chance flood have been documented in the Berkshire County region, those being in 1938, 1949, 1955 and 2011. These four events are bolded in Table 3.17. Not all these events were documented to a 1% chance storm for the region around Cheshire. For example, Tropical Storm (T.S.) Irene in 2011 was determined to be a 1% chance flood event in northern Berkshire County and a 2% chance storm (50-year recurrence) in central and southern Berkshire County (using data from the USGS Housatonic River stream gage in Pittsfield). Storms that directly impacted the Town of Cheshire are shown in italic text. According to the data, local officials and residents, the more notable and damaging flood events that occurred in recent years in Cheshire were 1955, 2005, 2011, 2012, 2014.

Table 3.11. Previous Flooding Occurrences That Impacted Cheshire

Date	Description of Event
Aug 1901	Cloudburst causes intense swelling of the Hoosic River, flooding most of the town (North Adams Transcript 1904).
June 1904	*Overflow of the Cheshire Harbor and over the Bassett Dam caused flooding and washout on the roads and train tracks leading to Cheshire Harbor and into East Cheshire. (North Adams Transcript 1904)*
1906	*Heavy rain causes rising waters of the Cheshire Harbor and nearby streams. Residents remarked that the "gutters of the roads were like small brooks." (The Berkshire Evening Edition 1906).*
1914	*Heavy showers flooded roads around Cheshire Harbor, causing traffic and shipping delays for days (North Adams Transcript 1914).*
1934	*A cloudburst in a series of 'freak' storms damaged the Adams-Savoy highway in East Cheshire, which was washed out for 500 feet of the road (North Adams Transcript 1934).*
1936	*Cheshire flood conditions peaked in the harbor section, which was flooded to a considerable depth, causing a traffic tie-up. Property and equipment damage to nearby stores. Water flowed over the top of the B&A bridge during the height of the flood (Berkshire Eagle July 1936)*
1938	**"The Great Hurricane of 1938" was considered a 1% annual chance flood event in several. The Hoosic River flooded downtown areas of North Adams, with loss of life and extensive damage to buildings.**
Dec. 31, 1948 - Jan. 1, 1949	**The New Year's Flood hit North Adams severely wiping out buildings along the Hoosic River and with many of areas registering the flood as a 1% annual chance flood event.**
1955	**Hurricanes Connie and Diane combined to flood many of the communities in the region and registering in 1% - 0.2% annual chance flood event (100-500-year flood event) (FEMA 1977-1991).**
March 1977	*Spring thaw and heavy rain combined clogged brooks and streams in Cheshire contributed to heavy flood damages, and road erosion caused an estimated $105,000 in damages (North Adams Transcript 4-6-77)*
March 1980	*Flooding damaged the Notch Rd bridge, causing $50,000 in damages (Berkshire Eagle, 1980)*
May 1984	A multi-day storm left up to 9" of rain throughout the region and 20" of rain in localized areas. This was reported as an 80-year flood for most of the area and higher where the rainfall was greater (USGS, 1989).
March 1987	*Two powerful storms swept through Mass., bringing heavy rain and snowmelt that caused catastrophic flooding. A state of emergency was declared as the region was deluged with over 8" of rain in a single day. First estimates to repair roads was $95,000 (North Adams Transcript 4-22-23). The resulting damage was extensive, with repairs costing over half a million dollars to restore roads and protect property from washouts on Route 116, Wells Rd., Maple Dr., and Sand Mill Rd.*
Sept. 1999	The remnants from Hurricane Floyd brought between 2.5-5" of rain and produced significant flooding throughout the region. Due to significant amounts of rain and the accompanying wind, there were numerous reports of trees down.
June 2000	*Flash flooding washed away Outlook Avenue, causing the replacement of a drainage system. Water came down the West Mountain and breached the dam, which damaged Route 8 and West Mountain Rd. Total damages reached more than $300,000. (Berkshire Eagle, 2000).*
Dec. 2000	A complex storm system brought 2-4" of rain with some areas receiving an inch an hour. The region had numerous reports of flooding
Mar. 2003	An area of low pressure brought 1-2" of rain, however this and the unseasonable temperatures caused a rapid melting of the snowpack.
Sept. 2004	The remnants from Hurricane Ivan brought 3-6" of rain. This, combined with previously saturated soils, caused flooding throughout the region.

Date	Description of Event
Oct. 2005	A stationary cold front brought over 6” of rain and caused widespread flooding throughout the region. During this 10-day period, approximately 6 to 15 inches of rainfall occurred within New England River basins. Flooding was reported on the Hoosic and Housatonic rivers and in small streams, creeks, urban areas, and poorly drained areas due to rainfall exceeding an inch per hour. Cheshire road damages cost more than $1 million (North Adams Transcript 2005).
Nov. 2005	Widespread rainfall across the region of 1-1.5”, which was preceded by 1-2 feet of snow, resulted in widespread minor flooding.
Sept. 2007	Moderate to heavy rainfall occurred, which lead to localized flooding.
Mar. 2008	Heavy rainfall ranging from 1-3” impact the area. Combined with frozen ground and snowmelt, this led to flooding across the region.
Aug. 2008	A storm brought very heavy rainfall and resulted in flash flooding across parts of the region.
Dec. 2008	A storm brought 1-4” of rain to the region, with some areas reporting ¼ to 1/3 of an inch an hour of freezing rain, before changing to snow. Moderate flooding and ponding occurred throughout the region.
June 2009	Numerous slow-moving thunderstorms developed across the region with intense rainfalls and up to 6” of hail. This led to flash flooding in the region.
July 2009	Thunderstorms across the region caused heavy rainfall and flash flooding.
Aug. 2009	An upper-level disturbance moved across the region during the afternoon hours and triggered isolated thunderstorms causing road flooding.
Oct. 2009	A low-pressure system moved across region bringing a widespread heavy rainfall to the area; 2-3” of rain was reported across the region.
Mar. 2010	Heavy rainfall of 1.5-3” across the region closed roads due to flooding.
Oct. 2010	The remnants from Tropical Storm Nicole brought 50-60 mph winds and 4-6” of rain resulting in urban flooding.
Mar. 2011	Heavy rainfall combined with runoff from snowmelt due to mild temperatures resulted in flooding of waterways, roads, and basements.
July 2011	Scattered strong to severe thunderstorms spread across the region resulting in small stream and urban flooding.
Aug. 2011	Two distinct rounds of thunderstorms occurred producing heavy rainfall and localized flooding of roads.
Aug. 2011	***T.S. Irene tracked over the region with widespread flooding and damaging winds. Riverine and flash flooding resulted from 3-9 inches of rain within a 12-hour period. Widespread road closures occurred throughout the region. In MA his event was a 1% annual chance flood event in the Hoosic River Watershed and a 50-year event in the Housatonic River Watershed.***
Sept. 2011	Remnants of Tropical Storm Lee brought 4-9” of heavy rainfall to the region. Due to the saturated soils from T.S. Irene, this rainfall led to widespread flooding on rivers as well as small streams.
Aug. 2012	Remnants from Hurricane Sandy brought thunderstorms repeatedly bringing heavy rains over the region. Upwards of 4-5” of rain occurred and flash flooding caused the closure of numerous roads.
May 2013	Thunderstorms brought wind and heavy rainfall caused flash flooding and road closures in areas.
Aug. 2013	Heavy rainfall repeatedly moved across the region with more than 3 inches of rain in just a few hours. Streams and creeks overflowed causing flash flooding.

Date	Description of Event
Sept. 2013	Showers and thunderstorms tracked over region and resulted in persistent heavy rain, flash flooding and road closures.
June 2014	Slow moving showers and thunderstorms developed producing very heavy rain over a short period of time. This led to some flash flooding and road closers, especially in urban and poor drainage areas.
June 2014	Showers and thunderstorms repeatedly passed over the same locations with heavy rainfall and significant runoff, causing flash flooding in some areas. Many roads were closed and some homes were affected.
July 2014	A cluster of strong to severe thunderstorms broke out causing heavy rainfall and flash flooding with 3-6" of rainfall occurring.
May 2016	Bands of slow-moving showers and thunderstorms broke out over the region. Heavy rainfall repeatedly fell over the area, resulting in flash flooding and some roads were temporarily closed.
Aug. 2017	Widespread rain moved through the area resulting in isolated flash flooding.
Jan. 2018	Warm air mass of 60 degrees and heavy rains of 2" cause flooding of water and ice blocks and isolated mudslides; water and ice blocked Route 8 in Cheshire.
July 2023	Heavy rains cause severe damage in North County damaging/closing several roads in Adams, N. Adams and Clarksburg; Adams and Clarksburg declares state of emergency; Cheshire received 3.2" of rain & Adams 4.2" (Berkshire Eagle 7-10-23)

Source: BRPC 2023 (unless otherwise noted)

According to the data and local officials and residents, the more notable flood events that occurred in Cheshire were the Hurricanes of 1955, the October 2005 rain event, T.S. Irene in 2011 and T.S. Sandy in 2012. The most impactful of these was the flooding and road damage in 1955. Dual Hurricanes Connie and Diane was classified in Cheshire as a 1% storm event. Impacts from T.S. Irene echoed these impacts with less extreme results. Cheshire experienced localized flooding, widespread power outages, and felled trees around Main St., West Mountain Rd, and Flaherty Street. One year later Cheshire received the tail-end of T.S. Sandy in which heavy winds toppled trees and power lines, closing roads and causing widespread power outages.

On the evening of June 25, 2014 Cheshire, like several central Berkshire communities, sustained severe damages to a few key roadways due to a heavy rain event. According to the local newspaper, four inches of rain fell at the NWS observation station at Pittsfield Municipal Airport during the five-hour period from 7 p.m. to midnight on the night of the storm. This is more than one month's worth of rainfall in a brief period, and apparently set a modern-era record, according to archived NWS data. Route 116 was the most severely damaged, with more than half the road caved in from a hole 8 to 10 feet deep, with the guard rails left hanging in midair. A portion of the road near the Cheshire and Savoy town lines was closed for several days. A portion of Windsor Road was initially impassable after

Figure 3.9. Main Street at Flaherty Road during T.S. Irene, Aug. 2011

Photo courtesy iBerkshires

heavy rains blew out a culvert carrying a tributary of South Brook Windsor Road. Costs to repair the storm's damages were estimated at the time to be nearly $1 million. Damages and road washouts were reported in other towns hilltowns in the Central Berkshire region.[21] As reported later in the Berkshire Eagle, during that month of June 2014 Berkshire County received more than 14 inches of rain, double the average amount.

Cheshire has two functional dams, namely the Cheshire Reservoir dam on Cheshire Lake and the Basset Brook Reservoir dam in Cheshire Harbor. While there have been no recorded dam breaches, the area faces frequent flooding along State Rd during periods of heavy precipitation. Notably, neighboring towns have experienced significant dam failures, such as the Mud Pond Dam incident in 1868 and 1968, which tragically resulted in 9 deaths, and the 1901 incident at Bassett/Dean Dam in Adams, which claimed one life.

Vulnerability Assessment

Geographic Areas Likely Impacted

Due to the hilly terrain and narrow stream corridors, there are relatively few floodplain acres in Cheshire. There are approximately 1,004 acres of land delineated by the FIRM map as floodplain, which comprises less than one percent of the Town. Approximately seven acres have been developed, which represents less than one percent of total floodplain acres in the Town. It should be noted that the FIRM map for Cheshire was issued in 1982, over 40 years ago. As precipitation patterns and flow regimes change in a warming climate, the boundaries of the 100-year floodplain could shift.

In Cheshire, the largest floodplain area is located along the low-lying terrain of Cheshire Reservoir and the Hoosic River corridor and its associated wetland complexes. The floodplain crossed Main Street (including the DPW facility) and extends northward between Railroad Street and Berkshire Village mobile home park. Other floodplain areas are found along Gore, Thunder and Dry Brooks. Floodplain areas are shown in green on the Critical Facilities and Areas of Concern Map.

Road flooding was identified as the top hazard in the Hazard Mitigation survey. The areas that have been identified as being of concern due to flooding are shown on the Critical Facilities and Areas of Concern Map. Cheshire has a road network of approximately 63 miles. Of these, the Town is responsible for maintaining 46 miles (74%). The rest are maintained by the state or are privately owned. Two roadways serve as main arteries for the town. State Route 8 is the main route through town, crossing from south to north, serving as a main regional artery for north-south commuter, commercial and emergency travel. It encircles Cheshire Reservoir and runs through the center of town and the main development center of the town. However, the proximity of Route 8 to Cheshire Reservoir increases the risk of flooding during heavy rainfall or severe weather events. In addition, Route 8 connects to several residential streets and branch off from it serving as important access points to and from residential areas.

[21] *Fanto, Clarence and Smith, Jenn; 6-27-14; "Updated: Heavy downpours wash out roads across Berkshires," Berkshire Eagle. Guerino, Jack; 6-28-14; "Cheshire Storm Damage Estimated at $1 Million," iBerkshires.*

Windsor Road and Savoy Road (aka Route 116) have histories of flood damages, partially due to steep slopes, stream ravines and stream crossings. Both roads were heavily damaged during a severe rain burst in June 2014.

Figs. 3.10 and 3.11. Heavy rain damaged and closed Windsor Road June 2014

Photos courtesty Chief Tom Francesconi.

Route 116 is particularly crucial as it provides access to the regional middle and high school, serving not only the students of Cheshire but also those from surrounding areas. Furthermore, Route 116 serves as a lifeline for residents in rural hilltowns situated to the east, such as Savoy and Windsor, by providing them with access to essential services. Additionally, Route 116 serves as a gateway to various outdoor recreational opportunities, serving as the scenic by-way and the well-known hiking trails and campgrounds on Savoy State Mountain. However, it is worth noting that this area is susceptible to frequent flooding and road washouts following heavy precipitation, which can disrupt transportation and pose challenges to commuters and residents.

Figure 3.12 Savoy Road washout 1988.

Beavers are part of the natural landscape, and by damming streams they create wetlands and open water habitats that support a more complex and biodiverse ecosystem. Wetland systems can provide flood storage capacities and reduce flashy flood conditions when beaver dams are intact. However, expansion of water levels upgradient of the dams can flood residential properties and impact the quality of drinking water sources and the functionality of septic systems. In these instances, risk to human health may require action to control water levels. In many instances installing water leveler devices in beaver dams to allow continued water flow or structures that bar beavers from clogging culverts alleviates flooding problems. Grants from the Human Society have helped to fund several such projects across the Berkshires. Where such methods do not solve the problem, removal of the beaver population must be undertaken, although this has become more difficult as trappers in the region have become less common.

In Cheshire there are areas where heavy and persistent beaver activity impacts infrastructure and private property. The area of most concern is along the Hoosic River and its associated wetlands northward of the Main Street / Railroad Street junction, west and north of Berkshire Village mobile home park. Other areas also of concern are found on Notch Road, Windsor Road, and between Wells and East Harbor Road. These areas are noted in purple hatching on the Critical Facilities and Areas of Concern map.

Flood impacts could effect a portion of properties along the Hoosic River and surrounding area in the center of Town if the Cheshire Reservoir dam were to fail. According to a draft Emergency Action Plan developed in 2018 for Cheshire Reservoir dam, inundation could effect properties on Main Street (including the DPW facility), where flooding be up to two feet deep. Properties bordering the Hoosic River on Meadowview Drive and Railroad Street could experience up to three or four feet of flooding, depending on location. The Ashuwillticook Rail Trail at the Railroad Street / Meadowview Drive could experience up to four feet of flooding. The Harbor Road at the Hoosic River bridge would also be impacted. The EAP does not list the individual properties or buildings that would likely suffer inundation.[22] An EAP for Bassett Brook Reservoir indicates that residential properties that lie between Harbor Road and Route 8 north of Reservoir Road, along with a portion of lower Reservoir Road, would be inundated if the dam at this reservoir were to fail.[23] There is not data to indicate potential flooding from the other small dams located in Cheshire.

People

The impact of flooding on life, health, and safety is dependent upon several factors, including the severity of the event and whether or not adequate warning time is provided to residents. Populations living in or near unmapped floodplain areas may be impacted during a flood event. In Cheshire, flooding conditions threaten the population at the Berkshire Village mobile home park off Dublin Road, which is comprised largely of low-income and elderly residents. Residents have in past decades reported flood damage at some homes. Although in recent years the trailer homes have not themselves been inundated, the road into the neighborhood floods at least once a year. Also, while the neighborhood is not itself in the floodplain as delineated in the FIRM, it is surrounded by wetlands and floodplain, and some areas in the park can at times become inundated during heavy precipitation events. The flooding of the road is an indication to residents and first responders that flooding is probable and could cut off emergency access, so a CodeRed is issued to residents to inform them of flood risk. Fortunately, most residents in this area are enrolled in CodeRed and kept informed. Other areas where properties are impacted by flooding are along the Cheshire Reservoir shoreline, where some septic systems tend to fail when water levels of the lake reach higher levels. Flooding here not only creates a potential human health hazard, but can impact water quality, reduce wildlife habitat and limit recreational use of the lake.

The total number of injuries and casualties resulting from typical riverine flooding is generally limited due to advance weather forecasting and warnings. CodeRed and other local emergency notification systems have increased communications between residents and emergency personnel. The historical record from 1993 to 2017 indicates that there have been two fatalities in in Massachusetts associated with flooding, both in Topsfield during the Mother's Day Flood of 2006, and five injuries associated with two flood events, occurring within two weeks of each other in March 2010. While six inches of moving

[22] Author unknown, 2018. *EAP for Cheshire Reservoir Dam Cheshire MA*, draft version 2018.07.17.
[23] Author unknown, 2021. EAP for Basset Brook Reservoir Dam, Cheshire, Berkshire, MA, version 2 10/25/21.

water can cause adults to fall, 1 foot to 2 feet of water can sweep cars away. Downed powerlines, sharp objects in the water, or fast-moving debris that may be moving in or near the water all present an immediate danger to individuals in the flood zone. Events that cause loss of electricity and flooding in basements, which are where heating systems are typically located in Massachusetts homes, increase the risk of carbon monoxide poisoning. Carbon monoxide results from improper location and operation of cooking and heating devices (grills, stoves), damaged chimneys, or generators.

Finally, the growth of mold inside buildings is often widespread after a flood. Investigations following Hurricane Katrina and Superstorm Sandy found mold in the walls of many water-damaged homes and buildings. Mold can result in allergic reactions and can exacerbate existing respiratory diseases, including asthma (CDC, 2004). Property damage and displacement of homes and businesses can lead to loss of livelihood and long-term mental stress for those facing relocation. Individuals may develop post-traumatic stress, anxiety, and depression following major flooding events (Neria et al., 2008 as cited in MEMA & EOEEA, 2018).

The Massachusetts Wetlands Protection Act provides some protection for wetland resources, requiring that development be conducted outside wetland and riverfront areas. Where development does occur within these areas, wetland mitigation can be required, including flood storage replication.

People and property downstream of dams may be at risk from dam failures. The Cheshire Reservoir dam is a Significant Hazard dam, although rated to be in Fair condition,

Built Environment

Floodwaters can severely damage or completely destroy homes and business structures. As noted by FEMA, owning a property is one of the most important investments most people make in their lives. Flooding is the most common and costly natural disaster in the U.S., just one inch of water can cause $25,000 in damages to residential homes[24]. Repeated flooding can over time render homes and structures unaffordable over time, or even uninhabitable. As defined by FEMA, a Repetitive Loss Structure is one that is a NFIP-insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978.

This Hazard Mitigation Plan attempts to quantify the potential losses to building owners if their buildings were flooded during a 100-year flood event. To determine potential losses, MassGIS FIRM and MassGIS assessor parcel data was reviewed and all properties that were fully or partially located within the FIRM boundaries were selected for analysis. Assessor building value data relating to those properties was used to estimate potential structural losses. It should be noted that values here are at assessed value, not market or replacement value, and therefore likely underestimate the costs that would be needed to bring a building back to its pre-disaster value. Also, this analysis includes only buildings and does not include potentially significant losses from infrastructural damage to roads, water lines or utility systems. For the purposes of this analysis, the value of contents for residential buildings is 50% of assessed value, and the value of commercial contents is 100% of assessed value. Town of Cheshire building content losses, which includes the DPW facility, were calculated using the commercial rate of 100%; given the high cost of heavy vehicles and equipment, this estimate may be undervalued. See Table 3.12 for potential losses due to a 100-year flood event.

[24] FEMA, Protect Your Home from Flooding,

Table 3.12. Properties in the 100-year Floodplain and Estimate of Losses (U.S. Dollars)

Type of Building	Number of Units	Building Value	Contents Value	Total
Residential	113	$ 9,211,400	$ 4,605,700	$ 13,817,100
Commercial	5	$ 444,000	$ 444,000	$ 888,000
Town (DPW, Farnam's Causeway)	5	$ 375,500	$ 375,500	$ 751,000
Total	**123**	**$10,030,900**	**$5,425,200**	**$15,456,100**

Source: Assessor Records 2022

The Town of Cheshire is a NFIP community. 4 CFR § 201.6(c)(2)(ii) requires all plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. According to 2017 data retrieved from MEMA, Cheshire has only had one property that has applied for and received funding. The property is a modest residential home located Main St and is not located within the floodplain. It sustained damage in January 2005 ($5,690 claim) and during T.S. Irene in August 2011 ($9,7460 claim). No data was available from 2018- 2023.

In the Berkshire region, rivers and streams exhibit dynamic characteristics, frequently experiencing stream channel and bank erosion. This erosion phenomenon is common in both headwater streams and the meandering floodplains of the Housatonic and Hoosic Rivers. Fluvial erosion is a process whereby a river erodes the bank, typically on the outer curve of a meander, resulting in the sloughing and collapse of the riverbank. This erosion process can gradually encroach upon the built environment, posing a risk of undermining and washing away structures such as buildings, roads, and bridges. Throughout the region, many roads align with streams and rivers, either situated within the floodplain or carved into the slopes adjacent to the riverbanks. Moreover, older buildings, including homes and barns, were often constructed in floodplain areas or in close proximity to stream channels, regardless of whether the location was rural or urban. Additionally, fluvial erosion has the potential to scour and lower the level of stream and river channels, thereby jeopardizing bridge pilings and abutments. It is worth noting that this type of erosion may occur outside of officially designated floodplain areas (MEMA, 2013).

Landslides on steep slopes can occur when soils are saturated and give way to sloughing, often dislodging trees and boulders that were bound by the soil. The damage from T.S. Irene in 2011 to Route 2 in the Florida/Charlemont and the Savoy area was a combination of fluvial erosion from the Cold and Deerfield Rivers and a landslide on the upland slope of the road.

Flooding of homes and businesses can impact human safety health if the area of inundation is not properly dried and restored. Wood framing can rot if not properly dried, compromising building structure and strength. Undetected populations of mold can establish and proliferate in carpets, duct work, wall board and almost any surface that is not properly dried and cleaned. Repeated inundation brings increased risks of both structural damage and mold.

Regarding dam failures, all structures, critical facilities and roadways in the inundation zone are vulnerable to damage. Flood waters may potentially cut off evacuation routes, limit emergency access, and destroy power lines and communication infrastructure.

Floodwaters can increase the risk of the creation of and dislodging of ice dams during the winter months. Blocks of ice can develop in streams and rivers to create a physical barrier or dam that restricts flow, causing water to back up and overflow its banks. Large ice jam blocks that break away and flow downstream can damage culverts, bridges and roadways whose openings are too small to allow passage (MEMA, 2013). As noted previously, ice dams and debris often block traffic along Route 8, a major north-south route to emergency and other services.

Electrical power outages can occur during flood storm events, particularly when storm events are accompanied by high winds, such as during hurricanes, tropical storms, thunderstorms and micro-bursts. Fortunately, most flooding in the Berkshire region is localized and have resulted in few widespread outages in recent years, and where it occurs service has typically been restored within a few hours. A severe flood event can threaten the functionality or structural integrity of the dams that are overtopped or fail.

Natural Environment

Flooding and saturated soils has the potential to affect the natural environment in several ways. Septic systems can flood, contaminating the surrounding areas, posing health risks, and damaging the environment. Flooding can spread chemical and bacterial contamination potentially harmful to people, the environment, and wildlife.

Flooding can remove trees, other vegetation, rocks and soil causing erosion, high turbidity and the loss of community assets. Excessive sedimentation of stream and lake beds can disrupt aquatic life cycles by smothering aquatic life and fish eggs. Sedimentation of lakes and ponds can create the shallower, warmer shoreline conditions that favor infestation of invasive aquatic plants such as Phragmites, purple loosestrife, Eurasian water milfoil, water chestnut and a host of others. Invasive aquatic plant species are a major environmental and public health concern in Cheshire Reservoir / Hoosac Lake. Invasive species can be carried downstream and dispersed into new areas in flood waters, particularly those like Japanese knotweed that readily spreads via broken plant fragments.

Stormwater drainage systems collect contaminants and sediment from roads and other surfaces and transports it into waterways if there is not a sufficient buffer to filter out the contaminants and sediment. Typically, there is no infrastructure in place to protect from nonpoint source pollution of this type.

The sudden and potentially extreme volumes of water released during dam failures can result in ecological damage both upstream and downstream of the dam. River channels downstream of the dam can experience severe scouring, banks can experience erosion and mass wasting, and boulders can become dislodged and move downstream. Trees and other vegetation can become uprooted and add to the debris moved by floodwaters, potentially clogging and threatening the integrity of culverts and bridges. Upstream of the dam the former impoundment could become partially or completely dewatered, altering, and potentially destroying lacustrine aquatic habitat (MEMA, 2013).

Economy

The impacts of flooding on the economy include the value of buildings and businesses potentially lost during a flood event, the loss of business revenue during the response and recovery period, economic loss due to an inability to commute to work or communicate, and the burden of paying for recovery and the rebuilding of infrastructure.

Future Conditions

Based on data gathered from the Northeast Climate Science Center (NECSC), the yearly precipitation total for Berkshire County has been experiencing a gradual rise over the last 70 years, rising from 40.1 inches in the 1960's to 48.6 inches in the 2000's. According to projections from the NECSC, the county is projected to experience an additional 3.55 inches by the 2050's and 4.72 inches by the 2090's. (Northeast Climate Science Center, 2018)

The scientific community agrees that climate change is altering the weather and precipitation patterns of the northeastern region of the U.S. The Intergovernmental Panel on Climate Change report of 2007 predicts temperature increases ranging from 2.5-5.0° C (36-41° F) over the next 100 years across the U.S., with the greatest increase in the northern states and during the winter months. More mid-winter cold/thaw weather pattern events could increase the risk of ice jams. Many studies agree that warmer temperatures late in the year will result in more rain-on-snow storm events, leading to higher spring melt flows, which typically are already the highest flows of the year.

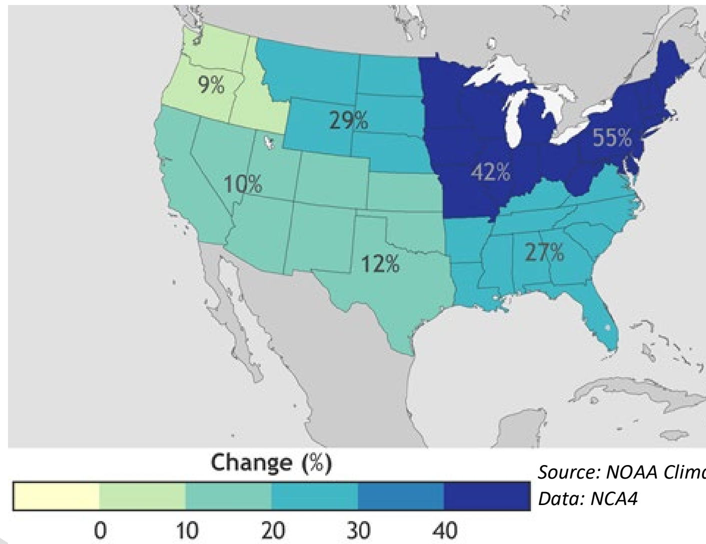
Studies have also reported increases in precipitation in both developed and undeveloped watersheds across the northeast, with the increases being observed over a range of precipitation intensities, particularly in categories characterized as heavy and extreme storm events. These events are expected to increase both in number and in magnitude. Some scientists predict that the recurrence interval for extreme storm and flood events will be significantly reduced. One study concluded that the 10-year storm may more realistically have a recurrence interval of 6 years, a 25-year storm may have a recurrence interval of 14 years and the 100-year storm may have a recurrence interval of 49-years. The same study predicts that if historic trends continue that flood magnitudes will increase, on average, by almost 17%.[25]

Data from USGS streamflow gages across the northeast show a clear increase in flow since 1940, with an indication that a sharp "stepped" increase occurred in the 1970s. This is despite the fact that much of the land within many New England watershed has been reforested, and this type of land cover change would tend to reduce, rather than increase, flood peaks.

[25] Walter, Meghan and Vogel, Richard (2010). Increasing Trends in Peak Flows in the Northeaster United States and their Impacts on Design found at https://acwi.gov/sos/pubs/2ndJFIC/Contents/2F_Walter_03_01_10.pdf

NOAA has documented that extreme or heavy precipitation events have grown more frequent since the start of the twentieth century, and such events are likely to become even more frequent over the twenty-first. Heavy precipitation is defined by NOAA as those heavy rain or snow events ranking among the top 1 percent (99th percentile) of daily events, has increased 55% in the Northeast between 1958-2012 [26]. It should be noted that during this period, a nine-year drought from 1961-1969, the drought of record for this region, occurred during this period. As such, this may underestimate the overall trend for future projections.

Figure 3.13. Increase in Precipitation Falling in Top 1% Extreme Precipitation Events 1958-2016

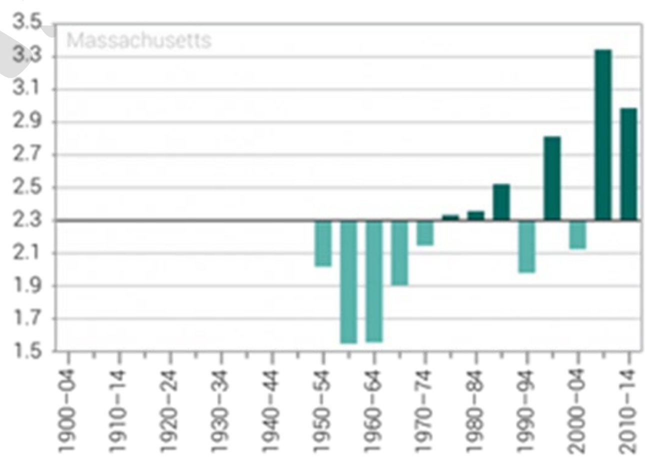


Source: NOAA Climate.gov, Data: NCA4

The Massachusetts Climate Change Projections report looked at the precipitation changes expected by greenhouse gas effects within the state's major watersheds. According to an upper-level scenario, the days per year with precipitation of more than one inch in the Housatonic River Watershed is predicted to increase from the baseline of six days per year to nine days by the 2050s, and to 10 days by the 2090s. The baseline reflects precipitation data 1971-2000. The upper scenario represents a 47% increase in these storms from the baseline by mid-century and a 66% increase by end of century.

Summer is currently season when there is the greatest chance for extreme precipitation events to occur, and summer is projected to continue to be the season of greatest chance and the season with the greatest increases in the number of days with extreme precipitation. Already observed in Massachusetts, the number of extreme precipitation events, those defined as more than two inches in one day, has increased since the the 1980s, with the greastest increase in the past decade (see Figure 3.14)[27].

Figure 3.14 Number of Extreme Precipitation Events of 2" or more in 1 Day



Source: https://statesummaries.ncics.org/ma

This trend has direct implications on the design of municipal infrastructure that can withstand extreme storm designs must be based on the most updated precipitation and stream gauge information available.

[26] Scott, Michon, 2019. Prepare for More Downpours. NOAA. Found at *https://www.climate.gov/news-features/featured-images/prepare-more-downpours-heavy-rain-has-increased-across-most-united-0*

[27] *NOAA National Center for Environmental Information. (2022) Massachusetts State Climate Summary*

Ensuring unimpeded road access is imperative due to the substantial influx of daily commuters for work and for buses but also for emergency services.

It may be prudent, therefore, to slightly overdesign the size of new stormwater management and flood control systems so that they have the capacity to accept the increase in flow or volume without failing. For many piped systems, such as culverts, drainage ditches and swales, the slight increase in size may provide a large increase in capacity, and for very little increase in cost. If space is available, an increase in the capacity of retention/detention ponds may also be cost effective. Bioretention cells can be engineered so that they can increase their holding capacity for extreme storm events with little incremental cost. The size of the engineered soil media, which is a costly component of the system, may remain the same size as current designs call for, but a surface ponding area surrounding the central soil media is increased to serve as a holding pond.

If climate change results in a greater number of severe precipitation events and shortens recurrence intervals them, as is predicted, it will require dam operators to become more vigilant in monitoring precipitation and temperature patterns. Individual rain events, particularly if occurring during periods of saturated or frozen soils that cannot absorb rainfall, may require that dam operators open spillways, flashboards and other safety features more often, causing a greater number of high discharge events and possible flooding on properties downstream of the dam. Although climate change may not increase the probability of catastrophic dam failure, it may increase the probability of design failures that were based on outdated precipitation patterns (MEMA, 2013).

Hazard Profile

Likely Severity

Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike damage could be significant, particularly if there is a home or other facility in its path. Many people could be displaced for an extended period of time; buildings could be damaged or destroyed; businesses could be forced to close for an extended period of time or even permanently; and routine services, such as telephone or power, could be disrupted.

The NWS rates tornadoes using the Enhanced Fujita scale (EF scale), which does not directly measure wind speed but rather the amount of damage created. This scale derives 3-second gusts estimated at the point of damage based on the assignment of 1 out of 8 degrees of damage to a range of different structure types. These estimates vary with height and exposure.

Figure 3.15 Enhanced Fujita Scale

Rating	Winds	Expected Damage
EF0	65-85 mph	**Minor damage.** Shingles or parts of roof peeled off; damage to gutters/siding; branches broken off; shallow-rooted trees toppled.
EF1	86-110 mph	**Moderate damage.** More significant roof damage; windows broken; exterior doors damaged or lost; mobile homes badly damaged or overturned.
EF2	111-135 mph	**Considerable damage.** Roofs torn off well-constructed homes; homes shifted off their foundation; mobile homes completely destroyed; large trees snapped or uprooted; cars may be tossed.
EF3	136-165 mph	**Severe damage.** Entire stories of well-constructed homes destroyed; significant damage to large buildings; homes with weak foundations may be blown away; trees begin to lose bark.
EF4	166-200 mph	**Extreme damage.** Well-constructed homes leveled; cars thrown significant distances; top story exterior walls of masonry buildings likely collapse.
EF5	> 200 mph	**Incredible damage.** Well-constructed homes swept away; steel-reinforced concrete structures critically damaged; high-rise buildings sustain severe structural damage; trees usually completely debarked, stripped of branches, and snapped.

Source: https://www.weather.gov

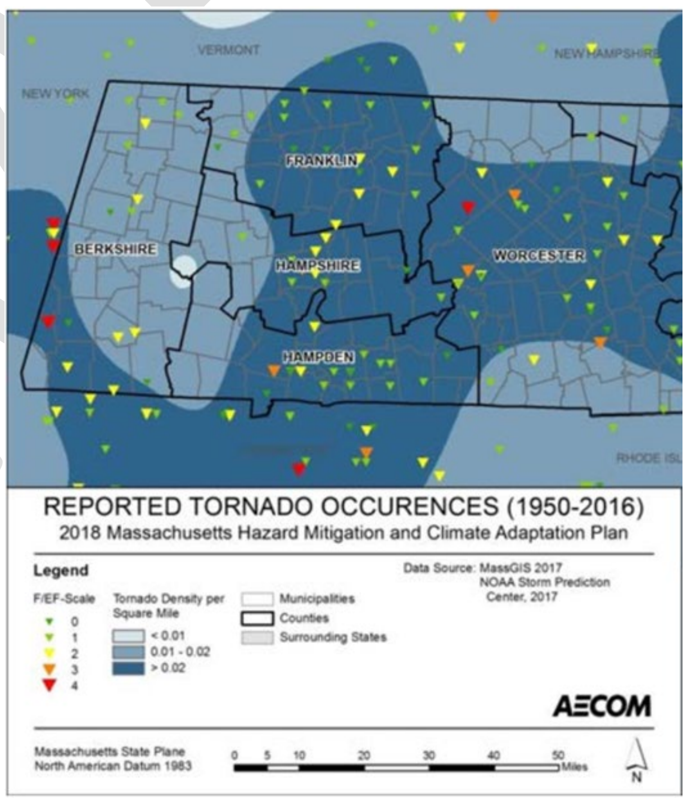
High winds and thunderstorms occur outside of notable storm events, but still can cause significant damages. Cheshire like other Berkshire County communities, has experienced numerous thunderstorms and high wind events including microbursts. Wind is air in motion relative to the surface of the earth. A thunderstorm is a storm originating in a cumulonimbus cloud. Cumulonimbus clouds produce lightning, which locally heats the air to 50,000 degrees Celsius, which in turn produces an audible shock wave, known as thunder. Frequently during thunderstorm events, heavy rain and gusty winds are present. Less frequently, hail is present, which can become very large in size. Tornadoes can also be generated during these events (MEMA & EOEEA, 2018).

Effects from high winds can include downed trees and/or power lines and damage to roofs, windows, and other structural components. High winds can cause scattered power outages. Massachusetts is susceptible to high winds from several types of weather events: before and after frontal systems, hurricanes and tropical storms, severe thunderstorms and tornadoes, and nor'easters. Sometimes, wind gusts of only 40 to 45 mph can cause scattered power outages from downed trees and wires. This is especially true after periods of prolonged drought or excessive rainfall, since both are situations that can weaken the root systems and make them more susceptible to the winds' effects. Winds measuring less than 30 mph are not considered to be hazardous under most circumstances.

A thunderstorm is classified as "severe" when it produces damaging wind gusts in excess of 58 mph, hail that is one inch in diameter or larger (quarter size), or a tornado (NWS, 2013). The severity of thunderstorms can vary widely, from commonplace and short-term events to large-scale storms that result in direct damage and flooding. Widespread flooding is the most common characteristic that leads to a storm being declared a disaster. The severity of flooding varies widely based both on characteristics of the storm itself and the region in which it occurs. Lightning can occasionally also present a severe hazard (MEMA & EOEEA, 2018).

Probability

Figure 3.16 Density of Reported Tornadoes per Square Mile



Source: MEMA, 2018, from NOAA Storm Prediction Center (SPC)

The location of tornado impact is totally unpredictable. Tornadoes are fierce phenomena which generate wind funnels of up to 200 MPH or more, and occur in Massachusetts usually during June, July, and August, although the county's most devastating was in Great Barrington in May. From 1950 to 2017, the Commonwealth experienced 171 tornadoes, or an average annual occurrence of 2.6 tornado events per year. In the last 20 years, the average frequency of these events has been 1.7 events per year (NOAA, 2018). Massachusetts experienced an average of 1.4 tornadoes per 10,000 square feet annually between 1991 and 2010, less than half of the national average of 3.5 tornadoes per 10,000 square feet per year (NOAA, n.d. as cited in MEMA & EOEEA, 2018).

According to the National Climatic Data Center, since 1950, there have been 13 tornados that have touched down or moved in a path across Berkshire County, and there are several others that occurred in adjacent counties and states in the region. The most recent of these was in July 2014 when a tornado struck in Dalton. This averages to one tornado striking the county approximately every five years. Of these, only two have been of a severity of an EF4, which indicates that such a severe tornado has a statistical recurrence rate of one in every 33 years. (NOAA, 2017).

Over a ten-year period (January 1, 2008 through December 31, 2017), a total of 435 high wind events occurred in Massachusetts for an annual average of 43.5 events occurred per year. High winds are defined by NWS as sustained non-convective winds of 35 knots or greater (~40 mph) or lasting for one hour or longer, or gusts of 50 knots or greater (58 mph) for any duration (NCDC, 2018). However, many of these events may have occurred as a result of the same weather system, so this count may overestimate the frequency of this hazard. The probability of future high wind events is expected to increase as a result of climate projections for the state that suggest a greater occurrence of severe weather events in the future.

Three basic components are required for a thunderstorm to form: moisture, rising unstable air, and a lifting mechanism. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise—by hills or mountains, or areas where warm/cold or wet/dry air bump together causing a rising motion—it will continue to rise as long as it weighs less and stays warmer than the air around it. As the warm surface air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool, releasing the heat, and the vapor condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice, and some of it turns into water droplets. Both have electrical charges. When a sufficient charge builds up, the energy is discharged in a bolt of lightning, which causes the sound waves we hear as thunder. An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms (MEMA & EOEEA, 2018). Lightning strikes primarily occur during the summer months. According to NOAA, there has been one fatality and 43 injuries as a result of lightning events from 1993 and 2012 in the Commonwealth (NCDC, 2012). Although thunderstorms with lightening may increase due to a more volatile atmosphere, the chance of death or injury is likely to remain low.

Geographic Areas Likely Impacted

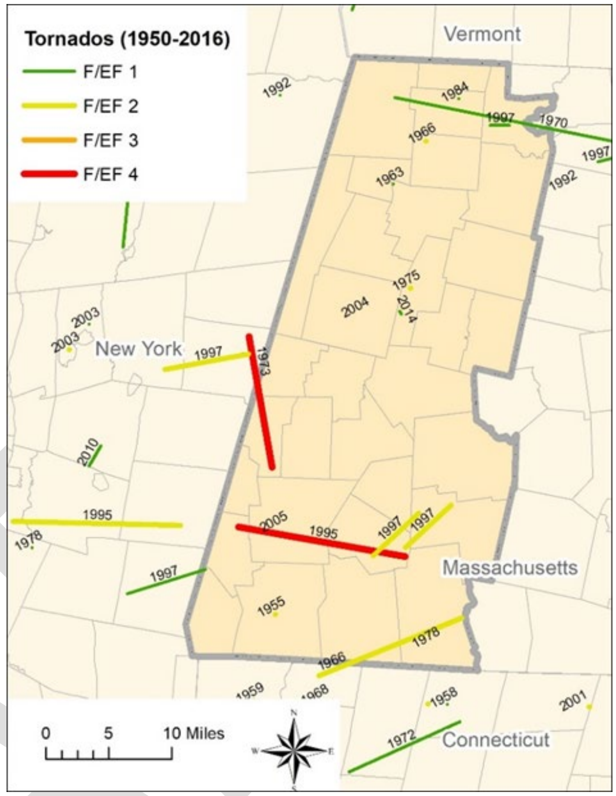
All of Cheshire is vulnerable to tornados, high winds and thunderstorms that can cause extensive damage. Microbursts can also occur anywhere associated with thunderstorms.

Historic Data

The National Climatic Data Center reports data on tornado events and does so as far back as 1950. Of the 18 tornados that have occurred in Berkshire County between 1950 and 2018, only one has occurred since 2007, an EF1 in July 2014 in neighboring Dalton. Four tornados occurred during a single storm on July 3, 1997. These have resulted in over $29 million in damage, seven deaths, and 60+ injuries. (NOAA, 2017).

According to an article in the local newspaper, there was an event residents described as a "twister" that struck Cheshire in 1964. The event was accompanied by an electrical storm with hail and 1.25" of rain that fell in 30 minutes. One child was injured and a garage was torn apart, with residents on West Mountain Road without power for two days. This may be the event that is shown as a F/EF 1 tornado in Figure 3.17 and erroneously labeled as 1963.

Figure 3.17 Tornados in the Berkshire Region and their Severity



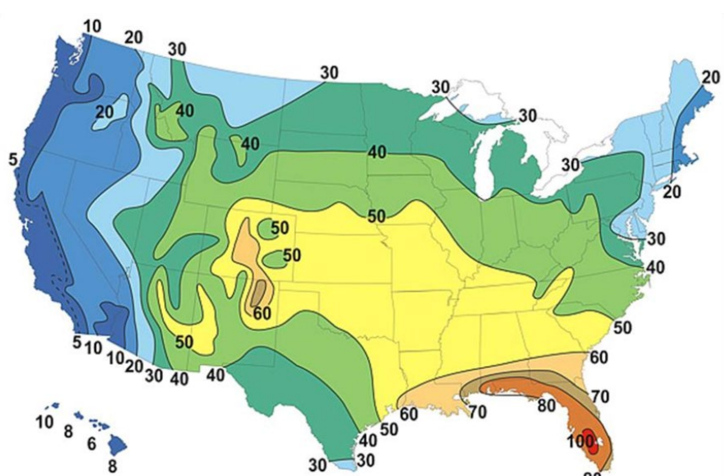
Source: Midwest Regional Climate Center, 2018.

Other memorable tornados in recent history occurred in West Stockbridge in August of 1973 (category F4) and in Great Barrington, Egremont, and Monterey in May of 1995 (category F4). In the West Stockbridge tornado four people died and 36 were injured, and in Great Barrington three people died and 24 were injured (MEMA & EOEEA, 2018). The signs of the tornado's destruction are still visible today in Great Barrington from Rt. 7. The hill to the east is scarred where the tornado uprooted and toppled trees.

High wind events occasionally impact the Town of Cheshire and require emergency response. In 2012 the winds that accompanied T.S. Sandy required response all across the Town. Local officials and private residents worked together with chainsaws and heavy equipment to open roads for utility crews and help neighbors open driveways.

It is difficult to define the number of other severe weather events experienced by Cheshire each year. Image 3.22 shows number of annual thunderstorm days across the United States. According to a map created by NOAA and NWS, and featured in the SHMCAP, Western Massachusetts experiences approximately 30 thunderstorm days each year. An average thunderstorm is 15 miles across and lasts 30 minutes, although severe thunderstorms can be much larger and longer (MEMA, 2013).

Figure 3.18 Annual Avg. Number of Thunderstorm Days in U.S.



Source: NOAA NWS, MEMA & EOEEA, 2018.

Microbursts occur throughout Berkshire County, downing trees, utility lines and sometimes causing damage to property. In the Berkshires microbursts are often accompanied by heavy rainfall that can cause additional damage from flooding. According to news media reports, several thunderstorm/microburst events have caused damages in the communities of Williamstown, North Adams, Cheshire, Lanesborough, Pittsfield, Lee, and Stockbridge in recent years.

An event that struck Pittsfield and other central Berkshire communities in July 2011 caused extensive damage and was responsible for the death of a man in Hinsdale who was struck by a falling utility pole. WMECO called in 339 out-of-state work electric crews and 14 out-of-state tree crews to remove trees and repair damaged lines.[28]

In June 2014, Cheshire experienced a "monsoon season" after a series of severe thunderstorms with 60-mile-an-hour winds and flooding caused over $ 1 million in flooding damages to roads and existing infrastructure.

In July 2016, as reported in the *Berkshire Eagle* newspaper, Cheshire was hit with a short but high-intensity microburst – a localized column of sinking air within a thunderstorm that caused extensive damage. The worst of the affected areas were Main Street, East Main Street, Mill Hill Road, and Meadowbrook Drive. Initially, power was cut for about 1,300 customers. Trees were knocked down, requiring the cleanup of branches and debris from area roads and the Ashuwillticook Rail Trail (see Figs. 3.19 and 3.20).

Figures. 3.19, 3.20. Strong storms leave a path of downed trees and power lines along East Main St. July 2016

Photos courtesy of Berkshire Eagle 7-18-16

Vulnerability Assessment

People

The entire population of Cheshire is considered exposed to tornado, high-wind and thunderstorm events. Downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. Individuals with limited communication capacity, such as those with limited internet or phone access, may not be aware of impending tornado or microburst warnings. In general, vulnerable populations include seniors, people with underlying health issues and disadvantaged populations. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible. This short warning time is part of why tornados are so dangerous. Tornado watches and warnings are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. (MEMA, 2018). Power

[28] *McKeever, Andy, 1-27-11. "Pittsfield Slammed by Surprise Microburst Storm," iBerkshires.*

outages resulting from tornado or high winds can be life-threatening to those who are dependent on electricity for life support.

In Cheshire, warning systems are broadcast through CodeRed, a highspeed telephone communication system, that first responders believe reaches approximately 80% of the community.

The most common problem associated with severe weather is loss of utilities. Severe windstorms causing downed trees can create serious impacts on electricity and aboveground communication lines. Downed power lines can cause blackouts, leaving large areas isolated. Loss of electricity and phone connections would leave certain populations isolated because residents would be unable to call for assistance. Additionally, the loss of power can impact heating or cooling systems and cause loss of electricity to power oxygen and other life-sustaining equipment. Downed wires can create the risk of fire, electrocution, or an explosion. People who work or engage in recreation outdoors are also vulnerable to severe weather, including downed live wires or lighting strikes.

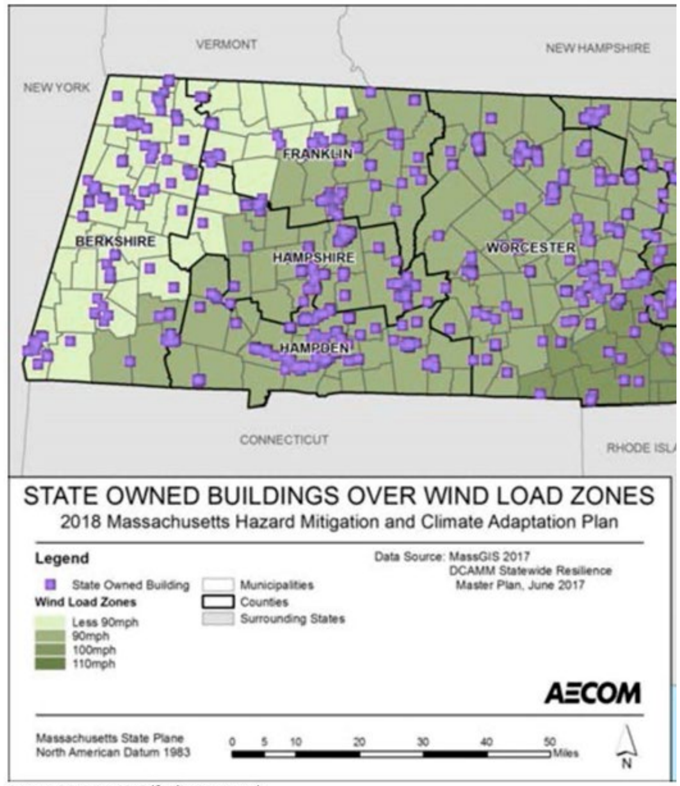
Socially vulnerable populations are most susceptible to severe weather based on a number of factors, including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing. In general, vulnerable populations include people over the age of 65, the elderly living alone, people with low socioeconomic status, people with low English language fluency, people with limited mobility or a life- threatening illness, and people who lack transportation or are living in areas that are isolated from major roads. The isolation of these populations is a significant concern. Power outages may also result in inappropriate use of combustion heaters, cooking appliances and generators in indoor or poorly ventilated areas, leading to increased risks of carbon monoxide poisoning.

All of these severe wind events present potential safety impacts for individuals without access to shelter during these events. Additionally, research has found that thunderstorms may cause the rate of emergency room visits for asthma to increase to 5 to 10 times the normal rate. Much of this phenomenon is attributed to the stress and anxiety that many individuals, particularly children, experience during severe thunderstorms. The combination of wind, rain, and lightning from thunderstorms with pollen and mold spores can exacerbate asthma (MEMA & EOEEA, 2018).

Built Environment

All elements of the built environment are exposed to severe weather events such as tornados, high winds and thunderstorms. Damage to buildings is dependent upon several factors, including wind speed, storm duration, path of the storm track, and building construction. The state is divided into four risk categories, the limits of which are defined by the Massachusetts State Building Code (9th Ed.). National wind data prepared by the American Society of Civil Engineers serve as the basis of these wind design. Generally speaking, structures should be designed to withstand the total wind load of their location. Massachusetts used these load zone determinations to determine risk to state facilities from wind hazards, and this map shows that Cheshire is located in the lowest load zone set at less than 90 mph (see Image 3.25).

Figure 3.21. Wind Load Zones for Massachusetts According to MA State Building Code



Source: DCAMM, 2017 (facility inventory)

Source: MEMA & EOEEA, 2018.

Public safety facilities and equipment may experience a direct loss (damage) from high winds. Roads may become impassable due to flash flooding, or due to landslides caused by heavy, prolonged rains. Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting) transportation needs. Water and sewer systems may not function if power is lost. The hail, wind, debris, and flash flooding associated with tornadoes can cause damage to infrastructure (MEMA & EOEEA, 2018). If a tornado hit a large expanse of Cheshire and/or its neighboring towns, electricity could be out for several days, as was the case when the ice storm of 2008 struck the Berkshire Hilltowns.

High winds could down power lines and poles adjacent to roads (resilient MA, 2018). Damage to aboveground transmission infrastructure can result in extended power outages. Incapacity and loss of roads and bridges are the primary transportation failures resulting from tornadoes, and these failures are primarily associated with secondary hazards, such as landslide events. Tornadoes can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating populations, and disrupting ingress and egress. Of particular concern are bridges and roads providing access to isolated areas and to the elderly (MEMA & EOEEA, 2018).

Natural Environment

As described under other hazards, such as hurricanes and nor'easters, high wind events can defoliate forest canopies and cause structural changes within an ecosystem that can destabilize food webs and cause widespread repercussions. Direct impacts may occur to flora and fauna small enough to be uprooted and transported by the tornado. Even if the winds are not sufficient to transport trees and other large plants, they may still uproot them, causing significant damage to the surrounding habitat. As felled trees decompose, the increased dry matter may increase the threat of wildfire in vegetated areas. Additionally, the loss of root systems increases the potential for soil erosion. Disturbances created by blowdown events may also impact the biodiversity and composition of the forest ecosystem. Invasive plant species are often able to quickly capitalize on the resources (such as sunlight) available in disturbed and damaged ecosystems. This enables them to gain a foothold and establish quickly with less competition from native species. In addition to damaging existing ecosystems, material transported by tornadoes can also cause environmental havoc in surrounding areas. Particular challenges are presented by the possibility of asbestos-contaminated building materials or other hazardous waste being transported to natural areas or bodies of water, which could then become contaminated.

Economy

Tornadoes may directly impact forestry species and agricultural crops, equipment, and infrastructure. Tornado events are typically localized; however, in those areas, economic impacts can be significant. High winds and thunderstorms impacts may be less severe but cover a larger area, so they can also impact the local economy. Types of impacts may include loss of business functions, water supply system damage, damage to inventories, relocation costs, wage losses, and rental losses due to the repair or replacement of buildings. Recovery and clean-up costs can also be costly. The damage inflicted by historical tornadoes in Massachusetts varies widely, but the average damage per event is approximately $3.9 million (MEMA, 2018).

According to the NOAA's Technical Paper on Lightning Fatalities, Injuries, and Damage Reports in the U.S. from 1959 to 1994, monetary losses for lightning events range from less than $50 to greater than $5 million (the larger losses are associated with forest fires, with homes destroyed, and with crop loss) (NOAA, 1997). Lightning can be responsible for damage to buildings, can cause electrical, forest, and/or wildfires; and can damage infrastructure, such as power transmission lines and communication towers (MEMA & EOEEA, 2018).

Future Conditions

Tornado activity in the U.S. has become more variable, and increasingly so in the last two decades. While the number of days per year that tornadoes occur has decreased, the number of tornadoes on these days has increased. Climate models show projections that the frequency and intensity of severe thunderstorms (which include tornadoes, hail, and winds) will increase (USGCRP, 2017 as cited in MEMA & EOEEA, 2018).

Research into the impact of climate change on severe storms such as thunderstorms has looked at the impact of the increased convective available potential energy (CAPE) on frequency and intensity of storms, and a decrease in wind shear as the Artic warms. Some studies show no change in the number of storms, but an increase in intensity due to more energy and evaporated moisture available to fuel storms. Other studies have shown an increase in the number and intensity of storms because the increase in CAPE compensated for a decrease in wind shear[29]. We can expect greater impacts of severe storms in the region while the exact changes are still being determined. Educating residents to be prepared emergency situations where loss of electricity occurs and maintaining an emergency communications system that can be used to reach isolated residents during power outages will become more important, especially to meet the needs of an increasingly elderly population.

[29] *https://earthobservatory.nasa.gov/features/ClimateStorms*

Drought

Hazard Profile

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

The Massachusetts Office of Energy and Environmental Affairs (EEA) and MEMA partnered to develop the *Massachusetts Drought Management Plan*, of which September 2019 is the most updated version. The state's Drought Management Task Force, comprised of state and federal agencies, was created to assist in monitoring, coordinating and managing responses to droughts and recommends action to minimize impacts to public health, safety, the environment and agriculture (EEA, MEMA, 2019). The Massachusetts Department of Conservation & Recreation (DCR) staff compile data from the agencies and develop monthly reports to track and summarize current water resource conditions.

In Massachusetts, the determination of drought level is based on seven indices: Standardized Precipitation Index, Crop Moisture Index, Keetch-Byram Drought Index, Precipitation, Groundwater levels, Streamflow levels, and Index Reservoir levels. Determinations regarding the end of a drought or reduction of the drought level focus on two key drought indicators: precipitation and groundwater levels. These two factors have the greatest long-term impact on streamflow, water supply, reservoir levels, soil moisture and potential for forest fires. Precipitation is a key factor because it is the overall cause of improving conditions. Groundwater levels respond slowly to improving conditions, so they are good indicators of long-term recovery to normal conditions.

Likely severity

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with immediate impacts on people or property, but they can have significant impacts on agriculture, which can impact the farming community of the region. As noted in the state Hazard Mitigation Plan, agriculture-related drought disasters are quite common, with 50-66% of the counties in the U.S. having been designated as disaster areas in each of the past several years. These designations make it possible for producers suffering losses to receive emergency loans. Such a disaster was declared in December 2010 for Berkshire County (USDA Designation # S3072). Because of this hazard's regional nature, a drought would likely impact the entire community, meaning the location of occurrence is "large" or over 50 percent of the town.

For the purposes of the state *Drought Management Plan*, drought conditions are classified into five levels: 'Level 0-Normal' (i.e., No Drought), 'Level 1-Mild Drought' (formerly Advisory), 'Level 2-Significant Drought' (formerly Watch), 'Level 3-Critical Drought' (formerly Warning), and 'Level 4-Emergency Drought' (formerly Emergency). These levels were selected to provide a distinction between different levels of drought severity and for adequate warning of worsening drought conditions (EEA & MEMA, 2019).

MassDEP has the authority to declare water emergencies for communities facing public health or safety threats as a result of the status of their water supply systems, whether caused by drought conditions or for other reasons. The Department of Public Health in conjunction with the DEP, monitors drinking water quality in communities.

Probability

As described below, Berkshire County is generally at a lower risk of drought relative to the rest of the Commonwealth. However, that does not eliminate the hazard from potentially impacting the County and the Town of Cheshire. The recorded historic patterns show near misses of severe drought conditions. Increases in temperature lead to faster evaporation of reservoirs, waterways, soils, and greater evapotranspiration rates in plants.

Geographic Areas Likely Impacted

For the purposes of tracking drought conditions across the Commonwealth, the state has been divided into six regions, with the Western Region being made up of Berkshire County. The Town of Cheshire utilizes public drinking water through two active groundwater supplies wells that are located east of Route 8, north of the center of town. Cheshire Water Department also maintains two emergencies, surface water reservoirs (Kitchen and Thunder Brook reservoirs).[30] Although a wide-spread event has not impacted the Town in recent memory, for the purposes of this plan, the entire Town of Cheshire is considered at risk of drought.

Historic Data

Massachusetts is relatively water-rich, with few documented drought occurrences. The most severe, state-wide droughts occurred in 1879-1883, 1908-1912, 1929-1932, 1939-1944, 1961-1969, 1980-1983, 2016-2017, and 2022. Several less-severe droughts occurred in 1999, 2001, 2002, 2007, 2008, 2010, 2014, and 2020. The nine-year drought from 1961-1969 is considered the drought of record. The longevity and severity of this drought forced public water suppliers to implement water-use restrictions, and numerous communities utilized emergency water supplies[31].

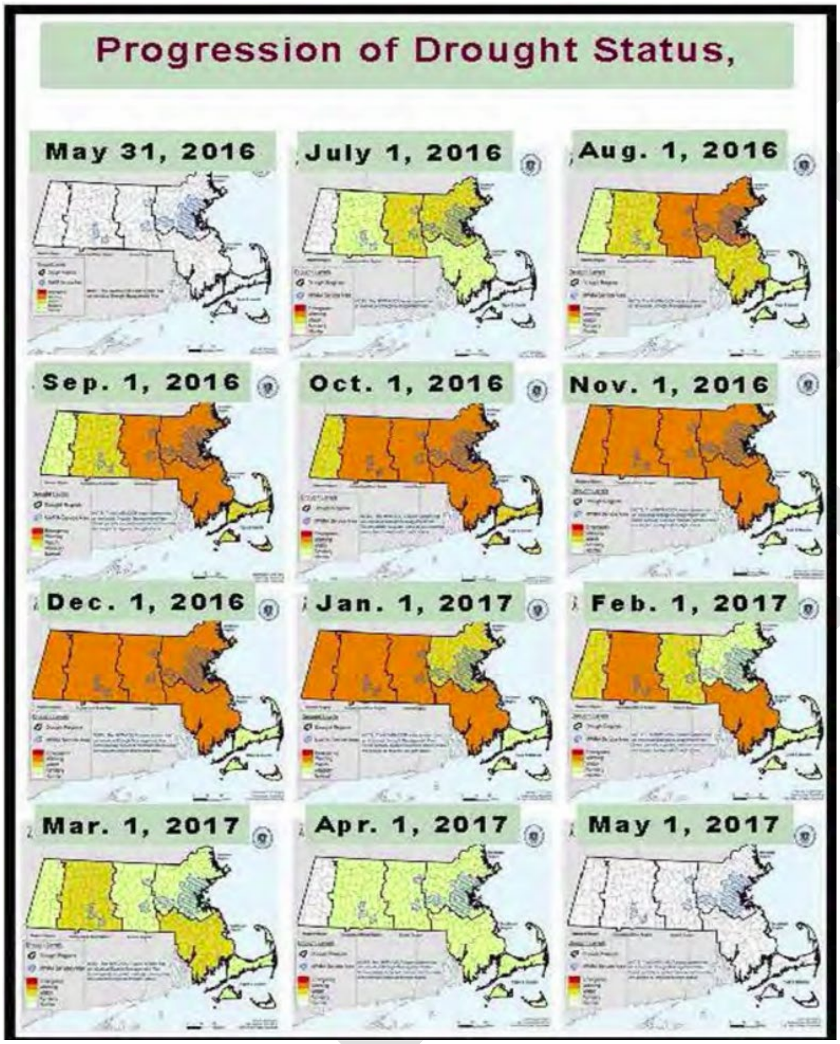
own officials are unaware of any residents whose wells have gone dry or were slow to recharge from use. The notable exception was in 1964, when a severe drought lasted 208 days and caused intense hardship for 20 families and their livestock[32]. With the frequency of droughts in the region, it is likely that there may be individuals whose wells are impaired but do not report the issue to the Town.

The most recent and significant drought in Massachusetts since the 1960s occurred during a 10-month span in 2016-17. In July 2016 Advisory and Watch drought levels began to be issued for the eastern and central portions of the state, worsening in severity until the entire state was under a Drought Warning status for the months of November-December 2016. In general, the central portion of the state faired the worse and Berkshire County faired the best, with the county entering the drought later and

[30] *https://www.mass.gov/doc/cheshire-water-department-swap-report/download*
[31] *https://www.mass.gov/doc/massachusetts-drought-management-plan/download*
[32] *The Berkshire Eagle Archives, December 12th, 1964, Vol 73 – No.183, p.23.*

emerging from the drought earlier than most of the rest of the state. Berkshire County was under an Advisory (yellow on Image 3.26) or Watch status (gold) for five months and under a Warning status (orange) for three months during the height of the drought. The Massachusetts Water Resources Commission stated that the drought was the worst since the state's Drought Management Plan was first issued in 2001, and the most severe since the 1960s drought of record.[33]

Figure 3.22. Progression of the 2016-17 Drought



Short periodic droughts were recorded in New England in 2020 and 2022. The 2022 drought was short but extreme, with drought conditions April through September, partially due to below-normal precipitation beginning in November 2021. As noted in a USGS publication, water levels at several groundwater monitoring and stream gage stations across New England recorded their lowest August water levels in 25 or 30 years.[34]

According to the local survey a number of respondents with well water have periodically experienced dry wells during the summer. These houses are located on the outskirts of town and a handful reported the need to install an artisanal well to ensure consistent water source.

Vulnerability Assessment

People

The entire population of Cheshire is exposed and vulnerable to drought. Residents and stakeholders who depend on water for their means of income, such as farmers, avocational growers, and camp

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[33] *MA Water Resources Commission, 2017. Annual Report, Fiscal Year 2017. Boston, MA.*

[34] McCarthy, D.E., LeNoir, J.M., and Lombard, P.J., 2023, 2022 drought in New England: U.S. Geological Survey Scientific Investigations Report 2023–5016, 34 p., https://doi.org/10.3133/sir20235016.

owners, could also be significantly impacted by a severe or prolonged drought. The Berkshire region has not suffered a severe, emergency level drought since the 1960s, and it is unclear how well the Town would fair during a prolonged drought given changes in population, water use, and precipitation patterns. The most recent 2022 drought conditions served as a warning for climate change conditions to come as farmers struggled to keep production high throughout the region.

One of the biggest concerns for Cheshire regarding drought is its impact on wildfires given the expanse of wild lands and conservation areas in to and inaccessible terrain in Town. This matched with Pitch Pine communities make for ready tinder that are more susceptible during drought conditions. Likewise, dead or dying hemlocks infested with wooly adelgid or ash trees dying from emerald ash borer provide dry matter that could lead to wildfire more readily than healthy forests. Drought would reduce the capacity of local firefighting efforts, hampering control of wildfire. A more detailed discussion of wildfire and the Town's vulnerability is found in that section of the report.

Built Environment

Drought does not threaten the physical stability of critical facilities in the same manner as other hazards such as wind-based or flood-related events. However, if drought led to wildfire, structures and woodlots across Cheshire would be at risk. Wildfire could also damage or destroy electrical and communication systems, including the Town's broadband internet services, which is the main communications system in the Town.

Natural Environment

The natural environment is at greatest risk due to drought. Drought can lead to low flow and low groundwater levels, threatening the continued flow of streams and rivers. The cold-water fishery streams, on which native brook trout and other cold-water species depend for survival, could become too dry to too warm to sustain them. Lower, shallower lake and pond waters force aquatic life to congregate in smaller water volumes with lower oxygen levels, leading to stress and fish kills. Lower soil moisture causes vegetated to become stressed or die, causing trees and other vegetation to drop leaves and forbs to die back. The lower moisture reduces the ability of soil organisms to break down accumulated plant and animal matter. This combination of greater build-up of dry matter on the forest floor increases the risk of wildfire. These drier conditions can lead to decreases in plant and animal populations that need moist conditions to survive. Benefits of such conditions can mean lower populations of insects that carry pathogens, such as mosquitoes and ticks.

Economy

The economic impacts of drought can be substantial, and would primarily affect the agriculture, recreation and tourism, forestry, and energy sectors. Increased injury or die-back of forest trees could occur, especially if they are already stressed by insect infestations and other factors, such as we see occurring in Cheshire. This increases the devaluation of timber stands for private woodlot owners and for the state. Decreased values bring decreased stumpage fees to the Town when forest sites are logged.

Drier summers and intermittent droughts may strain irrigation water supplies, stress crops, and delay or force premature harvest which may result in higher demand than can be locally supplied. This can increase importation of produce and drive up the price of food, leading to economic stress on a broader portion of the economy. Cheshire has more farms than surrounding area – mainly livestock. Drier summers have been reported to have put a strain on water resources and heat for these farmers.

Future Conditions

Changes in winter temperatures will lead to less snowpack and more rain-on-snow events, leading to more surface runoff and less groundwater recharge, leading to less stream and river base flows. Higher temperatures in warmer seasons can more severely impact the reduced base flows due to higher rates of evaporation of moisture from soil and lower groundwater and surface water inputs. According to the state's Climate Change Adaptation Report, a continued high greenhouse-gas-emission scenario could result in a 75% increase in the occurrence of drought conditions lasting 1-3 months. Given Cheshire is 71% forested, the risk of wildfire during drought conditions is a concern. This is especially given the high number of hikers that travel through Cheshire along the Appalachian Trail.

Invasive Species and Forest Pests

Hazard Profile

The Town of Cheshire chose to examine the hazard of both plant and animal invasive species. Invasive species are a widespread problem in Massachusetts and throughout the country. The damage rendered by invasive species can be significant. The Massachusetts Invasive Plant Advisory Group (MIPAG) defines invasive plants as non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. MIPAG is a collaborative representing organizations and professionals concerned with the conservation of the Massachusetts landscape, is charged by EOEEA to provide recommendations to the Commonwealth to manage invasive species of plants. These species have biological traits that provide them with competitive advantages over native species, particularly because in a new habitat they are not restricted by the biological controls of their native habitat. As a result, these invasive species can monopolize natural communities, displacing many native species and causing widespread economic and environmental damage. Uncontrolled growth of invasive species can alter soils, increase erosion, and reduce habitat value for native wildlife. Early detection and rapid response are key components to successful invasive species control.

Likely Severity

The damage rendered by invasive species is significant. Experts estimate that about 3 million acres within the U.S. (an area twice the size of Delaware) are lost each year to invasive plants (from Mass.gov "Invasive Plant Facts"). The massive scope of this hazard means that the entire Commonwealth experiences impacts from these species. Furthermore, the ability of invasive species to travel far distances (either via natural mechanisms or accidental human interference) allows these species to propagate rapidly over a large geographic area, both on land and in aquatic systems. Areas with high amounts of plant or animal life may be at higher risk of exposure to invasive species than less vegetated urban areas; however, invasive species can disrupt ecosystems of all kinds (MEMA & EEA, 2018). Because plant and animal life are so abundant throughout Cheshire and the Berkshire region, the entire area is considered to be at high risk of invasive species infestation.

Probability

Increased rates of global trade and travel have created many new pathways for the dispersion of exotic species. As a result, the frequency with which these threats have been introduced has increased significantly. Increased international trade in ornamental plants is particularly concerning because many of the invasive plants species in the U.S. were originally imported as ornamentals, although Massachusetts has established prohibition on the propagation and sale of many invasive plant species. Invasive species can also be spread by animals, people, equipment, and machines as they travel through the region's landscape and waterways. Hikers, mountain bikers, ATVs and boaters can unwittingly spread invasive species if they travel from an infested area to a non-infested areas. As outdoor recreational tourism continues to increase in the Berkshires, this risk will also increase.

Several natural hazards increase the risk of invasive species spreading beyond their current ranges. Many invasive plant species are readily uprooted, transported and/or distributed to new areas during flood events. Plant fragments and seeds from semi-aquatic and aquatic plants such as Japanese knotweed, purple loosestrife, common reed, water chestnut, Eurasian water milfoil and curly leaf pondweed are spread in this fashion. Berries and seeds from terrestrial invasive plants are also distributed in this way, particularly if they are found along river corridors or floodplain areas. Wind, ice storms, or poor forestry that fragment or open up the tree canopy of forested landscapes can damage or stress the remaining trees and create the temporary conditions that allow invasive species to take hold and suppress regeneration of native trees.

The same windstorm that damaged the tree canopy may be the mechanism by which dispersal of invasive plant seeds arrive in the damaged forest. Wildfires in the Berkshires are typically surface fires, burning forest duff and damaging/killing seedlings and ground forbs. The die-back of plants on the forest floor temporarily could open the way for invasive understory species to take hold, such as honeysuckles species, buckthorn species, bittersweet and hardy kiwi vine. The risk of invasive infestation increases if the burned area is in close proximity to (and particularly downwind of) existing invasive species populations and seed sources. Risk is further increased if hikers and mountain bikers track seeds or plant fragments from the infested area prior to traveling through the burned site.

The risk of forest pests is dependent on their life cycle, their ability to disperse and the abundance of their preferred food source. The emerald ash borer is a very capable flyer, allowing it to move easily through the Berkshire landscape that is well endowed with ash tree species. The woolly adelgid spreads through wind, mammal and bird spread particularly from March through July making it a threat to connected hemlock landscapes.

Risk of invasive aquatic and riparian species infestation from one riverine, pond and lake ecosystem to another is largely due to human activity, although transport and distribution by birds and mammals is also possible. Plant fragments and seeds, and aquatic animals, easily travel from one water body to another via kayak, canoes, boats and equipment, including waders.

Geographic Areas Likely Impacted

All of Cheshire and the surrounding region is at risk of invasive species, including its lakes and ponds. Phragmites also known as common reed, is a tall wetland grass that has a negative impact on the environment. It is an invasive species that can grow in any moist area, such as along highways, city streets, and farmland ditches. Originally from Europe, this plant has taken over valuable habitats, reducing the diversity of wetland plants and wildlife. Its dense growth can impede water flow, causing increased flood risks and compromising the natural hydrology of wetland areas. The extensive root system of phragmites can alter soil characteristics and drainage patterns, exacerbating flooding in affected areas. [35]

Similarly, Japanese knotweed is another invasive species that pose a threat to native habitats, particularly along waterways. This plant can easily spread through its underground rhizomes and broken stem pieces, making it difficult to control. It can be found in a variety of environments, including vacant lots, yards, and other areas where it can gain a foothold. Both Phragmites and Japanese knotweed are major concerns for conservation efforts and the preservation of natural habitats.

[35] https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mtpmcar10187.pdf

The forests of Massachusetts can be divided into five main categories: Northern Hardwoods, Oak/Hickory, White and Red Pine, Mixed Oak/White Pine, and Elm/Ash/Red Maple. The most frequently encountered tree species are White Pine, Red Maple, Northern Red Oak, and Hemlock
Forest pests like the emerald ash borer, Asian longhorn better, hemlock woolly adelgid and the southern pine beetle are the most concerning and could cause widespread tree death and ecosystem disruption. Affected trees can become structurally compromised, making it more prone to breakage or uprooting during high winds, storms, or other extreme weather events. Falling trees can cause property damage, disrupt infrastructure, block roadways, and pose a risk to human safety. Roadside ash trees are rapidly being infected and dying, increasing risk of limbs or trees falling onto adjacent properties or into the road and oncoming traffic.

Riparian invasive plant species such as phragmites are found within the wetlands that dominate the landscape especially in the southern end of East Street.

Historic Data

Cheshire Reservoir is located on the western side of Route 8, is divided into three basins by causeways. The lake's shallow depth makes it prone to weed growth, and non-native aquatic plants disrupt the ecosystem by outcompeting native species. Submerged vegetation is abundant, leading to ongoing invasive species management for Eurasian milfoil, Curly leaf Pondweed, European Naiad, and Thin-leaf Pondweed. In 2016, boating and fishing were severely disrupted due to the rapid growth of "tape grass" caused by a mild winter, long spring, and hot summer (Image 3.27).[36] This disruption also hindered the Fire Department from extracting water from the lake to supply houses on Hutchinson Lane and Lanesboro Road. Currently, the Town relies on annual herbicide treatment to reduce weed overgrowth. Cheshire Reservoir is also considered at high risk for zebra mussels based on water chemistry, although no mussels have yet to be found.[37]

Figure 3.23 Weeds clog and tangle at the Cheshire boat launch and form a thick carpet along the shoreline even after 80 dump truckloads of dead and rotting tape grass were removed.

Over the last decade, gypsy moth and winter moth have caused the most canopy damage in Massachusetts forests, totaling over 1.78 million acres. Hemlock woolly adelgid and emerald ash borer are now being seen extensively across the state, and a 110-square-mile area of central Massachusetts is regulated for the Asian longhorned beetle (ALB). In the fight to eradicate this non-native beetle, over

[36] *Bush, Susan. 2016. "A Perfect Storm: Weeds Choke Hoosac Lake's Boat Launch." The Berkshire Eagle. https://www.berkshireeagle.com/archives/a-perfect-storm-weeds-choke-hoosac-lakes-boat-launch/article_facc873f-cc4e-5900-b526-783a443b9568.html (February 4, 2023).*

[37] *ENSR International. 2005. "RAPID RESPONSE PLAN FOR THE ZEBRA MUSSEL for Massachusetts." https://www.mass.gov/doc/zebra-mussel-3/download?_ga=2.132837385.623741312.1675531103-19745917.1665080230 (February 4, 2023).*

24,000 infested trees have been cut and chipped. Additionally, hundreds of acres of high-risk trees have been removed and destroyed to slow the spread of this invasive pest. (DCR, 2020)

Addressing the issue of propagating and selling of invasive plants within the landscaping nursery industry began in the 1990s. MIPAG conducted field research to determine the most invasive plant species in the region, and in 2005 published its first list of plants designated as invasive or likely to be invasive in Massachusetts. Out of this list emerged a list of plants for which importation and propagation is currently prohibited within the state of Massachusetts. The sale, trade, purchase, distribution and related activities for these species, including all cultivars, varieties and hybrids, are not allowed. The latest list, revised in 2017, includes 140 species. The full list can be viewed at this site: https://www.mass.gov/doc/prohibited-plant-list-sorted-by-common-name/download. Active links to details on each species are found on this site.

Forests damage from insect and other pests can be extensive, and many of these are invasive species from other continents or other regions of the U.S. According to the 2020 Massachusetts State Forest Action Plan, the annual tree canopy damage from insects and diseases in Massachusetts ranged from 23,563 acres in 2012 to 939,051 acres in 2017. The average annual area of canopy damage was 201,681 acres (about 6% of total forest area) between 2009 and 2018. The three primary agents of canopy damage in total over that period were gypsy moth (1,481,115 acres), winter moth (300,571 acres), and weather events such as snow, ice, wind, tornado, frost, or hail (75,244 acres). Table 3.28 summarizes the most serious infestations facing Western Massachusetts forests. At this time the most threatening forest pest is the Emerald Ash Borer, which officially detected in Cheshire in 2019 and is now found in all 32 communities in Berkshire County. The sheer number of dying and dead standing ash trees along roads and on developed properties is creating a public safety hazard. This is particularly true on major arteries through town, Route 8, Well’s Road, and Route 116.

Table 3.13. Current Invasive and Nuisance Insect Threats to Cheshire Forests

Insect	Origin	Host Trees	DCR-Management Approach
Gypsy Moth	Introduced	Oaks, other deciduous species	Discovered in 1869, current management relies on natural population controls: naturally abundant virus and fungus populations regulate gypsy moth population cycles.
Winter Moth	Introduced	Maples, oaks, other deciduous trees (fruit)	Identified in state in 2003, it was introduced to Canada in the 1930s; a biocontrol species has been released and successfully established to manage populations in eastern MA.
Hemlock Woolly Adelgid	Introduced	Eastern hemlock	Discovered in 1989, two biocontrol species have been released in MA to limited establishment success.
Southern Pine Beetle	Native	Pitch pine	Population densities monitored through annual trapping; the impacts of climate change could significantly alter generation periods and devastate pitch pine stands.
Emerald Ash Borer	Introduced	All ash species	Discovered in 2012, three biocontrol species, were successfully released in MA; continued releases are planned.
White Pine Needlecast	Native	Eastern white pines	Needlecast has been identified to be caused by multiple fungal pathogens; white pine defoliation is being monitored across the state.
Red Pine Scale	Introduced	Red pine	Control with insecticides has not been successful and natural enemies are ineffective in reducing the population.

Sources: https://www.mass.gov/service-details/current-forest-health-threats; MA State Forest Action Plan 2020.

Hemlock woolly adelgid was introduced into Massachusetts in 1988 and attacks both Carolina and eastern hemlocks. Closely resembling an aphid, the hemlock woolly adelgid is a tiny insect covered with a woolly mass and looks like small white cotton balls at the base of the needles. It inserts its piercing/sucking mouthpart at the base of hemlock needles and can severely weaken and kill the hemlocks it feeds on. The cold, fluctuating winter temperatures we experience in Massachusetts cause woolly adelgid mortality that reduces the persistent feeding pressure. (DCR, 2020)

With rising temperatures, survival rates of some insect pests will increase, allowing them to expand their range. Woolly adelgid has been expanding northward, having crossed into the Housatonic River Valley from Connecticut in the early 2000s. Hemlocks are one of the four most common trees in Massachusetts and one of the top forest harvest products. Pines and hemlocks combined sequester around 80 million tons of carbon. In the Berkshires, hemlocks are valuable because they survive along steep ravines and help hold soil in place. Streams within hemlock forests have a greater diversity of aquatic invertebrates to support fish as compared to those within hardwood forests. Native brook trout are three times more likely to be found in streams surrounded by hemlock, which provide cooler water temperatures and more stable flows.

Vulnerability Assessment

People

Invasive species rarely result in direct impacts on humans, but sensitive people may be vulnerable to specific species that may be present in the state in the future. These include people with compromised immune systems, children under the age of 5, people over the age of 65, and pregnant women. Those who rely on natural systems for their livelihood or mental and emotional well-being are more likely to experience negative repercussions from the expansion of invasive species.

Built Environment

Mature roadside trees provide natural and cultural benefits to the community, creating the rural New England landscape that defines the region. Trees help to hold roadside soils in place and can act as windbreaks. Accelerated die-back of roadside trees can occur due to invasive pests such as the woolly adelgid or emerald ash borer or stressed and pulled down by prolific invasive vines such as bittersweet. Damage and die-off of these trees present increased risk to homeowners who live in close proximity, to utility lines and to travelers who frequent the roads they are located on. Additionally, invasive insects like termites or wood-boring beetles can infest and damage wooden structures, causing significant financial losses and compromising building safety. Buildings are expected to be directly impacted by invasive species under circumstances similar to our roadways.

Roadways and roadside drainage areas are perhaps most acutely impacted by herbaceous invasives such as stilt grass and phragmites in wetland areas. Both species tend to grow in thick mats and through compacted soil, a particular problem for town roads which are almost all gravel. Maintenance to roadside ditches to remove invasives is required to allow for runoff transportation.

Facilities that rely on native species, biodiversity or the health of surrounding ecosystems, such as outdoor recreation areas, public or botanical gardens or agricultural/forestry operations, are more vulnerable to impacts from invasive species.

Natural Environment

Invasive species can reduce the resilience of ecosystems to future hazards by placing a constant stress on the system (MEMA & EOEEA, 2018). A 1998 study found that competition or predation by alien species is the second most significant threat to biodiversity, only surpassed by direct habitat destruction or degradation (Wilcove et al., 1998). An analysis of threats to endangered and threatened species in the U.S. indicates that invasive species are implicated in the decline of 42% of the endangered and threatened species. In 18% of the cases, invasive species were listed as the primary cause of the species being threatened, whereas in 24% of the cases they were identified as a contributing factor (Somers, 2016). This indicates that invasive species present a significant threat to the environment and natural resources in the Commonwealth.

Cheshire is a hotspot of wildlife habitat and conservation importance. Cheshire is located, almost entirely, in the Hoosic River Watershed, and is moreover found at the headwaters of this river. The town contains several local and state conservation areas, such as Mount Greylock, Cheshire Reservoir, Hoosic River, Stafford Hill, and the Cobbles of North Mountain and the Chalet Forest Reserve. These areas provide essential habitats for various species, including the endangered monarch butterfly and northern long-eared bat. Cheshire's conservation areas also serve as crucial resting and foraging grounds for important migratory birds, including the Bald Eagle. These birds rely on the town's habitats during their long-distance journeys, making Cheshire a significant stopover point. They provide not only sanctuary for a diverse range of wildlife but also opportunities for outdoor recreation, including hiking and birdwatching.

Economy

Invasive species are widely considered to be one of the costliest natural hazards in the U.S. A widely cited paper found that invasive species cost the U.S. more than $120 billion in damages every year. One study found that in one year alone, Massachusetts agencies spent more than $500,000 on the control of invasive aquatic species through direct efforts and cost-share assistance. This figure does not include the extensive control efforts undertaken by municipalities, nonprofits, and private landowners, lost revenue due to decreased recreational opportunities, or decreases in property value due to infestations. Individuals who are particularly vulnerable to the economic impacts of this hazard would include all groups who depend on existing ecosystems in the Commonwealth for their economic success (MEMA & EOEEA, 2018).

Forest-based employment in the recreation and tourism sector is quite broad, including not just the outfitters, guides, and sporting goods vendors, but also the full suite of support services, such as dining and lodging. These services facilitate and promote the enjoyment of the greater experience of engaging in forest-based recreation. Fall foliage viewing, camping, hiking, and snowmobiling are examples of exceedingly popular activities that hinge upon the greater forested landscape, but also require a host of support services to make them successful. Other noteworthy forest-based recreational activities include cross-country skiing, mountain biking, wildlife tracking, and birdwatching. A 2015 report estimated that about 9,000 people are employed in the diverse industries that support this sector, with a total annual payroll equivalent of $293 million.[38] Another report in 2020 estimated that forest related recreation was a $2.2 billion industry in Massachusetts.[39] This includes all individuals working in outdoor recreation activities and tourism based on maintaining a natural landscape. This is especially important in Berkshire County, where the scenic beauty and outdoor recreational opportunities complement the region's international status as a cultural destination.

Future Conditions

Invasive species can trigger a wide-ranging cascade of lost ecosystem services. Additionally, they can reduce the resilience of ecosystems to future hazards by placing a constant stress on the system. Temperature, concentration of CO_2 in the atmosphere, frequency and intensity of hazardous events, atmospheric concentration of CO_2, and available nutrients are key factors in determining species survival. It is likely that climate change will alter all these variables. As a result, climate change is likely to stress native ecosystems and increase the chances of a successful invasion. Additionally, some research suggests that elevated atmospheric CO_2 concentrations could reduce the ability of ecosystems to recover after a major disturbance, such as a flood or fire event. As a result, invasive species—which are often able to establish more rapidly following a disturbance—could have an increased probability of successful establishment or expansion. Other climate change impacts that could increase the severity of the invasive species hazard include the following (as cited in MEMA & EOEEA, 2018):

- Elevated atmospheric CO_2 levels could increase some organisms' photosynthetic rates, improving the competitive advantage of those species.
- Changes in atmospheric conditions could decrease the transpiration rates of some plants, increasing the amount of moisture in the underlying soil. Species that could most effectively capitalize on this increase in available water would become more competitive.

[38] *EOEEA, DCR, Bureau of Forest Fire Control & Forestry, 2020.*
[39] *DCR, Massachusetts Forest Action Plan, 2020.*

- Fossil fuel combustion can result in widespread nitrogen deposition, which tends to favor fast-growing plant species. In some regions, these species are primarily invasive, so continued use of fossil fuels could make conditions more favorable for these species.
- As the growing season shifts to earlier in the year, several invasive species (including garlic mustard, barberry, buckthorn, and honeysuckle) have proven more able to capitalize by beginning to flower earlier, which allows them to outcompete later-blooming plants for available resources. Species whose flowering times do not respond to elevated temperatures have decreased in abundance. As temperature increases, the length of the growing season will also increase. Since the 1960s, the growing season in Massachusetts increased by approximately 10 days (CAT, n.d. as cited in MEMA & EOEEA, 2018).
- Some research has found that forests pests (which tend to be ectotherms, drawing their body heat from environmental sources) will flourish under warming temperatures. As a result, the population sizes of defoliating insects and bark beetles are likely to increase.
- Warmer winter temperatures also mean that fewer pests will be killed off over the winter season, allowing populations to grow beyond previous limits.
- There are many environmental changes possible in the aquatic environment that can impact the introduction, spread, and establishment of aquatic species, including increased water temperature, decreased oxygen concentration, and change in pH. For example, increases in winter water temperatures could facilitate year-round establishment of species that currently cannot overwinter in New England (Sorte, 2014 as cited in MEMA & EOEEA, 2018).

Change in Average Temperatures / Extreme Temperatures

Hazard Profile

Temperature is a fundamental measurement of describing climate, which is the prevailing weather patterns in a given area. Climate determines the types of plant and animal species that can survive in a region, and changes in climate will have significant impacts on the landscape because most species will not have the time to evolve and adapt over multiple generations to the new climate[40]. Data from several scientific sources indicate that 2011-2020 was the warmest decade recorded,[41] and this increase drives our weather patterns. The ocean's waters act as a "heat sink," and those warmer waters influence air temperatures and spawn a greater number and increased intensity of storms. In the Northeast we will generally see more frequent and more intense precipitation, heat waves, longer fall and spring, and warmer winters with heavier snow.

Likely severity

Relative to the rest of the Commonwealth, the Town of Cheshire is somewhat protected from extreme heat by the Town's higher elevation and heavy forest cover. Roads and homes tend to be located along the lower elevations in Town, around the 1,400-1,700 foot elevation, although elevations change dramatically within short distances. The environment and people have adapted to cooler conditions; however, extremes in hot and cold still can and will occur, particularly in the changing climate. Homes here have traditionally been built with heating systems and some level of insulation to keep in warmth, but few were built with central air conditioning systems.

NOAA utilizes data to determine average temperature using land-based weather station measurements and by satellite measurements that cover the lowest level of the Earth's atmosphere. In moderate climate like in the Berkshires, the most severe impacts of the change in average temperature will be on our environmental composition, as well as on our vulnerable populations, particularly the elderly, people with underlying health conditions and low-income residents.

A heat wave is defined as three or more days of temperatures of 90°F or above. A basic definition of a heat wave implies that it is an extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle and which may have adverse health consequences for the affected population (MEMA & EOEEA, 2018).

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature Index. Wind Chill is the temperature that people and animals feel when they are outside, and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body loses heat at a faster rate, causing the skin's temperature to drop.

[40] *https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-temperature*
[41] *https://climate.copernicus.eu/2020-warmest-year-record-europe-globally-2020-ties-2016-warmest-year-recorded#:~:text=The%20Copernicus%20Climate%20Change%20Service%20(C3S)%20today%20reveals%20that%20globally,2020%20the%20warmest%20decade%20recorded*

Probability

According to extensive scientific study, the global changes in climate will lead to temperature shifts as weather patterns are altered. In general air temperatures are increasing across the globe, with relatively higher increases in the Northeast than in most other portions of the U.S. The Massachusetts Climate Change Clearinghouse (resilient MA) is a gateway to data and information relevant to climate change adaptation and mitigation across the state. It provides the most up-to-date climate change science and decision support tools to support scientifically sound and cost-effective decision making for policy-makers, practitioners, and the public. As part of this effort, the clearinghouse is linked to the Department of Interior's Northeast Climate Adaptation Science Center (NE CASC), which is hosted by the University of Massachusetts, Amherst. NE CASC is part of a federal network of eight Climate Adaptation Science Centers created to work with natural and cultural resource managers to gather the scientific information and build the tools needed to help fish, wildlife, and ecosystems adapt to the impacts of climate change.

NE CASC is the main source used in this hazard mitigation plan to understand observed and projected changes in temperatures. Climate change projections for Massachusetts are based on simulations from the latest generation of climate models included in the Coupled Model Intercomparison Project Phase 5 (CMIP5). As part of this work, the state created projections on county- and major watershed-level information, derived by statistically downscaling CMIP5 model results using the Local Constructed Analogs (LOCA) method[42]. As noted in the CMIP5 models, the state-wide temperatures are expected to rise and cause these projections for the mid-21st century (2050s), as relative to the observed 1971-2000 baseline average. The details for projections for mid-century and 2090s are outlined in Table 3.30.

Cooling degree days (CDD) are a measure of how much and for how long outside air temperature was higher than a specific base temperature. CDDs are the difference between the average daily temperature and 65°F, which has been determined to be a temperature that does not typically call for use of indoor cooling systems. For example, if the temperature mean is 90°F, subtract 65 from the mean and the result is 25 CCDs for that day. Similarly, heating degree days are those where the temperature is lower than 65°F. If the temperature is 30°F, subtract the mean from 65 and the result is 30 HDD for that day.

Table 3.14. Projected Statewide Temperature Changes from Observed 1971-2000 to Projected 2050s and 2090s

Variable	Observed value 1971 - 2000 average	Change by 2050s	Change by 2090s
Annual average temperature	47.5°F	Increase by 2.8 - 6.2°F	Increase by 3.8 - 10.8°F
Number of days per year with daily Total max > 90°F	5 days	Increase by 7 - 26 days	Increase by 10 - 63 days
Number of days per year with daily Total min < 32°F	146 days	Decrease by 19 - 40 days	Decrease by 24 - 64 days
Heating degree-days per year (HDD)	6839 Degree-Day °F	Decrease by 773 - 1627	Decrease by 1033 - 2533
Cooling degree-days per year (CDD)	457 Degree-Day °F	Increase by 261 - 689	Increase by 356 - 1417

Source: https://resilientma.org/datagrapher/?c=Temp/state/maxt/ANN/MA/

[42] NE CASC, 2021, Massachusetts Climate Change Projections found at https://necasc.umass.edu/projects/massachusetts-climate-change-projections

Geographic Areas Likely Impacted

All of Cheshire is exposed to the impacts of increased annual and extreme temperatures. The Town's gravel roads are impacted more severely during the increased freeze/thaw cycles that are occurring during the winter season. Hoosic River flows through the center of the Town is located within the Hoosic Watershed, which is part of the greater Hudson River Watershed. Temperature data from the Hudson River Watershed data will be used in this analysis.

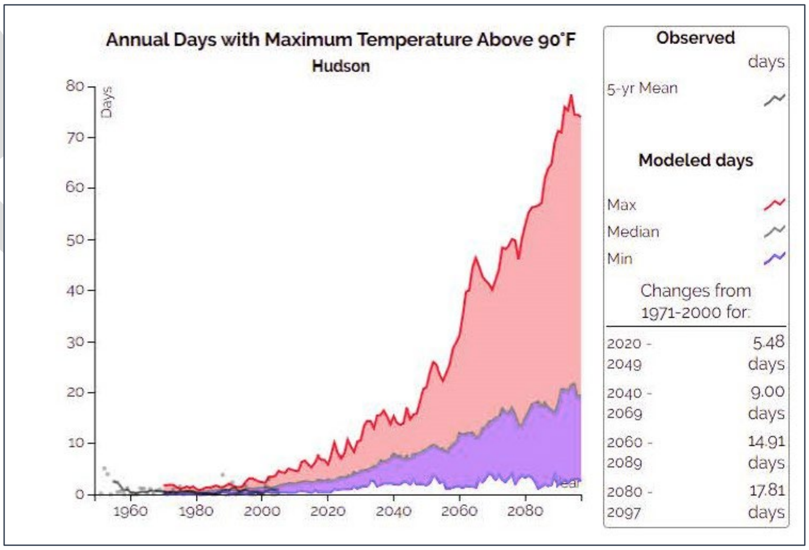
Historic Data

According to according to scientists from NOAA's National Centers for Environmental Information (NCEI), the last seven years prior to 2020 were the hottest years on record, as ranked by their departure from the 20th century average temperature. Projections by NOAA and other scientific organizations across the globe expect the trend to continue upwards, with the magnitude of the change depending on the amount of greenhouse gas levels in the atmosphere. In general, the highest temperatures in the Berkshires occur in July, and the lowest tend to occur in January.

The following are some of the highest temperatures recorded for the period from 1895 to 2017, showing as comparison Boston and three Berkshire County locations (National Climatic Data Center, 2017.)

- Boston, MA 102°F
- Great Barrington, MA 99°F
- Adams, MA 95°F
- Pittsfield, MA 95°F

Figure 3.24. Observed and Projected Extreme Temperatures for Hudson River Watershed



Source: NE CASC, 2017.

Historically, Cheshire has little experience with days when the air temperature exceeds 90°F, but that will soon change as we see an increase in the number of days with dangerous levels of heat. As seen in Figure 3.24, during the years 1960-2000, there were few if any days where the temperature was above 90°F in the Hudson River Watershed.

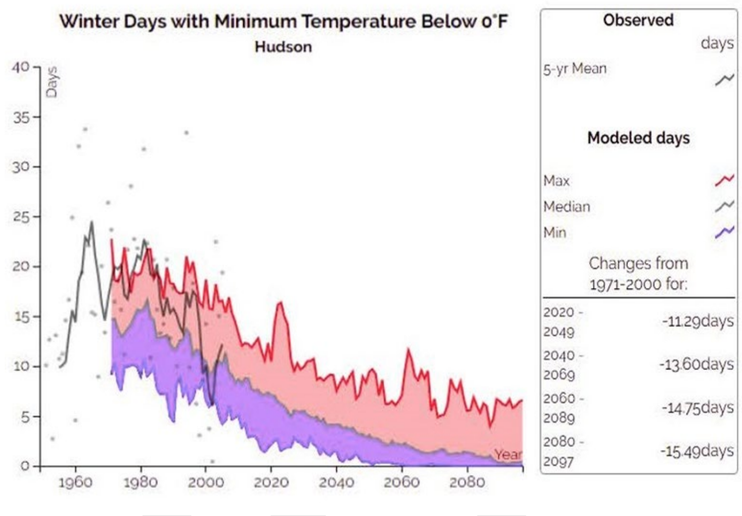
During the baseline years 1971-2000 there was an average of 1.3 days per summer when the temperature exceeded 90°F in the Hudson River Watershed in Massachusetts.[43] The

[43] *MA Climate Change Projections by Basin report, 2017.*

CMIP5 model offered by the NE CASC projects that the median number of days per year when the air temperature exceeds 90°F will increase to nine per year by mid-century and to 18 by the 2090s. Under a high-greenhouse gas emissions scenario, the maximum number of days when the air temperature exceed 90°F could reach 26 days per year by mid-century and 74 days per year by the 2090s .[44]

Just as the summers in the Berkshires tend to be cooler than in other parts of the state, the winters also exhibit a distinct coolness.

Figure 3.25. Observed and Projected Extreme Temperatures for Hudson River Watershed



Source: NE CASC, 2017.

The slightly higher elevations of the Berkshire hills, including the Mount Greylock complex, contribute to the overall cooler temperatures experienced in Cheshire. However, the town's lower elevation, coupled with its proximity to the Hoosic River, influences a milder winter climate compared to higher elevation regions. The following are some of the lowest temperatures recorded in the Berkshire region for the period from 1895 to 2017.[45]

- Lanesborough, MA –28°F
- Great Barrington, MA –27°F
- Stockbridge, MA –24°F
- Pittsfield, MA -19°F

In the same manner that climate change will increase summer high temperatures, so too will it increase the lower winter temperatures. As illustrated in Figure 3.25, the number of observed winter days when the temperature dipped below 0°F has historically been unpredictable during the years 1960-2000. The 5-year mean trend line shows that there was quite a range where temperatures fell below 0°F, with as few as 9 days in 1999 and 13 days in 1969 and a high of 15 days in 1965. The baseline years of 1971-2000 averaged 17 days in the winter where the temperature fell below 0°F. By mid-century the median number of days where temperatures will fall below 0°F will decrease by 14 days, meaning there will only be 3 days of below 0 temperatures. By 2090 there will less than one (0.39 days) where the temperature will fall that low.[46] This will bring some relief and reduce risk to people and buildings from extreme low temperatures.

As described earlier in the Flood Risk Section of the plan, this change has implications for snow and ice management, with snows being heavier, snow melts more often and ice formation more often.

[44] *NE CASC, 2017. https://resilientma.org/datagrapher/?c=Temp/basin/tx90/JJA/Hudson/*
[45] National Climatic Data Center, 2017.
[46] *NE CASC, 2017, https://resilientma.org/datagrapher/?c=Temp/basin/tn0/DJF/Hudson/*

Vulnerability Assessment

People

All residents in the Town of Cheshire are vulnerable to the health effects of extreme temperatures, with those who work outside directly at a greater risk. According to the Centers for Disease Control and Prevention, populations most at risk to extreme heat and cold events include the following: (1) people over the age of 65, who are less able to withstand or regulate temperatures extremes due to their age, health conditions, and limited mobility to access shelters; (2) infants and children under 5 years of age; (3) individuals with pre-existing medical conditions that impair heat tolerance (e.g., heart disease or kidney disease); (4) low-income individuals who cannot afford proper heating and cooling; (5) people with respiratory conditions, such as asthma or chronic obstructive pulmonary disease; and (6) the general public who may overexert themselves when working or exercising during extreme heat events or who may experience hypothermia during extreme cold events. Berkshire County has a higher level of asthma-related emergency room visits than other parts of the state. Additionally, people who live alone—particularly the elderly and individuals with disabilities—are at higher risk of heat-related illness due to their isolation and reluctance to relocate to cooler environments.

Figure 3.26. Heat Index Chart and Human Health Impacts

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.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Source: EOEEA & MEMA, 2013.

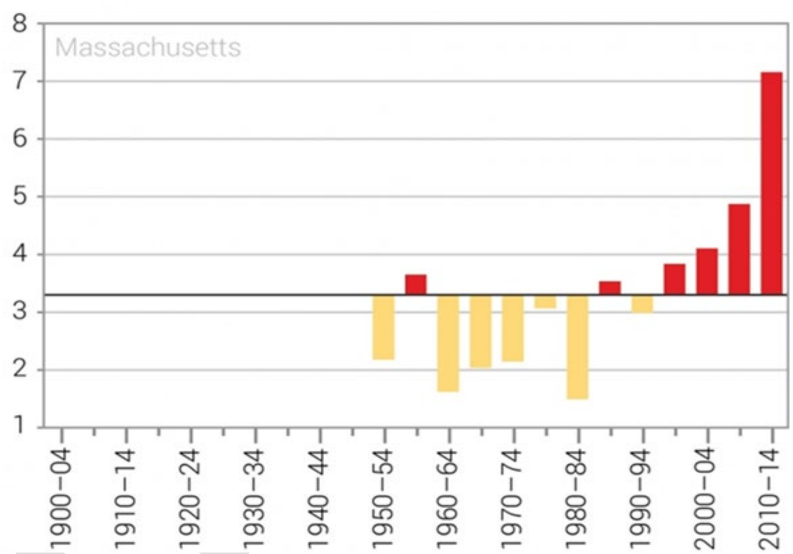
The National Weather Service (NWS) issues a Heat Advisory when the Heat Index is forecast to reach 100°-104°F for two or more hours. The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105°F or more for two or more hours. The NWS Heat Index is based both on temperature and relative humidity and describes a temperature equivalent to what a person would feel at a baseline humidity level. It is scaled to the ability of a person to lose heat to their environment. It is important to know that the heat index values are devised for shady, light wind conditions. Exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can increase the risk of heat-related impacts.

When people are exposed to extreme heat, they can suffer from potentially deadly illnesses, such as heat exhaustion and heat stroke. Heat is the leading weather-related killer in the U.S., even though most heat-related deaths are preventable through outreach and intervention (EPA, 2016). A study of heat-related deaths across Massachusetts estimated that when the temperature rises above the 85th percentile (hot: 85-86°F), 90th percentile (very hot: 87-89°F) and 95th percentile (extremely hot: 89-92°F) there are between five and seven excess deaths per day in Massachusetts. It should be noted that temperature alone does not define the stress that heat can have on the human body – humidity plays a powerful role in human health impacts, particularly for those with pre-existing pulmonary or cardio-vascular conditions.

Locally, a significant increase in heat-related deaths has not been reported in Berkshire County. When interviewed in 2016 about projected climate change impacts, local ambulance crews reported no increase in heat-related calls in recent years (BRPC & BCBOHA, 2016). However, many Berkshire communities since that time have begun to develop protocols for opening cooling centers.

What may be more concerning is the trend for higher nighttime temperatures. Warm nights are those where the minimum temperature stays above 70°F. As can be seen in Figure 3.27, the number of nights where the temperature did not dip below 70°F has increased from a median of slightly more than three in the years 1950 – 1990, to greater than seven in the 2010s. Historically the cooler evening temperatures in the Berkshires has allowed residents to cool their body temperatures in the night air and to cool their homes by opening windows and using fans to bring in the cooler air. Human bodies need time to cool off, which typically occurs during sleep when core body temperature naturally dips. Without relief during the night the physiological strain on the body continues unabated.

Figure 3.27. Number of Nights When Temperatures Remain 70°F or Higher



https://statesummaries.ncics.org/ma

When it is both too hot and too humid for sweat to do its job of dissipating body heat, there can be fatal consequences like organ failure. Warmer and more humid nighttime temperatures will make it increasingly difficult to bring down the temperature in homes that are not equipped with air conditioning.

In the Berkshires, extreme cold temperatures are those that are well below zero for a sustained period of time, causing distress for vulnerable populations that are exposed to the temperatures when outside and straining home heating systems. The severity of extreme cold temperatures is generally measured through the Wind Chill Temperature Index (see Figure 3.28). Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop (MEMA, 2013)

The NWS issues a Wind Chill Advisory if the Wind Chill Index is forecast to dip to –15°F to –24°F for at least three hours, using only the sustained winds (not gusts). The NWS issues a Wind Chill Warning if the

Wind Chill Index is forecast to fall to –25°F or colder for at least three hours using only the sustained wind. In 2001 the NWS implemented a Wind Chill Temperature Index to more accurately calculate how cold air feels on human skin and to predict the threat of frostbite. According to the calculations, people can get frostbite in as little as 10 minutes when the temperature is -10°F degrees and winds are 15 miles per hour. (MEMA, 2013). To date Cheshire has not established a protocol for cooling centers. The current emergency center (which is also the Fire Station) is open during extreme weather events including severe cold. The Town would like to complete a public safety complex with emergency shelter for Cooling and Warming Center. See actions table in Chapter 4.

Figure 3.28. Wind Chill Temperature Index and Frostbite Risk

Wind (mph)	Temperature (°F)																	
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

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

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

Effective 11/01/01

Source: EOEEA & MEMA, 2013.

Built Environment

All elements of the built environment are exposed to the extreme temperature hazards. The impacts of extreme heat on buildings include: increased thermal stresses on building materials, which leads to greater wear and tear and reduces a building's useful lifespan; increased air-conditioning demand to maintain a comfortable temperature; overheated heating, ventilation, and air-conditioning systems; and disruptions in service associated with power outages (resilient MA, 2018).

Warmer annual winter temperatures are less consistent than in the past. Warm "false spring" periods have become more common. This results in more freeze/thaw events that begin earlier in late winter/early spring. In other words, the infamous New England "mud season" starts earlier and has more thaw events. The shifting seasons are already driving up costs to maintain dirt roads and ensure safe passage for vehicles.

The shifting and warming winter temperatures are a major concern that has cost implications to the Town of Cheshire and safety concerns for residents. Extreme cold temperature events can damage buildings through freezing or bursting pipes and freeze and thaw cycles. Additionally, manufactured buildings (trailers and mobile homes) and antiquated or poorly constructed facilities may not be able to withstand extreme temperatures. The heavy snowfall and ice storms associated with extreme cold temperature events can also cause power interruptions. Backup power is recommended for critical facilities and infrastructure. Extreme cold can cause materials such as plastic to become less pliable, increasing the potential for these materials to break down during extreme cold events (resilient MA, 2018). In addition to the facility-specific impacts, extreme temperatures can impact critical infrastructure sectors of the built environment in a number of ways, which are summarized in the subsections that follow.

The Berkshires are currently a moderately temperate climate, but an increase in summer temperatures will create higher peak summer electricity demands for cooling, particularly with an increase in the number of air conditioning units being installed. In the summer, the number of Cooling Degree Days (CDD)[47] was 189 in the Hudson River Watershed of Massachusetts for the baseline years of 1971-2000. The summer CDD rate is expected to increase by 94-237% (additional 177-448 degree-days) by mid-century, and by 126-469% (additional 238-886 degree-days) by end of century.[48] Historically CDD demand has been concentrated in the summer months, but as the climate warms, need for air conditioning can be expected to expand outward into the shoulder months of spring and autumn.

Extreme heat has potential impacts on the design and operation of the transportation system. Impacts on the design include the instability of materials, particularly pavement, exposed to high temperatures over longer periods of time, which can cause buckling and lead to increased failures. High heat can cause pavement to soften and expand, creating ruts, potholes, and jarring, and placing additional stress on bridge joints. Extreme heat may cause heat stress in materials such as asphalt and increase the frequency of repairs and replacements (resilient MA, 2018).

Natural Environment

There are numerous ways in which changing temperatures will impact the natural environment. Because the species that exist in a given area have adapted to survive within a specific temperature range, extreme temperature events can place significant stress both on individual species and the ecosystems in which they function. Warming temperatures may cause a decline in forest health (e.g., biodiversity, biomass, resiliency) along with loss of carbon sequestration and other ecosystem services with impacts varying by forest type. High-elevation spruce-fir forests, forested boreal swamp, and higher-elevation northern hardwoods are likely to be highly vulnerable to climate change (MCCS and DFW, 2010 in the MEMA & EOEEA, 2018). Changing climatic conditions shift suitable habitat for native species (flora and fauna), increase the risk of new species introductions, and increases competition from established invaders, potentially causing losses in native biodiversity and loss of culturally important species.

Rising temperature and changing precipitation patterns will lead to a reduction in ambient water quality and changes in water quantity, resulting in changes to habitat quality in rivers, streams, ponds, lakes and freshwater wetlands (EOEEA, 20222). Higher summer temperatures will disrupt wetland hydrology. Paired with a higher incidence and severity of droughts, high temperatures and evapotranspiration rates could lead to habitat loss and wetlands drying out (MCCS and DFW, 2010 in the MEMA & EOEEA, 2018).

Individual extreme weather events usually have a limited long-term impact on natural systems, although unusual frost events occurring after plants begin to bloom in the spring can cause significant damage.

[47] Cooling degree days (CDD) are a measurement used to estimate the amount of energy required to cool a building or space during warmer weather is used primarily in the field of energy consumption analysis, particularly in relation to air conditioning systems and energy planning.
[48] *MA Climate Change Projections, NE CASC, 2017.*

However, the impact on natural resources of changing average temperatures and the changing frequency of extreme climate events is likely to be massive and widespread.

Economy

The agricultural industry is particularly vulnerable to the economic impacts and damage caused by extreme temperatures and drought events. These climatic changes pose risks to crops like apples, cranberries, and maple syrup, which depend on specific temperature conditions (Resilient MA, 2018). Unseasonably warm temperatures in early spring that are followed by freezing temperatures can result in crop loss of fruit-bearing trees. Farmers may have the opportunity to introduce new crops that are viable under warmer conditions and longer growing seasons; however, a transition such as this may be costly (resilient MA, 2018 as cited in MEMA & EOEEA, 2018). Most agricultural acreage in Cheshire is in the eastern portion of town, although there are smaller clusters of agricultural land on West Mountain Rd., Outlook Avenue, Route 8, as well as Ingalls and Brough Roads.[49] The agricultural sector encompasses over 2,100 acres of land, representing 12.4% of the Town's total land use. This level of land allocation underscores the significant role agriculture plays as a core component of the town's economic sector.

Livestock are also impacted, as heat stress can make animals more vulnerable to disease, reduce their fertility, and decrease the rate of milk production. Additionally, scientists believe the use of parasiticides and other animal treatments may increase as the threat of invasive species grows. Increased use of these treatments increases the risk of pesticides entering the food chain and could result in pesticide resistance, which could result in additional economic impacts on the agricultural industry (MEMA & EOEEA, 2018).

Future Conditions

According to NOAA, global temperature data document a warming trend since the mid-1970s. Temperature changes are predicted to be gradual over the years. However, for the extremes, meteorologists can accurately forecast event development and the severity of the associated conditions with several days lead time. High, low, and average temperatures in Massachusetts are all likely to increase significantly over the next century because of climate change. Increased electricity demand for CDDs throughout the northeast could stress the New England electricity grid system and lead to brownouts or controlled blackouts, stressing or injuring the health of vulnerable populations and possibly impairing functions of government and communications systems.

For the Town of Cheshire, there will be a need to identify and maintain communications with vulnerable populations such as the elderly, people with underlying health problems, and low-income residents whose homes do not have cooling systems adequate to bring down indoor temperatures. As warming temperatures become more common, the need for a cooling shelter may be necessary as a part of the emergency response strategy for the Town. This cooling strategy will be increasingly important as residents age and retire in the community.

Climate change is anticipated to be the second-greatest contributor to this biodiversity crisis, which is predicted to change global land use. One significant impact of increasing temperatures may be the northern migration of plants and animals. Over time, shifting habitat may result in a geographic

[49] Town of Cheshire Master Plan 2017

mismatch between the location of conservation land and the location of critical habitats and species the conserved land was designed to protect. Between 1999 and 2018 (fiscal years), the Commonwealth spent more than $395 million on the acquisition of more than 143,033 acres of land and has managed this land under the assumption of a stable climate. As species respond to climate change, they will likely continue to shift their ranges or change their phenologies to track optimal conditions (MCCS and DFW, 2010 in the MEMA & EOEEA, 2018). As a result, climate change will have significant impacts on traditional methods of wildlife and habitat management, including land conservation and mitigation of non-climate stressors (MCCS and DFW, 2010 in the MEMA & EOEEA, 2018).

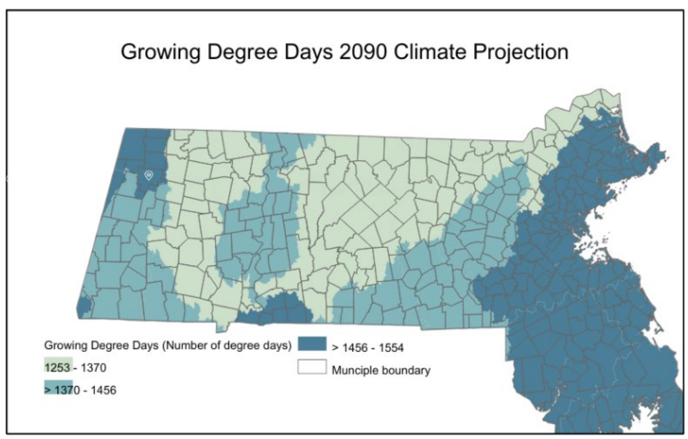
Changing temperatures, particularly increasing temperatures, will also have a major impact on the sustainability of our waterways and the connectivity of aquatic habitats (i.e., entire portions of major rivers will dry up, limiting fish passage down the rivers). Warming temperatures can deplete lakes and ponds of oxygen and create more favorable conditions for harmful algal blooms. Cold water fisheries that support cold-adapted species like brook trout are particularly sensitive to changes in in-stream temperatures.

Additional impacts of warming temperatures include the increased survival and grazing damage of white-tailed deer, increased invasion rates of invasive plants, and increased survival and productivity of insect pests, which cause damage to forests (MCCS and DFW, 2010 in the MEMA & EOEEA, 2018).

Warming temperatures in the Northeast will have various impacts on agriculture. Changes in plant hardiness zones and the viability of crops will occur, opening up opportunities for new crops. However, longer growing seasons and warmer winters will lead to intensified weed and pest pressure, posing a challenge for farmers. Early spring blooms followed by frost can also cause significant damage to crops like apples and peaches. This occurred most recently across Berkshire County in spring 2023. Furthermore, extreme heat, dry conditions, and drought can negatively affect crop production and harvest, as well as cause heat-related stress in livestock and reduce milk yield from dairy cattle.

As temperatures rise, the growing season is expected to expand, as depicted in Figure 3.27. This expansion is measured by Growing Degree Days (GDD).[50] In Cheshire, GDD is expected to increase by approximately 180-200% from 2030 to 2090. While a longer growing season offers potential benefits, it also creates conditions for increased fungal and bacterial activity. This heightened activity can impact crop health and raise the risk of plant diseases.

Figure 3.29. GDD Projections (MA Resilient Adapted for National Weather Service)



[50] *Growing Degree Days (GDD) is a measure used in agriculture to estimate the amount of heat available for plant growth during the growing season. It takes into account the average daily temperature above a certain base temperature threshold. GDD provides an indication of how favorable the climate is for plant growth and development.*

Climate change is also likely to result in a shift in the timing and durations of various seasons. This change will likely have repercussions on the life cycles of both flora and fauna within the Commonwealth. While there could be economic benefits from a lengthened growing season, a lengthened season also carries a number of risks. The probability of frost damage will increase, as the earlier arrival of warm temperatures may cause many trees and flowers to blossom prematurely only to experience a subsequent frost. Additionally, pests and diseases may also have a greater impact in a drier world, as they will begin feeding and breeding earlier in the year (Land Trust Alliance, n.d. as cited in MEMA & EOEEA, 2018).

The longer growing season and increased allergens and pollen associated with rising temperatures can have significant impacts on vulnerable populations, particularly those with existing respiratory issues. The extended period of plant growth and higher pollen levels can result in compromised air quality, triggering or exacerbating respiratory symptoms such as asthma attacks, allergic reactions, and other respiratory disorders. These effects are especially concerning for vulnerable individuals, including the elderly, children, and those with pre-existing respiratory conditions.

Wildfires

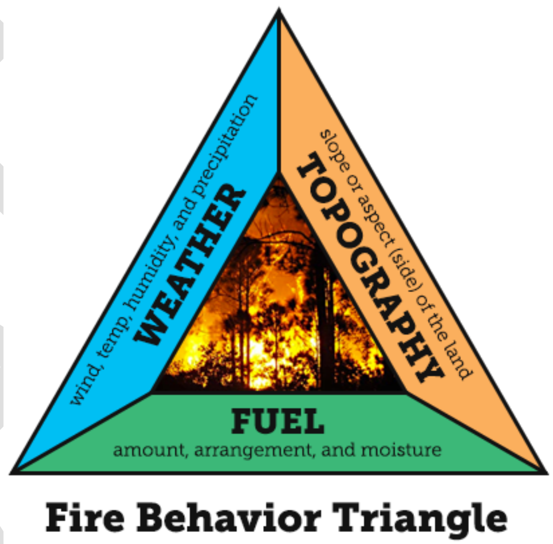
Hazard Profile

A wildfire can be defined as any non-structure fire that occurs in vegetative wildland that contains grass, shrub, leaf litter, and forested tree fuels. Wildfires in Massachusetts are caused by natural events, human activity, or prescribed fire. Wildfires often begin unnoticed but spread quickly, igniting brush, trees, and potentially homes (MEMA & EOEEA, 2018).

Likely severity

Given that Cheshire is 71% forested, and that its neighboring communities are also heavily forested, the risk of wildfire is definitely present. The "wildfire behavior triangle" reflects how three primary factors influence wildfire behavior: fuel, topography, and weather. Each point of the triangle represents one of the three factors, and arrows along the sides represent the interplay between the factors. For example, drier and warmer weather with low relative humidity combined with dense fuel loads and steeper slopes can result in dangerous to extreme fire behavior. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.

Image 3.30. Fire Behavior Triangle



Source: WeatherSTEM

Fuel

- Lighter fuels such as grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs, and trunks take longer to warm and ignite.
- Snags and hazard trees, especially those that are diseased or dying, become receptive to ignition when influenced by environmental factors such as drought, low humidity, and warm temperatures.

Weather

- Strong winds, especially wind events that persist for long periods or ones with significant sustained wind speeds, can exacerbate extreme fire conditions or accelerate the spread of wildfire.
- Dry spring and summer conditions, or drought at any point of the year, increases fire risk. Similarly, the passage of a dry, cold front through the region can result in sudden wind speed increases and changes in wind direction.
- Thunderstorms in Massachusetts are usually accompanied by rainfall; however, 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.

Terrain

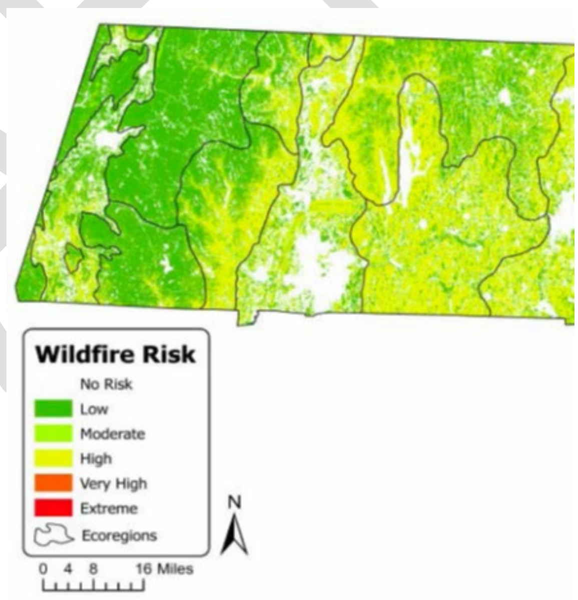
- Topography of a region or a local area influences the amount and moisture of fuel.
- Barriers such as highways and lakes can affect the spread of fire.
- Elevation and slope of landforms can influence fire behavior because fire spreads more easily uphill compared to downhill.

Probability

It is difficult to predict the likelihood of wildfires in a probabilistic manner because several factors affect fire potential and because some conditions (e.g., ongoing land use development patterns, location, and fuel sources) exert changing pressure on the wildland-urban interface zone. There is at least one notable wildfire that erupts in the Commonwealth each year. However, based on the frequency of past occurrences in the region, the probably of Chesire being impacted is low to moderate, with the central valley portion of Town being more moderate. In general Cheshire spans across the Western New England Marble Valleys and the Green Mountains/Berkshire Highlands ecoregions.

According to the 2020 Massachusetts State Forest Action Plan, there are relatively few natural forest fires in the state because lightning is almost always accompanied by rain. Fires occur primarily as a result of human activity; thus, the risk of forest fire increases in forest areas that are close to development and/or open to public use. A working group led by the U.S. Forest Service developed the Northeast Wildfire Risk Assessment model that considered three components: 1) fuels, 2) wildland-urban interface, and 3) topography (slope and aspect). These three characteristics are combined to identify wildfire prone areas where hazard mitigation practices would be most effective. As seen in Figure 3.32, Cheshire has been assessed to have Low Wildfire Risk. High and very high-risk areas have fire prone forest types (pitch pine-scrub oak and oak) and significant forest-human interaction, and large expanses of these areas are found in the eastern portion of the state. .

Figure 3.32. Wildland-Urban Interface and Intermix for the Commonwealth of Massachusetts



Source: Northeast Wildfire Risk Assessment Geospatial Working Group 2009

The assessment model has a flaw in that it does not take into account human activity outside the wildland interface and intermix areas. Local firefighters and other first responders highlight the fact that many wildland fires occur in remote areas where campfires or discarded lit cigarettes were the cause of the fire and, due to lack of access, the fires can get an extensive start before fire crews and equipment can reach these areas. As an example, the two largest wildfires in Berkshire County within the last 100 years, that of April 2015 (272 acres burned) and May 2021 (950+ acres burned), were located in areas in Clarksburg assessed as Low Wildfire Risk. The cause of the 2015 was a campfire that got out of control along the Appalachian Trail. There are several camp sites and lean-tos within the Mount Greylock State Reservation, all of which are located in areas of rugged terrain. The cause of the 2021 fire was not specifically determined but dry forest leaves and kindling due to drought caused its spread. The assessment modeling had predicted that there was a low risk of wildfire in the areas in Clarksburg where the fires occurred, presumably because of a lack of wildland-urban interface (the fires burned remote areas within Clarksburg State Forest).

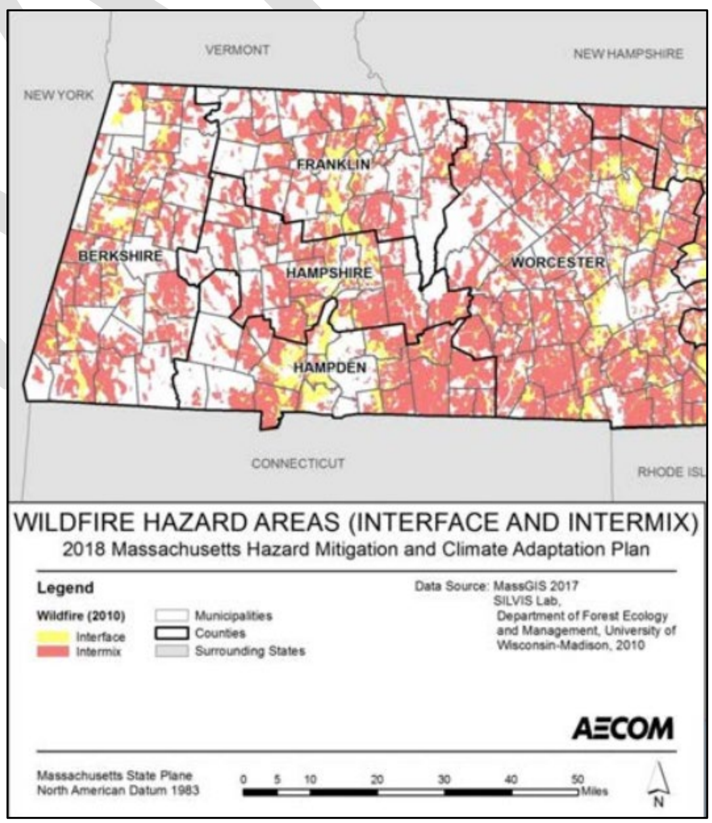
Geographic Areas Likely Impacted

Cheshire is vulnerable to fire across the Town. The lower slopes in the region support forests consisting mainly of dominant trees such as sugar maple, American beech, yellow birch, and northern red oak. Some areas also feature a combination of northern hardwoods with eastern hemlock and eastern white pine. Similar to much of New England, the region is predominantly composed of second-growth forest.

Fire risk and associated damages increases where there is a mix of development and forested land. While the risk of fire is relatively low for Cheshire compared to the Commonwealth as a whole, there is some hazard still posed by wildfire. Given increasing temperature and evaporation, drought and forest fire concerns are growing. Given predictions for increasing temperature, evaporation, and short-term periods of drought, forest fire concerns are a growing concern in rural communities. Areas where campfires or discarded burning cigarettes can start wildfires are most at risk.

The SILVIS Lab at the University of Wisconsin-Madison Department of Forest Ecology and Management classifies exposure to wildlife hazard as "Interface" or "Intermix." Cheshire contains both Interface and Intermix throughout the town. An Interface community exists where structures such as homes or business facilities directly abut wildland fuels with a clear line of demarcation between them. An Intermix community exists where structures are scattered throughout a wildland area (more than one in 40 acres) and wildland fuels are continuous outside of and within the developed area (Haight et al, 2004). Inventoried assets (population, building stock, and critical facilities) were overlaid with these data to determine potential exposure and impacts related to this hazard. Figure 3.33 shown on the map, the generally developed areas along the Route 8 corridor, are classified as Interface zones. These areas directly interface with wildland vegetation, posing a higher risk of wildfire spreading between the built environment and surrounding natural areas. The more rural sections, such as Notch Road (part of Mt. Greylock), Windsor Road near the Chalet Conservation area, Jenks Road, that borders of Stafford Hill Wildlife Area, fall into the Intermix zone category. These

Figure 3.33. MA Wildfire Hazard Areas (Interface and Intermix)



Source: SHMCAP, 2018.

areas exhibit a closer intertwining of human development and wildland vegetation, with a less defined boundary between the two. The presence of scattered structures amidst natural vegetation creates a unique wildfire risk scenario, where fire can potentially spread through a combination of continuous fuels and the proximity of structures. Image 3.40 identifies where the Town is most concerned with wildfires.

The assessment model used does not consider overnight rest stops commonly used by hikers, where individual campfires are most frequently created. Cheshire has notable hiker accommodations in close proximity to the town center, including a recently opened Appalachian Trail Campsite situated directly off Main Street. Additionally, the Mount Greylock Campsite on Cheshire's western edge and the Crystal Mountain Campground in the Chalet Wildlife Area on the southern edge are only 7 miles away from the town center. These camping sites are situated in rugged terrain, making them challenging to access with fire trucks or tankers in the event of a wildfire.

Historic Data

The wildfire season in Massachusetts usually begins in late March and typically culminates in early June, corresponding with the driest live fuel moisture periods of the year. April is historically the month in which wildfire danger is the highest. Drought, snowpack level, and local weather conditions can impact the length of the fire season (MEMA & EOEEA, 2018). Historically small brush fires set unexpectedly by residents are the most common fires seen in Cheshire.

Figure 3.34. Wildfire in Clarksburg, MA 2015

Source: iBerkshires.com 2015.

Based on the DCR Bureau of Forest Fire Control and Forestry records, in 1911, more than 34 acres were burned on average during each wildfire statewide. Since then, that figure has been reduced to 1.17 acres burned annually statewide (MEMA, 2013). According to the Massachusetts Fire Incident Reporting System, wildfires reported to DCR in the past five years are generally trending downward. According to this system there were 901 fire incidents, combined urban and wildland, in Berkshire County during the years 2007-2016, and of these 411 (46% of total) occurred in the City of Pittsfield, the urban center of the region. This same data reports that a total of 832 acres were burned in the county during those 10 years, 631 (76%) of which are reported as acres of wildland burned. This indicates that over this 10-year span an average of 63 acres of wildland burned annually in Berkshire County. Of the 901 incidents, only 12 burned more than 10 acres and two of these burned more than 100 acres. It should be noted that during this same time period there were two large wildland fires in the county: 168 acres in Lanesborough in 2008 and 272 acres in Clarksburg near the Williamstown border in 2015. If these incidents were considered statistic outliers and removed from the data, the average totaled burned acres during 2007-2016 would be 39 and the average wildland acres burned would be 19. In 2021 a wildfire started in eastern Williamstown and quickly moved eastward across the town border into Clarksburg, consuming approximately 950 acres of forest land.

Cheshire has been fortunate to not experience any large wildfires. According to the Fire Chief, the majority of fire related responses are from small brush fires either from hikers on the AT, or brush burning during regulated brush burning times.

The Town of Clarksburg in northern Berkshire County has battled the two largest forest fires to occur within the county (2015 and 2021) since records have been kept. It is known that the 2015 fire started as a cooking fire at the Sherman Brook primitive campsite along the AT that got out of control. Forest conditions at the time were dry, a Class 4 High fire danger rating. The fire burned outward from its origins and eventually burned a total of 272 acres of forest land within the Clarksburg State Forest. According to Incident Reports filled out at the time, the fire was largely a surface fire, burning hardwood leaf litter and Mountain Laurel shrub fuel and did not become a major tree or crown fire.

The fire was difficult to fight because the site was so inaccessible and because of the rugged and steep elevations that fire fighters had to traverse to reach the fire sites. Brush trucks and tankers were not able to reach the site, so crews at first had to hike in and use back packs and portable water pumps, refilling equipment in small mountain streams. Crews used shovels, chainsaws and leaf blowers to create fire breaks where they could. Finally, the tool that was able to really stop the fire was when DCR staff arranged to have a National Guard Black Hawk helicopter drop water on the fire, ferrying 500 gallons of water at a time from Mount Williams Reservoir in North Adams.[51]

The 2021 East Mountain fire started on Friday, May 14th off Henderson Road in Williamstown, and by the next day had swept eastward. By the end of day on May 16th the fire had quadrupled to almost 800 acres, and by the time the fire was 90% contained on May 18th it had consumed 950 acres of land, the majority in Clarksburg. As in 2015, the fire occurred in rugged, steeply-sloped terrain that fire trucks or tankers could not access, so fire fighters and equipment had to be hauled to the sight on ATVs or, in many places where there are no trails, by foot. Firefighters accessed the site from landings in Williamstown and North Adams. More than 120 firefighters from 19 different companies and agencies in Massachusetts and Vermont battled the fire for four days, including water dropping helicopters from the state police and National Guard. Like the fire of 2015 this fire was predominantly a surface fire, burning leaf litter, twigs, branches and debris, fueled on by unusually dry conditions that officials believe are residual effects from the dry 2020 summer/fall season.[52]

Vulnerability Assessment

People

As demonstrated by historical wildfire events, potential losses from wildfire include human health and the lives of residents and responders. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. In 2018 MEMA and EOEEA estimated the population vulnerable to the wildfire hazard by overlaying the interface and intermix hazard areas with the 2010 U.S. Census population data. The Census blocks identified as interface or intermix were used to calculate the estimated population exposed to the wildfire hazard. Interface or intermix areas are those where buildings intermingle with

[51] *Daniels, T., 5-1-15. "Clarksburg Brush Fire Contained on Third Day", as reported in iBerkshires*
[52] *Guerino, Jack, 5-17-21. "Tuesday UPDATE: Forest Fire Operation Transitioning to 'Mop Up'", as reported in iBerkshires*

forest. In Berkshire County 131,219 persons were in Wildlife Hazard Areas: 55,486 in Interface areas, and 39,171 in Intermix areas. Refer to Figure 3.33 for these areas in Cheshire.

All individuals whose homes or workplaces are located in wildfire hazard zones are exposed to this hazard, as wildfire behavior can be unpredictable and dynamic. However, the most vulnerable members of this population are those who would be unable to evacuate quickly, including those over the age of 65, households with young children under the age of five, people with mobility limitations, and people with low socioeconomic status. Landowners with pets or livestock may face additional challenges in evacuating if they cannot easily transport their animals. Outside of the area of immediate impact, sensitive populations, such as those with compromised immune systems or cardiovascular or respiratory diseases, can suffer health impacts from smoke inhalation. Individuals with asthma are more vulnerable to the poor air quality associated with wildfire. Finally, firefighters and first responders are vulnerable to this hazard if they are deployed to fight a fire in an area they would not otherwise be in.

Smoke and air pollution from wildfires can be a severe health hazard. Smoke generated by wildfire consists of visible and invisible emissions containing particulate matter (soot, tar, and minerals), gases (water vapor, carbon monoxide, carbon dioxide (CO_2), and nitrogen oxides), and toxics (formaldehyde and benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Other public health impacts associated with wildfire include difficulty in breathing, reactions to odor, and reduction in visibility. Due to the high prevalence of asthma in Massachusetts, there is a high incidence of emergency department visits when respiratory irritants like smoke envelop an area. Wildfires may also threaten the health and safety of those fighting the fires. First responders are exposed to dangers from the initial incident and the aftereffects of smoke inhalation and heat-related illness.

Built Environment

All buildings and other facilities are vulnerable to wildfire through direct impacts of burning or indirect through cut off from utilities. If any portion of a communications or and electrical systems were impacted by wildfire it would impact a portion or the entire system. Most roads would be without damage except in the worst scenarios. However, fires can create conditions that block or prevent access, and they can isolate residents and emergency service providers. The wildfire hazard typically does not have a major direct impact on bridges, but wildfires can create conditions in which bridges are obstructed as well (MEMA & EOEEA, 2018).

The wildland-urban interface is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. There are a number of reasons that the wildland-urban interface has an increased risk to wildfire damage. The wildland-urban interface is an area where protection of structures from wildfires is difficult, due to access and fire suppression issues. The wildland-urban interface is also at risk for wildfires due to human-caused fire ignitions, which are the most common. In these areas, homes are built among densely wooded areas, so humans are more likely to start a fire that will easily spread to the surrounding forested areas with plentiful vegetative fuels (MEMA, 2013).

Natural environment

Figure 3.35. Fire on East Mountain, Clarksburg, MA. Photo taken May 16, 2021 from Stop & Shop parking lot on Route 2 in North Adams.

Source: Berkshire Eagle 5-18-21, "A volcanic-like glow over the Berkshires: Residents share their wildland fire photo." This photo taken by Brenda Armstrong.

Fire is a natural part of many ecosystems and serves important ecological purposes, including facilitating the nutrient cycling from dead and decaying matter, removing diseased plants and pests, and regenerating seeds or stimulating germination of certain plants. However, many wildfires, particularly man-made wildfires, can also have significant negative impacts on the environment. In addition to direct mortality, wildfires and the ash they generate can distort the flow of nutrients through an ecosystem, reducing the biodiversity that can be supported. Frequent wildfires can eradicate native plant species and encourage the growth of invasive species. There are also risks related to hazardous material releases, where containers storing hazardous materials could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading of the wildfire and escalating it to unmanageable levels. In addition, these materials could leak into surrounding areas, saturating soils and seeping into surface waters to cause severe and lasting environmental damage (MEMA & EOEEA, 2018). The risk of hazardous materials releases is higher in the urban-wildland intermix and interface areas.

Economy

Wildfire events can have major economic impacts on a community, both from the initial loss of structures and the subsequent loss of revenue from destroyed businesses and a decrease in tourism. Individuals and families also face economic risk if their home is impacted by wildfire. The exposure of homes to this hazard is widespread. Additionally, wildfires can require thousands of taxpayer dollars in fire response efforts and can involve hundreds of operating hours on fire apparatus and thousands of man-hours from volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from work to fight these fires (MEMA & EOEEA, 2018).

According to the Incident Status Summary drafted by the state DCR Bureau of Forest Fire Control at the close of the Clarksburg State Forest Fire of 2015, the cost to put out that fire was estimated to be between $20,000-30,000. This figure was for state-incurred costs and did not include locate fire company costs. The cost to the Clarksburg Fire Company was in the low thousands of dollars for food, water, equipment and other direct costs; uncompensated were the hundreds of volunteer firefighters who attended the fire and the local citizens who came to the staging area and provided food and support to the firefighters and other first responders at the scene.

Future Conditions

While climate change is unlikely to change topography, it can alter the weather and fuel factors of wildfires. As noted in the Extreme Temperature section of this plan, the mean annual summer temperature in Cheshire and the region is projected to increase. Hot dry spells create the highest fire risk, due to decreased soil moisture and increased evaporation and evapotranspiration. While in general annual precipitation has slightly increased Massachusetts in the past decades, the timing of snow and rainfall is changing. Less snowfall can lead to drier soils earlier in the spring and possible drought conditions in summer. More of our rain is falling in downpours, with higher rates of runoff and less soil infiltration. Such conditions would exacerbate summer drought and further promote high elevation wildfires where soil depths are generally thin. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods (MEMA, 2013).

- Without an increase in summer precipitation (greater than any predicted by climate models), future areas burned is very likely to increase.
- Infestation from insects is also a concern as it may affect forest health. Potential insect populations may increase with warmer temperatures and infested trees may increase fuel amount.
- Tree species composition will change as species respond uniquely to a changing climate.

Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure (MEMA, 2013).

Landslides

Hazard Profile

The term landslide includes a wide range of ground movements, such as rock falls, deep failure of slopes, and shallow debris flows. The most common types of landslides in Massachusetts include translational debris slides, rotational slides, and debris flows. Most of these events are caused by a combination of unfavorable geologic conditions (silty clay or clay layers contained in glaciomarine, glaciolacustrine, or thick till deposits), steep slopes, and/or excessive wetness leading to excess pore pressures in the subsurface (MEMA & EOEEA, 2018).

Likely Severity

Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions (MEMA & EOEEA, 2018). Estimations of the potential severity of landslides are informed by previous occurrences as well as an examination of landslide susceptibility. It is important to note, however, that landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur (MEMA & EOEEA, 2018).

Table 3.15. Risk of Landslide Destructiveness

Estimate Volume (cubic yards)	Expected Landslide Velocity		
	Fast moving (rock fall)	Rapid moving (debris flow)	Slow moving (slide)
<0.001	Slight intensity	--	--
<0.6	Medium intensity	--	--
>0.6	High intensity	---	--
<654	High intensity	Slight intensity	--
654-13,080	High intensity	Medium intensity	Slight intensity
13,080–65,398	Very high intensity	High intensity	Medium intensity
>653,976	--	Very high intensity	High intensity
>>653,976	--	--	Very high intensity

Source: Cardinali, et al, 2002.

A study conducted in 2001 attempted to estimate landslide risk as a measure of destructiveness of landslide event. Destructiveness was defined as a function of the volume and velocity of material movement. For slow-moving slides, volume depended on the estimated depth of movements; for rapid moving debris flows it depended on the size of the catchment and the estimated volume of debris in source areas and along channels; while for fast-moving rock falls it depended on the maximum size of a single block as estimated from field observations. The expected landslide velocity depends on the type of failure, its volume and the estimated depth of movement. For a given landslide volume, fast moving rock falls have the highest landslide intensity, while rapidly moving debris flows exhibit intermediate intensity, and slow-moving landslides have the lowest intensity (Cardinali, et al, 2002). As way of perspective, the Mohawk Trail landslide of 2011 had an estimated volume of 5,000 cubic yards of material.

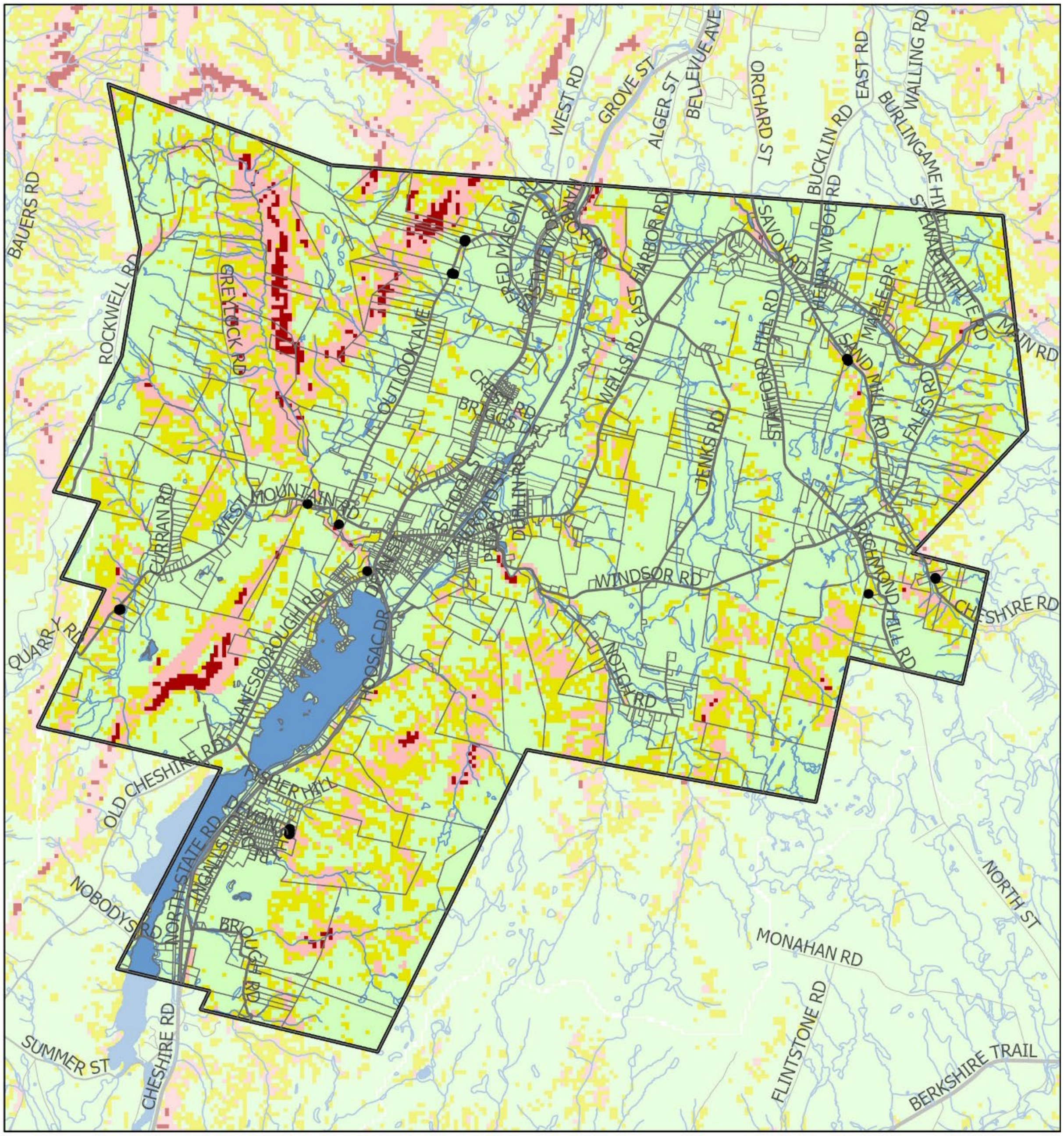
Probability

For the purposes of this HMCAP, the probability of future occurrences is defined by the number of events over a specified period of time. Looking at the recent record, from 1996 to 2012, there were eight noteworthy events that triggered one or more landslides in the Commonwealth. However, because many landslides are minor and occur unobserved in remote areas, the true number of landslide events is probably higher. Based on conversations with the Massachusetts Department of Transportation (MassDOT), it is estimated that about 30 or more landslide events occurred in the period between 1986 and 2006.[53] This estimate roughly equates to one to three landslide events each year.

The probability of instability metric indicates how likely each area is to be unstable. In 2013, the Massachusetts Geological Survey prepared an updated map of potential landslide hazards for the Commonwealth (funded by FEMA's Hazard Mitigation Grant Program) to provide the public, local governments, and emergency management agencies with the location of areas where slope movements have occurred or may possibly occur in the future under conditions of prolonged moisture and high-intensity rainfall (MEMA & EOEEA, 2018). Using this technology, it appears that of the Town's 17,745 acres, 212 are rated as Unstable (1% of total land area) and 1,684 are rated as Moderately Unstable (9% of total). The results of this study for the Town of Cheshire are illustrated in Figure 3.36, with corresponding map legend on the following page.

[53] Mabee, Stephen and Duncan, Christopher (2013). Slope Stability Map of Massachusetts. http://www.geo.umass.edu/stategeologist/Products/Landslide_Map/Slope_Stability_Map_MA_Report.pdf?_ga=2.218289625.1917141679.1562177934-548417844.1562177934

Figure 3.36. Slope Stability Map



Slope Stability

- Unstable
- Moderately Unstable
- Low Stability
- Stable
- Buildings in Unstable / Moderately Unstable Area
- M058TaxPar

N

0 0.5 1 Miles

This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the municipality may have supplied portions of this data.

Source: BRPC, 2023, MassGIS 2017.

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 FS≤1	>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

[1]**Relative Slide Ranking—**This column designates the relative hazard ranking for the initiation of shallow slides on unmodified slopes.

[2]**Stability Index Range—**The stability index is a numerical representation of the relative hazard for shallow translational slope movement initiation based on the factors of safety computed at each point on a 9-meter (~30-foot) digital elevation model grid derived from the National Elevation Dataset. The stability index is a dimensionless number based on factors of safety generated by SINMAP that indicates the probability that a location is stable, considering the most and least favorable parameters for stability input into the model. The breaks in the ranges of values for the stability index categories are the default values recommended by the program developers. [3]

Factors of Safety—The factor of safety is a dimensionless number computed by SINMAP using a modified version of the infinite slope equation that represents the ratio of the stabilizing forces that resist slope movement to destabilizing forces that drive slope movement (Pack et al., 2001 as cited in MEMA & EOEEA, 2018). A FS>1 indicates a stable slope, a FS<1 indicates an unstable slope, and a FS=1 indicates the marginally stable situation where the resisting forces and driving forces are in balance.

[4]**Probability of Instability—**This column shows the likelihood that the factor of safety computed within this map unit is less than one (FS<1, i.e., unstable) given the range of parameters used in the analysis. For example, a <50% probability of instability means that a location is more likely to be stable than unstable given the range of parameters used in the analysis.

[5]**Possible Influence of Stabilizing and Destabilizing Factors—**Stabilizing factors include increased soil strength, root strength, or improved drainage. Destabilizing factors include increased wetness or loading, or loss of root strength (Massachusetts Geologic Survey and UMass Amherst, 2013; Pack et al., 2001 as cited in MEMA & EOEEA, 2018).

Geographic Areas Likely Impacted

Landslides associated with slope saturation occur predominantly in areas with steep slopes underlain by bedrock or glacial till. Bedrock is relatively impermeable relative to the unconsolidated material that overlies it. Similarly, glacial till is less permeable than the soil that forms above it from organic material. Thus, there is a permeability contrast between the overlying soil and the underlying, and less permeable, unweathered till and/or bedrock. Water accumulates on this less permeable layer, increasing the pore pressure at the interface. This interface becomes a plane of weakness. If conditions are favorable, failure will occur (Mabee, 2010 as cited in MEMA & EOEEA, 2018). Occasionally, landslides occur as a result of geologic conditions and/or slope saturation. Adverse geologic conditions exist wherever there are lacustrine or marine clays, as clays have relatively low strength. These clays often formed in the deepest parts of the glacial lakes that existed in Massachusetts following the last glaciation. (MEMA & EOEEA, 2018).

Although specific landslide events cannot be predicted like a storm, a slope stability map shows where slope movements are most likely to occur after periods of high-intensity rainfall. Cheshire is located in within the Green Mountains/Berkshire Highlands ecoregion. The underlying bedrock in Cheshire is predominantly of metamorphic rocks, including gneiss, schist, and quartzite, relatively hard materials that locally resists erosion. Due to their durability and resistance to erosion, these rocks can create rugged topography characterized by steep slopes, cliffs, and deep valleys.[54]

As noted in Figure 3.36, areas with large tracts of Unstable landscapes are found along the mountain ridgeline that is associated with Mount Greylock, along the Town's western border, which coincides with extremely steep slopes. Fortunately, these areas are located within the Mount Greylock State Reservation, where no buildings are currently located, and none are likely to be constructed. The other areas of extensive Unstable landscapes include a mountain ridgeline near Pettibone Brook and the Former Farnam Limestone Quarry. These areas are undeveloped open space and unlikely to have new construction. While these are adjacent to the residential area of Lanesboro Rd, which consists of waterfront properties along the Hoosic Lake there is no historical occurrences of landslides in this section of Cheshire. Refer to Image 3.36 for these critical areas.

Historic Data

Historical landslide data for the Commonwealth suggests that most landslides are preceded by two or more months of higher-than-normal precipitation, followed by a single, high-intensity rainfall of several inches or more (Mabee and Duncan, 2013 as cited in MEMA & EOEEA, 2018). This precipitation can cause slopes to become saturated. In Massachusetts, landslides tend to be more isolated in size and pose threats to high traffic roads and structures that support tourism, and general transportation. Landslides commonly occur shortly after other major natural disasters, such as earthquakes and floods, which can exacerbate relief and reconstruction efforts. Many landslide events may have occurred in remote areas, causing their existence or impact to go unnoticed. Expanded development and other land uses may contribute to the increased number of landslide incidences and/or the increased number of reported events in the recent record (MEMA & EOEEA, 2018).

Some areas of town are particularly susceptible. One such notable place is Route 116. Located on a steep embankment, Route 116 is threatened with landslide and poor bank stability. In summer 2023,

[54] *Landscape Assessment and Forest Management Framework: Berkshire Ecoregions in Massachusetts; found at https://www.mass.gov/doc/2settingpdf/download*

some of the railing needed to be replaced due to bank failure. This instability is pronounced during heavy rains where flashy stream systems erode banks and undermine road infrastructure along 116.

The most severe landslide to occur in the Berkshire region occurred along Route 2 in Savoy during T.S. Irene in 2011 (Image 3.47). The slide was 900 feet long, approximately 1.5 acres, with an average slope angle is 28° to 33°. The elevation difference from the top of the slide to the bottom was 460 feet, with an estimated volume of material moved being 5,000 cubic yards. Only the top 2 to 4 feet of soil material was displaced (BRPC, 2012). The soil and tree debris covered the entire width of Route 2 and caused its closure for weeks (see bottom photo left). The landslide has a significant impact on norther Berkshire County communities because Route 2 is a major east-west transportation route in that region.

Figs. 3.37, 3.38. Landslide in Savoy, MA along Mohawk Trail, August 2011

Source: Top: Mabee, Stephen B., Duncan, Christopher C. 2013. Slope Stability Map of Mass., MA Geological Survey. Bottom: courtesy Stan Brown of Florida, MA

Vulnerability Assessment

People

There are 11 structures that have been identified within areas modeled as Moderately Unstable areas. There are no structures located in Areas modeled as Unstable. All the buildings are in residential use.

Populations who rely on potentially impacted roads for vital transportation needs are considered to be particularly vulnerable to this hazard. The number of lives endangered by the landslide hazard is increasing due to the state's growing population and the fact that many homes are built on property atop or below bluffs or on steep slopes subject to mass movement. People in landslide hazard zones are exposed to the risk of dying during a large-scale landslide. For Cheshire, damage to infrastructure that impedes emergency access and access to health care is the largest health impact associated with this hazard. Mass movement events in the vicinity of major roads could deposit many tons of sediment and debris on top of the road. Restoring vehicular access is often a lengthy and expensive process. Additionally, landslides can result in injury and loss of life.

Landslide risk in the county is largely associated with prolonged rain events and heavily saturated soils, and as extreme precipitation events increase in number and severity due to climate change people living in the Unstable areas will be increasingly at risk.

Built Environment

According to the Slope Stability modeling conducted as part of this analysis, there are 11 properties that are located fully or partially located within areas categorized as Moderately Unstable (there are no structures in areas categorized as Unstable). The value of all the buildings located on properties located in Moderately Unstable area in Cheshire totals $1,499,200. If adding building content to this figure (estimated at 50% of building value), the total potential building loss due to landslide would be $2,248,800. This is the estimate of potential loss of all the buildings and their contents. As noted in the Inland Flooding cost estimate analysis, the figures used here are assessed values, not market or replacement value, and thus likely underestimate reimbursements needed to bring buildings back to pre-disaster conditions.

The energy sector is vulnerable to damaged infrastructure associated with landslides. Transmission lines are generally elevated above steep slopes, but the towers supporting them can be subject to landslides. A landslide may cause a tower to collapse, bringing down the lines and causing a transmission fault. Transmission faults can cause extended and broad area outages (MEMA & EOEEA, 2018).

Natural Environment

Landslides can affect a number of different facets of the environment, including the landscape itself, water quality, and habitat health. Following a landslide, soil and organic materials may enter streams, reducing the potability of the water and the quality of the aquatic habitat Additionally, mass movements of sediment may result in the stripping of forests, which in turn impacts the habitat quality of the animals that live in those forests (Geertsema and Vaugeouis, 2008 as cited in MEMA & EOEEA, 2018). Flora in the area may struggle to re-establish following a significant landslide because of a lack of topsoil.

Figure 3.39. Mount Greylock in Adams, MA. 1990 landslide area still void of vegetation years later.

Source: BRPC, 1999.

Economy

Direct costs of landslide include the actual damage sustained by buildings, property, and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, ground failure threatens transportation corridors, fuel and energy conduits, and communication lines (USGS, 2003 as cited in MEMA & EOEEA, 2018). Landslides that affect farmland can result in significant loss of livelihood and long-term loss of productivity. Forests can also be significantly impacted by landslides.

Future Conditions

Increased precipitation, severe weather events and other effects of climate change affecting the region may lead to a higher likelihood for landslides as soil and vegetative cover are impacted.

Earthquakes

Hazard Profile

An earthquake is the vibration of the Earth's surface that follows a release of energy in the Earth's crust. These earthquakes often occur along fault boundaries. As a result, areas that lie along fault boundaries—such as California, Alaska, and Japan—experience earthquakes more often than areas located within the interior portions of these plates (MEMA & EOEEA, 2018).

Likely severity

The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth. The focal depth of an earthquake is the depth from the surface to the region where the earthquake's energy originates (the focus). Earthquakes with focal depths up to about 43.5 miles are classified as shallow. Earthquakes with focal depths of 43.5 to 186 miles are classified as intermediate. The focus of deep earthquakes may reach depths of more than 435 miles. The epicenter of an earthquake is the point on the Earth's surface directly above the focus. Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. 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 sizes of earthquakes. The Richter scale is the most widely known scale for measuring earthquake magnitude. It has no upper limit and is not used to express damage. Earthquakes above about magnitude 5.0 have the potential for causing damage near their epicenters, and larger magnitude earthquakes have the potential for causing damage over larger areas.

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 structural damage. The perceived severity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features, and severity varies with location. Intensity is expressed by the Modified Mercalli Scale, which describes how strongly an earthquake was felt at a particular location. The Modified Mercalli Scale expresses the intensity of an earthquake's effects in a given locality in values ranging from I to XII, with accompanying descriptions of what the earthquake will feel like to people in the area. Table 3.49 describes the intensity and the equivalent Richter Scale rating.

Table 3.16. Modified Mercalli Intensity Table and Description of Impacts

Equivalent Richter Scale Magnitude	Mercalli Intensity	Abbreviated Modified Mercalli Intensity Scale Description
NA	I	Felt by very few people; barely noticeable.
< 4.2	II	Felt by few people, especially on upper floors of buildings.
NA	III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake; vibration similar to passing of a truck.
NA	IV	Felt by many indoors, few outdoors; may feel like heavy truck striking building.
< 4.8	V	Felt by almost everyone, some people awakened; small objects move, trees and poles may shake.
< 5.4	VI	Felt by all, many frightened; some furniture moved; few instances of fallen plaster; damage slight.
< 6.1	VII	Damage negligible in buildings of good design & construction; slight-moderate in well-built ordinary buildings; considerable damage in poorly designed & constructed.
NA	VIII	Buildings suffer slight damage if well-built, severe damage if poorly built. Some walls. Chimneys, factory stacks collapse.
< 6.9	IX	Damage considerable in specially designed structures; damage great in buildings with partial collapse; buildings shifted off foundations.
< 7.3	X	Some well-built wooden structured destroyed; most masonry and frame structured destroyed with foundations.
< 8.1	XI	Few, if any (masonry) structures remain standing; bridges destroyed.
> 8.1	XII	Damage total; objects thrown into the air.

Source: MEMA & EEA, 2018.

Probability

New England experiences intraplate earthquakes because it is located deep within the interior of the North American plate. Scientists are still exploring the cause of intraplate earthquakes, and many believe these events occur along geological features that were created during ancient times and are now weaker than the surrounding areas (MEMA & EOEEA, 2018).

A 1994 report by the USGS, based on a meeting of experts at the Massachusetts Institute of Technology, provides an overall probability of occurrence. This report found that the probability of a magnitude 5.0 or greater earthquake centered somewhere in New England in a 10-year period is about 10 percent to 15 percent. This probability rises to about 41 percent to 56 percent for a 50-year period. The last earthquake with a magnitude above 5.0 that was centered in New England took place in the Ossipee Mountains of New Hampshire in 1940 (MEMA & EOEEA, 2018). More noticeable in Berkshire County was a 5.1 earthquake centered near Plattsburg in upstate New York on April 21, 2002, which shook homes throughout the region.

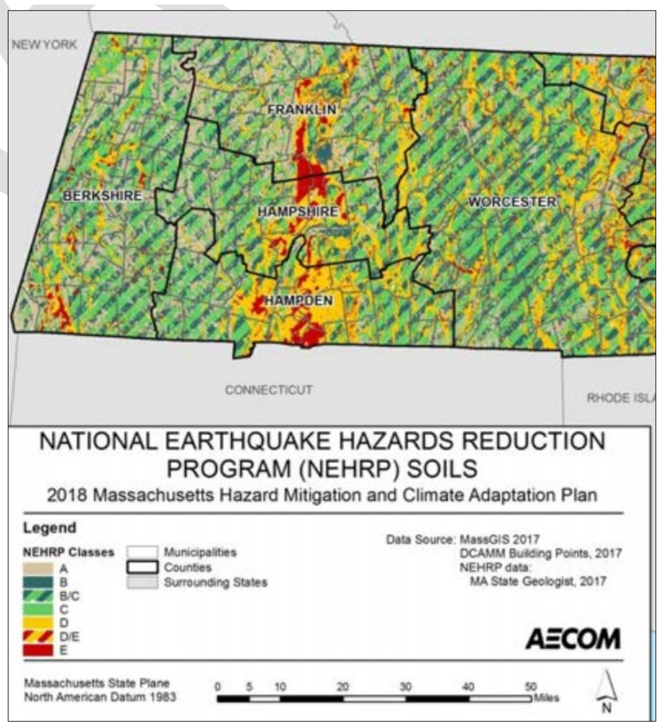
Because of the low frequency of earthquake occurrence and the relatively low levels of ground shaking that are usually experienced, the entirety of the Commonwealth and the Town of cCheshire can be expected to have a low to moderate risk to earthquake damage as compared to other areas of the country. However, impacts at the local level can vary based on types of construction, building density, and soil type, among other factors (MEMA & EOEEA, 2018).

Geographic Areas Likely Impacted

New England is located in the middle of the North American Plate. One edge of the North American Plate is along the West Coast where the plate is pushing against the Pacific Ocean Plate. The eastern edge of the North American Plate is located at the middle of the Atlantic Ocean, where the plate is spreading away from the European and African Plates. New England's earthquakes appear to be the result of the cracking of the crustal rocks due to compression as the North American Plate is being very slowly squeezed by the global plate movements. As a result, New England epicenters do not follow the major mapped faults of the region, nor are they confined to particular geologic structures or terrains. Because earthquakes have been detected all over New England, seismologists suspect that a strong earthquake could be centered anywhere in the region. Furthermore, the mapped geologic faults of New England currently do not provide any indications detailing specific locations where strong earthquakes are most likely to be centered. Instead, a probabilistic assessment conducted through a Level 2 analysis in Hazus (using a moment magnitude value of five) provides information about where in Massachusetts impacts would be felt from earthquakes of various severities. For this plan, an assessment was conducted for the 100-, 500-, 1,000-, and 2,500-year Mean Return Periods (MRP). The results of that analysis are discussed later in this section (MEMA & EOEEA, 2018).

Ground shaking is the primary cause of earthquake damage to man-made structures. This damage can be increased due to the fact that soft soils amplify ground shaking. A contributor to site amplification is the velocity at which the rock or soil transmits shear waves (S waves). The National Earthquake Hazards Reduction Program (NEHRP) developed five soil classifications, which are defined by their S-wave velocity, that impact the severity of an earthquake.

Figure 3.40. NEHRP Soil Types in Massachusetts



Sources: MEMA & EOEEA, 2018; Mabee and Duncan, 2017; Preliminary NEHRP Soil Classification Map of Massachusetts

The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. These soil types are shown in Figure 3.40 Soil types A, B, C, and D are reflected in the HAZUS analysis that generated the exposure and vulnerability results for Berkshire County that are discussed later in the section (MEMA & EOEEA, 2018).

Historic Data

In the morning of April 20, 2002, a 5.1-rated earthquake rattled homes and work people up throughout Berkshire County. Residents describe the affects as vibrating or shaking their homes, rattling hangings on the wall, and sounding loud like a train or large truck passing by. According to a local news article, no injuries were reported and the only local damages reported were a cracked home foundation on Houghton Street in Clarksburg.[55] Another earthquake in Virginia on August 23, 2011 was felt in Western Massachusetts.

In some places in New England, including locations in Massachusetts, small earthquakes seem to occur with some regularity. For example, since 1985 there has been a small earthquake approximately every 2.5 years within a few miles of Littleton, Massachusetts. It is not clear why some localities experience such clustering of earthquakes, but a possibility suggested by John Ebel of Boston College's Weston Observatory is that these clusters occur where strong earthquakes were centered in the prehistoric past. The clusters may indicate locations where there is an increased likelihood of future earthquake activity (MEMA & EOEEA, 2018).

Although it is well documented that the zone of greatest seismic activity in the U.S. is along the Pacific Coast in Alaska and California, in the New England area, an average of six earthquakes are felt each year. Damaging earthquakes have taken place historically in New England. According to the Weston Observatory Earthquake Catalog, 6,470 earthquakes have occurred in New England and adjacent areas. However, only 35 of these events were considered significant (MEMA & EOEEA, 2018).

Vulnerability Assessment

People

The entire population of Massachusetts is potentially exposed to direct and indirect impacts from earthquakes. 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. In addition, the time of day also exposes different sectors of the community to the hazard. There are many ways in which earthquakes could impact the lives of individuals across the Commonwealth. Business interruptions could keep people from working, road closures could isolate populations, and loss of utilities could impact populations that suffered no direct damage from an event itself. People who reside or work in unreinforced masonry buildings are vulnerable to liquefaction.

The populations most vulnerable to an earthquake event include people over the age of 65 and those living below the poverty level. These 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, the location and construction quality of their housing, and the inability to be self-sustaining after an incident due to a limited ability to stockpile supplies.

Hazus performed for the *Massachusetts HMCAP* estimates the number of people that may be injured or killed by an earthquake depending on the time of day the event occurs. Results were calculated on the county level. Estimates are provided for three times of day representing periods when different sectors of the community are at their peak: peak residential occupancy at 2 a.m.; peak educational, commercial, and industrial occupancy at 2 p.m.; and peak commuter traffic at 5 p.m. Table 3.14 shows the number of injuries and casualties expected for events in Berkshire County of varying severity (based on mean return periods) and for at various times of the day. Damages and loss due to liquefaction, landslide, or

[55] *Gosselin, Lisa, 4-21-02. "Earthquake Wakes up Northeast," Berkshire Eagle.*

surface fault rupture were not included in this analysis. Estimated damages to the general building stock were generated at the Census-tract level.

Residents may be displaced or require temporary to long-term sheltering due to the event. The number of people requiring shelter is generally less than the number displaced, as some who are displaced use hotels or stay with family or friends following a disaster event. Shelter estimates from Hazus are intended for general planning purposes and should not be assumed to be exact. It should also be noted that, in Massachusetts, the season in which an earthquake occurs could significantly impact the number of residents requiring shelter. For example, if an earthquake occurred during a winter weather event, more people might need shelter if infrastructure failure resulted in a loss of heat in their homes. These numbers should be considered as general, year-round average estimates (MEMA & EOEEA, 2018).

Table 3.17. Estimated Number of Injuries, Causalities and Sheltering Needs in Berkshire County based upon Mean Return Period

Mean Return Period (MRP)	100-Year MRP			500-Year MRP			1,000-Year MRP			2,500-Year MRP		
Time of Event	**2 am**	**2 pm**	**5 pm**	**2 am**	**2 pm**	**5 pm**	**2 am**	**2 pm**	**5 pm**	**2 am**	**2 pm**	**5 pm**
Injuries	0	0	0	4	6	4	9	13	10	22	35	25
Hospitalization	0	0	0	0	1	1	1	2	1	3	6	5
Casualties	0	0	0	0	0	0	0	0	0	1	1	1
Displaced Households	0			21			51			143		
Short-Term Sheltering Needs	0			12			29			82		

Source: MEMA & EOEEA, 2018 HAZUS

Built Environment

All elements of the built environment in the planning area are exposed to the earthquake hazard. Municipal water and sewer lines could be damages or destroyed. In addition to direct impacts, there is increased risk associated with hazardous materials releases, which have the potential to occur during an earthquake from fixed facilities, transportation-related incidents (vehicle transportation), and pipeline distribution. These failures can lead to the release of materials to the surrounding environment, including potentially catastrophic discharges into the atmosphere or nearby waterways, and can disrupt services well beyond the primary area of impact (MEMA & EOEEA, 2018).

Earthquakes can damage power plants, gas lines, liquid fuel storage infrastructure, transmission lines, utilities poles, solar and wind infrastructure, and other elements of the energy sector. Damage to any components of the grid can result in widespread power outages (MEMA & EOEEA, 2018). Damage to road networks and bridges can cause widespread disruption of services and impede disaster recovery and response (MEMA & EOEEA, 2018).

Earthquakes can also cause large and sometimes disastrous landslides and wildfires. Soil liquefaction is a secondary hazard unique to earthquakes that occurs when water-saturated sands, silts, or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Liquefaction may occur along the shorelines of rivers and lakes and can also happen in low-lying areas away from water bodies but where the underlying groundwater is near the Earth's surface. Earthen dams and levees are highly susceptible to seismic events, and the impacts of their eventual failures can be considered secondary risks for earthquakes (MEMA & EOEEA, 2018).

Natural Environment

Earthquakes can impact natural resources and the environment in a number of ways, both directly and through secondary impacts. For example, damage to gas pipes may cause explosions or leaks, which can discharge hazardous materials into the local environment or the watershed if rivers are contaminated. Fires that break out as a result of earthquakes can cause extensive damage to ecosystems, as described in Section 4.3.2. Primary impacts of an earthquake vary widely based on strength and location. For example, if strong shaking occurs in a forest, trees may fall, resulting not only in environmental impacts but also potential economic impacts to any industries relying on that forest. If shaking occurs in a mountainous environment, cliffs may crumble, and caves may collapse. Disrupting the physical foundation of the ecosystem can modify the species balance in that ecosystem and leave the area more vulnerable to the spread of invasive species (MEMA & EOEEA, 2018).

Economy

Earthquakes also have impacts on the economy, including loss of business functions, damage to inventories, relocation costs, wage losses, and rental losses due to the repair or replacement of buildings. The business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses of those people displaced from their homes because of the earthquake. Additionally, earthquakes can result in loss of crop yields, loss of livestock, and damage to barns, processing facilities, greenhouses, equipment, and other agricultural infrastructure. Earthquakes can be especially damaging to farms and forestry if they trigger a landslide (MEMA & EOEEA, 2018).

Table 3.52 summarizes the estimated potential building-related losses per earthquake scenario for Massachusetts. Lifeline-related losses include the direct repair cost for transportation and utility systems and are reported in terms of the probability of reaching or exceeding a specified level of damage when subjected to a given level of ground motion. Additionally, economic losses include the business interruption losses associated with the inability to operate a business due to the damage sustained during the earthquake as well as temporary living expenses for those displaced.

Table 3.18. Economic Loss Estimates, Hazus Probabilistic Scenarios

Economic Losses for Berkshire County	100-Year MRP	500-Year MRP	1,000-Year MRP	2,500-Year MRP
Building-Related Loss Estimates, Hazus Probabilistic Scenarios	$570,000	$25,660,000	$66,220,000	$200,810,000
Transportation and Utility Losses	$170,000	$7,800,000	$23,180,000	$74,200,000

Source: MEMA & EOEEA, 2018 Hazus.

Future Conditions

Earthquakes cannot be predicted and may occur at any time. Peak Ground Acceleration maps are used as tools to determine the likelihood that an earthquake of a given Modified Mercalli Intensity may be exceeded over a period of time, but they are not useful for predicting the occurrence of individual events. Therefore, geospatial information about the expected frequency of earthquakes throughout Massachusetts is not available. Unlike previous hazards analyzed in this plan, there is little evidence to show that earthquakes are connected to climate change (MEMA & EOEEA, 2018). However, there are some theories that earthquakes may be associated with a thawing Earth as the temperature increases.

Vector-borne Diseases

Hazard Profile

A vector-borne disease refers to an illness transmitted by vectors, such as mosquitoes or ticks, carrying pathogens like bacteria, viruses, or parasites. In Massachusetts, some common types of vector-borne diseases include Lyme disease, Babesiosis, Anaplasmosis, Eastern Equine Encephalitis (EEE), West Nile virus, and Powassan virus. These diseases pose public health risks and require mitigation strategies like vector control and public awareness campaigns (CDC, 2021).

Likely severity

The likely severity of vector-borne diseases in Cheshire can vary based on several factors, the presence of suitable vectors like ticks and mosquitoes, favorable climatic conditions, and proximity to areas with known disease prevalence. Favorable climatic conditions, such as moderate temperatures and suitable humidity levels, contribute to the proliferation of vectors and increase the risk of vector-borne diseases. Vector-borne diseases can have a substantial impact on a community, leading to significant consequences that affect the quality of life, work capacity, loss of specific bodily functions, increased long-term illness, and mortality rates. Surveillance and reporting of these diseases are carried out by authoritative organizations such as the Massachusetts Department of Public Health (MDPH), the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA), and local health departments, who monitor vector populations and provide guidance on prevention and control measures.

Probability

According to the CDC, the presence and spread of vectors and the diseases they carry depend on various factors like climate, land use, socioeconomics, pest control, healthcare access, and human behavior. Changes in climate can lead to adaptations and shifts in the geographic range of vectors and pathogens. Infectious disease transmission is sensitive to local weather variations, human impact on the environment, diversity of animal hosts, and human behaviors that affect contact with vectors. These factors collectively influence the distribution and dynamics of vector-borne diseases.

In a CDC report, mosquito, flea, and tick-borne illnesses in the United States experienced a three-fold increase between 2004 and 2016. West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE or “Triple E”) are viruses that occur in Massachusetts and can cause illnesses ranging from mild fever to more serious diseases like encephalitis or meningitis. The MDPH currently ranks the Berkshires as low risk for mosquito-borne illness as EEE is not usually found in the Berkshires, and WNV infection is also likely not possible due to its low occurrence.

The Massachusetts Climate Assessment Report states that climate change is expected to increase the occurrence of vector-borne diseases like Lyme disease in Western Massachusetts. Rising temperatures and longer vector seasons contribute to this increase. The consequences are considered significant, with potentially fatal and nonfatal outcomes. While exposure to these diseases is not disproportionately high, there is a moderate need for adaptation measures to address the changing risks.

Geographic Areas Likely Impacted

Cheshire in its entirety is likely already impacted by vector-borne disease and is likely to be increasingly impacted. Exposure to any outdoor area with tall grasses, standing water, and trees increases risk. Residents and visitors can be exposed at home and in more commercial areas, although exposure in commercial areas is generally less likely.

Historic Data

Lyme disease accounted for 82% of all tickborne cases, but spotted fever rickettsioses, babesiosis, and anaplasmosis/ehrlichiosis cases also increased. Anaplasmosis/Ehrlichiosis (848 cases in 2016, can be fatal), Babesiosis (518 cases in 2016, significantly higher than any other state, can be fatal), Lyme (198 cases in 2016), Powassan (5 cases in 2016, fatality rate is 10%), Spotted fever rickettsiosis (8 cases in 2016, 20% untreated cases are fatal), and Tularemia (5 cases in 2016).

During the years of 2004 to 2016, nine vector-borne human diseases were reported for the first time from the United States and US territories. According to the CDC, vector-borne diseases have been difficult to prevent and control, and a Food and Drug Administration (FDA) approved vaccine is only available for yellow fever virus. Insecticide resistance is widespread and is increasing.

<u>Lyme Disease</u>

In 2016, the United States reported a total 96,075 cases, of which 1,827 were reported in the state of Massachusetts. Lyme disease is the most prevalent tick borne disease throughout the state. It is estimated that around 87,000 individuals in Massachusetts contract the bacteria Borrelia burgdorferi, the causative agent of Lyme disease, each year, as per experts' assessments. Figure 3.41 shows the annual incidence of Lyme disease, which is calculated as the number of new cases per 100,000 people. The graph is based on cases that local and state health departments report to CDC's national disease tracking system. Massachusetts is among the 14 states where the CDC reported that 95 percent of Lyme disease cases occurred in 2016. The CDC indicates that cases of vector-borne diseases are substantially underreported.

Figure 3.41. Reported Cases of Lyme Disease 1991- 2018. (CDC)

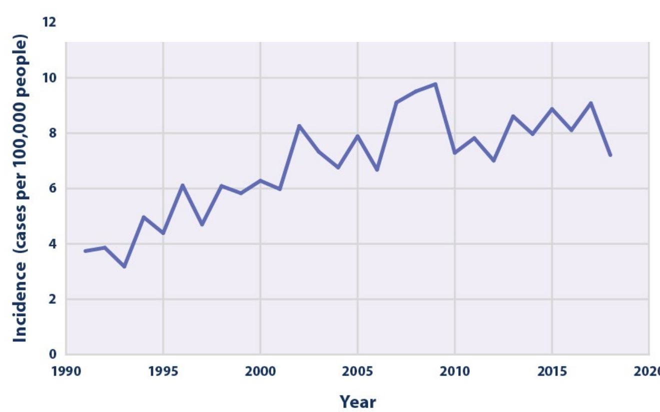
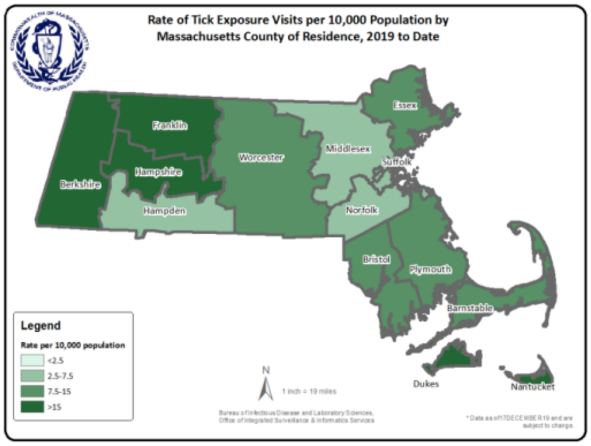


Figure 3.42. Rate of Tick Exposure



Source: Department of Public Health 2019

Tick activity and diseases occur year-round, with two peaks in March/April through August and October-November. The majority of tick-borne disease cases occur in June to August. Figure 3.42 shows the rate of emergency department visits related to tick exposure per 10,000 population by county in Massachusetts in 2019.

Vulnerability Assessment

People

Vector-borne illness have a significant impact on humans and on a community, and significantly affect health, long-term morbidity and mortality, quality of life, and can significantly reduce a persons' ability to work or contribute to the community in other ways. In addition to the direct effect of vector-borne illnesses on a person, pesticides and herbicides used to control populations of vectors can also negatively impact human health.

Built Environment

Vector-borne diseases can impact infrastructure in various ways. They can strain healthcare systems, leading to increased demand for medical services and putting pressure on healthcare facilities. Infrastructure may also be modified to support vector control efforts, such as improving drainage systems to prevent mosquito breeding. Overall, the impact of vector-borne diseases on infrastructure depends on factors like disease prevalence and the capacity to respond effectively.

Natural Environment

The rise in vector-borne illnesses can lead to the increased use of chemical pesticides and herbicides to control vector populations. However, this heightened usage can have adverse effects on the natural environment, including vegetation, rivers, streams, and animal populations. Decreasing tick and mosquito, populations may disrupt the food sources of dependent animals. Moreover, diseases carried by insects can impact wildlife. In response to disease threats, there is a risk of altering the environment in ways that disrupt vector habitats, potentially causing long-term damage to ecosystem health.

Economy

Diseases can have economic consequences, including direct costs for treatment and indirect costs from lost productivity and reduced tourism. Public health departments and local authorities may need to allocate resources for disease surveillance, vector control programs, and public education campaigns.

CHAPTER 4: MITIGATION STRATEGY

44 CFR § 201.6(c)(3-5)

The defined mission for the Town of Cheshire Hazard Mitigation and Climate Adaptation Plan is to reduce loss and damage to life, property, infrastructure, and the natural resources of the Town due to disaster and climate change by identifying and developing cost-effective actions to mitigate damages and loss. The Mitigation Strategy outlines how the Town of Cheshire intends to reduce potential losses identified in the Risk Assessment chapter. The goals and objectives of the Town guide the selection of actions to mitigate and reduce potential losses. A prioritized list of cost-effective, environmentally sound, and technically feasible mitigation actions is the product of reviewing benefits and costs of each proposed project.

Hazard Mitigation Objectives

In developing this plan, the Town of Cheshire established the following goals for this HMCAP:

1. Reduce the risk of flood damage
2. Ensure road security
3. Increase accessibility of emergency services
4. Manage invasive species

National Flood Insurance Program (NFIP)

The Town of Cheshire is an NFIP community. The NFIP works with communities required to adopt and enforce floodplain management regulations that help mitigate flooding effects. In exchange, FEMA offers flood insurance to property owners and renters. The combination of floodplain management and insurance reduces the socio-economic impact of disasters. Refer to Image 3.2 to review the Town's floodplain areas.

Existing Protections

The Town of Cheshire is fortunate in having natural mitigative infrastructure in the contiguous forests, fields and wetland resources that dominate the landscape. The Town's undeveloped land serves as important green infrastructure performing ecosystem services including stormwater management, flood control and reduction, soil stabilization, wind mitigation, water filtration, and drought prevention amongst other benefits not easily quantified. One study by the Trust for Public Land found that for every $1 invested through the Land and Water Conservation Fund, there was a return on that investment of $4 from the value of natural goods and services[56]. As such, partnering with state and local conservation organizations to protect and maintain the hazard mitigation functions of the Town's natural landscape is a key component in overall efforts to reduce the impacts of natural hazards and disasters on the Town's people, property, and wildlife habitats.

The Town of Cheshire has adopted zoning bylaws to oversee future development in the Town, with the latest amendments having taken place in 2019. As stated in the bylaws, "the purpose of this Bylaw is to achieve greater implementation of the powers granted to municipalities under Article 89 of the

[56] *http://cloud.tpl.org/pubs/benefits-LWCF-ROI%20Report-11-2010.pdf*

Amendments to the Constitution of the Commonwealth in the general interest of public health, safety and welfare." Specifically noted is the protection of the Town's "significant environmental features such as: flood plains and flood prone areas, wetlands, Hoosic River, reservoir, brooks, ponds, water resources, woodlands, areas of scenic beauty, and sites and structures of historic importance." The bylaw also references the enforcement of existing protections in state law, stating that the Town should "employ cooperatively the various measures by the Town's agencies under diverse legislative authority, including the State Sanitary Code, Wetlands Protection Act, Subdivision Control Legislation, and the State Building Code, for the protection and enhancement of the Town's existing small-town character, open spaces, low density of population, and in the interests of the Town's orderly growth at a deliberate pace."

Cheshire's zoning bylaws are short and direct, providing the Town with broad brush standards on which to evaluate development proposals and issue special permits. The bylaw does provide that Special Permitting Granting Authorities (SPGAs) may hire professionals to provide technical review and recommendations of development proposals, with the cost to be borne by the applicant. The ability to hire professional engineers or other experts can be key in providing long-term protections of resources and reducing future risk of flooding or other hazards resulting from new development.

Cheshire's zoning bylaws specifically include floodplain and drinking water supply protection through the creating of overlay districts. The Town has created a set of Flood Prone Area and Wetland Regulations (Section 9.1), which specifically states that "No dwelling or industrial building shall be constructed in the Flood Plain District, nor shall land fill be permitted." While this clearly addresses dwellings and industrial uses, it leaves gaps on allowing other principal uses (business, municipal, recreational, institutional, community, etc.) or accessory uses. The regulations do not discuss district boundaries or reference potential wetland resource boundary delineation. The Town could benefit from a review and possible update of this bylaw to better define the purpose and scope of this section. An update should clarify exactly what land areas are included under this District by defining exactly what "flood prone area", "wetland" areas and "Flood Plain" areas are included. Adding to unclarity, one section of this bylaw specifically states that the granting of a special permit under this section does not indicate in any way compliance with the Massachusetts Wetlands Protection Act. The boundaries of this overlay district should also be delineated.

The regulations for the Flood Hazard District are more specific in detail, clearly stating that "All encroachments, including fill, new construction, substantial improvement to existing structures and other development are prohibited unless certification by a registered professional engineer is provided by the applicant demonstrating that such encroachment shall not result in any increase flood levels during the occurrence of the 100-year flood". Requirements on infrastructure and other uses is addressed, specifically referencing compliance with flood plain requirements in the State Building Code. Regulations are also provided regarding the construction of all mobile homes in Zone A-A1-A2-A4. As stated in the bylaw, "The Flood Hazard District includes all special flood hazard areas designated as Zone A, A1-A2-A4 in the Town of Cheshire Flood insurance rate maps (FIRM), and the flood boundary and floodway maps dated July 19, 1982."

The Commonwealth has developed a model floodplain bylaw to assist municipalities in understanding the minimum requirements of the NFIP and to assure that their local bylaws contain the necessary and property language for compliance with the program. The 2020 Massachusetts

State Model Floodplain Bylaw also helps town officials understand the NFIP requirements that are not already found elsewhere in mandatory state laws and regulations, such as the Wetlands Protection Act and Building Code. It may be beneficial for the Town of Cheshire to consider adopting a version of this model bylaw. The model may be sufficient enough in detail to be able to merge the Town's current Flood Prone and Wetland Areas and Flood Hazard District into one single overlay district to reduce redundancy and avoid inconsistencies.

Wetland resource areas in Cheshire are partially protected from adverse development impacts through the Massachusetts Wetlands Protection Act (310 CMR 10.00), one of the most protective wetlands laws in the U.S. Under the Wetlands Protection Act no one may "remove, fill, dredge, or alter" any wetland, floodplain, bank, land under a water body, land within 100 feet of a wetland, or land within 200 feet of a perennial stream or river, without a permit from the local Conservation Commission. The Act identifies several presumed "interests" or values to be protected: flood control, prevention of storm damage, prevention of pollution, and protection of fisheries, shellfish, groundwater, public or private water supply, and wildlife habitat. The term "alter" is defined to include any destruction of vegetation, or change in drainage characteristics or water flow patterns, or any change in the water table or water quality. The wetland regulations prohibit most destruction of wetlands and naturally vegetated riverfront areas and require replacement of flood storage loss when floodplains are filled. The Act is locally administered by the Cheshire Conservation Commission.

Additionally, the Massachusetts Building Code (780 CMR 1.00-36.22) has some of the most stringent building code standards in the country, including construction within flood zone or floodplains, and the Town of Cheshire has adopted this code as its minimum building standards. Local municipal building inspectors must be certified by the state to be eligible for the position.

According to the Massachusetts Office of Dam Safety, dam owners are required to inspect and report results every two years for High Hazard Potential dams, every five years for Significant Hazard Potential dams and every 10 years for Low Hazard Potential dams. The Cheshire Reservoir, Basset Brook Reservoir, and Kitchen Brook dams (see Table 3.9) are classified as Significant Hazard. Of those Cheshire Reservoir and Basset Brook Reservoir have Emergency Action Plans and are inspected every five years. Bassett Brook Emergency Action Plan is shared with Town of Adams as well as Cheshire Emergency Personnel. Cheshire's Fire Department, Police Department, Town Administrator, and Hoosac Lake District hold Cheshire Reservoir Dam EAP.

The Cheshire Public Works Department, which manages both water and highway, is a small but dedicated crew, working under challenging financial constraints to maintain the road system throughout the Town. Staff frequently inspect culverts and bridges to ensure that they are clear of debris. The Public Works Department Director works in the field with his crew members and is aware of road conditions. There are several areas where upsizing culverts should be undertaken, but outside funding is needed to bring them up to state stream crossing standards. Additionally, during the 2023 Town Meeting, Chesire recently passed a stormwater bylaw that will assist in mitigating flooding and water pollution effectively. Currently, the bylaw is under review at the Attorney General's Office. As a Municipal Separate Storm Sewer System (MS4) community, the Town is proactively engaging in the identification and retrofitting of opportunities to enhance the infiltration and retention of stormwater. This initiative aims to improve localized flooding. However, it's important to note that funding constraints pose a challenge with these stormwater management goals.

Table 4.1. Summary of Existing Protections – Cheshire

Type of Existing Protection	Description	Area Covered	Effectiveness	Improvements Needed
Zoning - Flood Prone Area and Wetlands Overlay District	No dwelling or industrial building nor landfill allowed in Flood Plain; special permit required for new development or alteration or moving of existing structures.	Flood Plain	Effective	Boundaries of overlay district boundaries should be clarified.
Zoning – Flood Hazard District	In floodway all encroachments, including new construction or other development prohibited unless certification by engineer is provided to demonstrate such encroachment shall not result in increase flood levels; special provisions for mobile homes.	Areas designated as Zone A, A1-A2-A4 in the Town of FIRM, and the flood boundary and floodway maps dated July 19, 1982.	Effective	Consider updating zoning to meet standards in MEMA-updated zoning bylaw template.
Zoning - Water Supply Protection District	Prohibits or restricts land uses that threaten quality and safe yield of Town's public water supply.	DEP-approved recharge area Zone I & II as referenced in Zoning Map.	Effective	None
Zoning – Special Permits	Required findings that proposed uses are essential or desirable, not detrimental to neighborhoods or overload public infrastructure; Town may impose conditions to permit; Town may require professional technical review of proposal, paid for by applicant.	Areas where specific uses require Special Permit.	Somewhat effective.	None
Bylaws – Stormwater Bylaw	The Stormwater Bylaw in Cheshire is designed to regulate stormwater management. It assigns enforcement responsibilities to the Conservation Commission, prohibits non-stormwater discharges into the drainage system or waterbodies, and regulates land disturbance of one acre or more within the MS4 area. Larger development	Entire Town	Effective	None

Type of Existing Protection	Description	Area Covered	Effectiveness	Improvements Needed
	projects require a Land Disturbance Permit to address sedimentation, erosion, and post-development stormwater pollutants.			
Building Code	The Town enforces the state building code	Entire town	Effective	None
MA Wetlands Protection Act	The Cheshire Conservation Commission administers the Act to protect Wetland Resources as defined, including floodplains	Wetland Resources as defined by the Act	Somewhat effective	Enforce the Act to reduce flood risk
Stormwater System	The Town has a system of stormwater control.	Entire town	Somewhat effective	Replace/maintain drainage system where flooding occurs.
Invasive Species Management	Major invasives are emerald ash borer which impact threat of trees on powerlines, and aquatic invasives in Cheshire Reservoir.	Entire town	Somewhat effective	Need more wholistic approaches to address aquatic invasives. Town is looking into a phosphorous study for Cheshire Reservoir.
Tree Trimming	The Town works with utilities to maintain overhead branches	Majority of town	Effective	Increased need for tree trimming due to dead ash.
Ditch maintenance	The town regularly maintains their system of ditches.	Entire town	Effective	None
Catch Basin Maintenance	Town has annual cleaning of catch basins	Entire town	Effective	None
Replacement of Small Culverts	The Town has replaced a number of culverts over the past few years as needed.	Entire town	Mostly Effective	Culverts throughout town need upsizing due to increase precipitation. Additional funding is needed to meet road stream crossing standards and due to rising material costs.
Emergency Response	The Town maintains a mostly volunteer fire department, manages a CodeRed emergency alert system and contracts with a private ambulance service from the Town of Adams.	Entire town	Mostly Effective	The Town would like to explore ways to improve recruitment and retention of emergency staff.
Dam Monitoring	Dedicated volunteers from the Hoosac Lake Prudential Committee monitor water levels at the dam spillway	Cheshire Reservoir and Hoosic River	Historically Effective	Volunteers would like more direct contact and cooperation from MA DCR staff to ensure proper maintenance and operation of dam for public safety

Strengths and Challenges

As part of the hazard mitigation planning process, the Town conducted a self-evaluation of its policies, regulations, operations, and emergency preparedness. Additionally, one-on-one interviews were held with key Town officials, department heads and first responders.

The Town's main strengths lie in the resilience and self-reliance exhibited by its residents, complemented by a Yankee spirit of generosity and independence. When faced with a storm, they demonstrate their preparedness and knowledge of what needs to be done. Winters are generally harsh and long, and wind and ice damages can be severe. Services such as stores, fuels or medical care are many miles away, and those who live here are generally equipped to shelter in place if necessary. Also, residents here have a willingness to work together during emergency situations.

One significant strength is the Cheshire Fire Department that has a small but dedicated team of firefighters. Their expertise and experience contribute to the town's ability to handle hazardous situations and protect the community. They have also had considerable success in obtaining grants for equipment. The town has secured funding to acquire essential resources for emergency services and preparedness including portable pumps that are used to help pump out residential basements during major flooding events. However, recruiting, training, and retention are a growing concern as there has been a decline in volunteers over the years. Exploring an Emergency Services Pathway at the high school could help to increase local workforce development.

Additionally, The Fire Department has established a strong partnership with Adams Ambulance Services. This collaboration ensures that prompt and professional medical assistance is available, particularly when volunteer services are not readily accessible. The close working relationship between the fire department and the ambulance services enhances the town's capacity to provide vital medical support during emergencies. Unfortunately, Adams Ambulance, being a private company, faces financial risks due to low federal reimbursement rates. The potential closure of the company could leave the town vulnerable and without immediate access to emergency care, especially with the absence of a hospital within the town.

National Grid is a key partner in Cheshire's emergency response efforts. The cooperative relationship between the town and National Grid allows for efficient communication and coordination during power outages. By providing accurate and timely information on power disruptions, the Town's Chief and emergency response teams can better manage the situation and allocate resources effectively. With approximately 90% of the town connected to National Grid, power outages are typically resolved within a day, minimizing the impact on residents, and ensuring a swift recovery.

In terms of emergency communication, Cheshire has implemented reverse 911 system called CodeRed, employed during extreme storms or emergencies, reaching those who sign up (currently 1617 phones, 80 emails, and 156 text accounts) in the town with critical alerts and instructions. This ensures that residents receive timely information to take appropriate action and stay safe. Moreover, the use of Code Red enhances communication for warnings and non-emergency notifications, keeping residents informed and prepared for potential hazards.

Other areas of great concern are unpaved roads that become dangerous or impassible during wash outs caused by severe storms or during freeze/thaw events and mud season. In general, the Town repairs gravel roads on an annual basis, but overall there has been an increase in the number of freeze/thaw events per year for the past several years, leading to more and longer periods where some roads become impassible to all but very hardy vehicles. For local residents who have lived on these roads for years or decades, mud season is considered as something that has to be endured each spring. In recent years freeze/thaw cycles have become more frequent and severe due to periods of warmer weather, making life more inconvenient for them.

One of the region's greatest challenges is drawing and retaining volunteers for town offices and committees. Decreasing volunteerism in fire and ambulance companies is a common issue across the region and the U.S., due to a variety of trends, among them:

- An increasing elderly population in the county: this increases demand for emergency response.
- Volunteers are aging out: many current volunteers are retiring from their volunteer fire and ambulance positions.
- Economic trends: two-income families are the norm, leaving less free time for volunteerism.
- Increased trainings: there are ever-greater demands for achieving and maintaining fire and medical training and certification, a burden for those with limited time to volunteer.
- Social trends: the able-bodied population of today generally has less time and capacity to volunteer.

The Town of Cheshire is too small to employ a technical staff (e.g. Community Planner, Civil Engineer, etc.) and turns to Berkshire Regional Planning Commission for technical assistance in a variety of disciplines, including data collection, zoning and energy planning, public health and grant writing. Local engineering firms and other technical advisors are hired as needed.

The Town of Cheshire has developed formal planning documents or protocols. A Master Plan was completed in 2017 which outlines an economic development plan and future land use strategy and map. The Town has adopted local "Safe Growth" policies including green building codes, stormwater management and land conservation efforts.

While the Commonwealth owns the Cheshire Reservoir Dam, the responsibility of monitoring weather projections and controlling water levels in anticipation of high precipitation events is undertaken by local volunteers. The few local volunteers who currently conduct these activities have voiced their need for training, guidance and more cooperation from local DCR staff so to create a flood and dam safety program that is secure and has redundancy built into the system.

Prioritizing Actions

Through a public process and open listening sessions, the Hazard Mitigation and Municipal Vulnerability Preparedness core team developed four main priorities which include:

Natural Resource Management

- Implement comprehensive monitoring and cleanup initiatives to maintain the ecological integrity of the Hoosic River.
- Develop and execute a strategic management plan to mitigate the impact of invasive species on local ecosystems.

Stormwater Management

- Conduct a thorough assessment of the townwide stormwater system to identify and rectify issues related to flooding, sedimentation, and illicit discharge.
- Secure necessary funding and procure essential equipment for the Department of Public Works (DPW) to perform regular catch basin cleaning and ensure effective stormwater management.
- Assess bridges for structural deficiencies, compile detailed reports, and explore alternative funding sources to ensure the integrity and safety of the bridge infrastructure.

Roadways

- Evaluate the culvert on Route 116 near the Rt 116/Henry Woods Rd junction to determine necessary measures for enhancing roadway safety and functionality.
- Conduct a comprehensive assessment of all roadways, develop a prioritization plan for repairs and maintenance, and explore funding options for critical equipment necessary to ensure safe travel.

Water Infrastructure

- Assess available funding options for the replacement of outdated water mains and fire hydrants that are no longer functional.
- Upgrade the electronic monitoring system for private wells, groundwater, and freshwater resources, while also modernizing generators and pumps that support the delivery of safe drinking water.

Emergency Services and Preparedness

- Develop and implement a winter program to enhance preparedness and response capabilities for hazardous winter weather conditions.
- Establish and maintain a comprehensive database of contact information for residents, particularly seniors, to ensure prompt assistance during hazardous events.
- Strengthen the emergency services workforce by devising recruitment, retention, and training strategies for qualified personnel and volunteer staff.
- Create a comprehensive management plan for effective beaver control in Berkshire Village/Wells Rd, collaborating with the Conservation Commission and DCR for necessary approvals.
- Enhance public awareness and education programs targeting homeowners in flood-prone areas, incorporating their inclusion in the CodeRED alert system and providing guidance for proactive measures.

Table Explanation

Actions are categorized within primary *Mitigation Types*:

- Local plans and regulations
- Structural projects
- Education, preparedness, and response
- Natural resource protection

Description of Action is the brief summary of the mitigation action the community has identified to reduce their vulnerability to a hazard or more broadly increase resilience.

Benefit explains what the action mitigates or how it increases resilience.

Implementation Responsibility will reflect ownership and/or jurisdiction of a facility or action that will be mitigated or otherwise receive funding for improved resilience.

Priority of a project is High or Medium, determined by factors including conditions due to disaster events and recovery priorities; local resources, community needs, and capabilities; State or Federal policies and funding resources; hazard impacts identified in the risk assessment; development patterns that could influence the effects of hazards; climate change implications, and partners that have come to the table.

Timeframe is listed at Short, Medium, Long, and Ongoing to reflect the timeframe identified for projects through the MVP Community Resilience Building process.

Short: A project that has been identified as short-term is one that can be implemented within the next 1-3 years. These projects are likely to have a favorable benefit-cost outcome, have the political and community support necessary, and are practicable. **Medium** timeframes can be implemented in 3-5 years. **Long-term** projects require multiple steps before implementation, including studies, engineering, and gaining community support, a timeframe that's expected to take between 5 - 10 years. **Ongoing** projects are those that may be implemented immediately but will require constant investment of resources for maintenance or other project requirements such as education.

Cost was estimated and categorized as follows:

High: Over $500,000
Medium: Between $50,000 - $499,999
Low: Less than $50,000
N/A: For some projects, cost is not applicable

Resources and Funding for each action are known or potential technical assistance, materials and funding for the type of project identified.

Table 4.2 provides a roadmap for the Town of Cheshire to increase resiliency and will be updated with the new plan in five years.

Table 4.2. Mitigation Action Plan for the Town of Cheshire

Category of Action	Description of Action	Implementation Responsibility	Timeframe	Priority	Cost	Resources / Funding
Structural projects	Have the town DPW evaluate the culvert on Route 116 (Stream near Rt 116/Henry Woods Rd junction).	Town	1 - 3 years	High	less than $50,000	EOEEA MVP Action Grant, MassDEP 604b and 319 Grant Program, FEMA BRIC
Structural projects	Explore funding options/equipment procurement to allow DPW to perform scheduled catch basin cleaning (currently a contractor is hired to perform work).	Town	1 - 3 years, ongoing	High	less than $50,000	319 Grant Program
Structural projects	Assess stormwater system townwide to document issues related to flooding, sedimentation, and illicit discharge	Town	1 - 3 years, ongoing	High	less than $50,000	EOEEA MVP Action Grant, MassDEP 604b and 319 Grant Program, FEMA BRIC
Structural projects	Replace Main Street Bridge and Raise Structures in the Berkshire Village	Private	5 - 10 years	High	over $500,000	EOEEA, Municipal Small Bridge Program
Natural resource protection	Keep the Hoosic River clean	Town	ongoing	Low	less than $50,000	Support from outside partners such as the Hoosic River Watershed Association
Structural projects	Assess bridges for deficient structures, compile bridge reports and assess funding alternatives	Town	1 -3 years	High	Between $50,000 - $499,999	Municipal Small Bridge Program
Structural projects	Coordinate with State to replace/enlarge Kitchen Brook bridge and Bridge along Route 8	Town, state	ongoing	Medium	N/A	Municipal Small Bridge Program

Category of Action	Description of Action	Implementation Responsibility	Timeframe	Priority	Cost	Resources / Funding
Structural projects	Conduct Notch Rd bridge bank stabilization interventions at intersection	Town	3 -5 years	High	over $500,000	FEMA Hazard Mitigation Grant, DER Restoration Grants, Berkshire Clean, Cold, and Connected Technical Assistants
Local plans and regulations	Regularly review bridge status	Town	3- 5 years, ongoing	Medium	less than $50,000	MassDOT, CDBG, TIP
Structural projects	Assess all roadways, develop a prioritization plan for fixing all roadways in need of repair, and assess funding and design options for fixing/maintaining gravel roads that need work or that need to accommodate higher levels of throughput traffic.	Town	3- 5 years	Medium	less than $50,000	Chapter 90 Funding
Education, preparedness, and response	Explore winter gravel road program	Town	1 -3 years, ongoing	High	less than $50,000	Chapter 90 Funding
Structural projects	Assess funding options for replacing old water mains and fire hydrants that do not work.	Town	1 -3 years, ongoing	High	over $500,000	FEMA BRIC
Structural projects	Upgrade electronic system to monitor water levels for private wells , groundwater and freshwater along with upgrades to generators and pumps that supply drinking water	Town	1 -3 years, ongoing	High	Between $50,000 - $499,999	FEMA Hazard Mitigation Funding, MassDEP State Revolving Loan Fund, Mass Clean Water Trust
Education, preparedness, and response	Conduct study to determine water table and private well vulnerability	Private, Town, State	1 -3 years, ongoing	High	less than $50,000	EOEEA MVP

Category of Action	Description of Action	Implementation Responsibility	Timeframe	Priority	Cost	Resources / Funding
Local plans and regulations	Continue exploring a back-up water supply that would be made available through an 'interconnection' with the Town of Adams.	Town, State	5 -10 years	High	less than $50,000	EOEEA MVP
Local plans and regulations	Develop maintenance program and replacement for aging Town owned buildings and undertake more frequent maintenance of town owned buildings	Town	1 -3 years	High	less than $50,000	CPA, DOER, EOEEA, MHC, MassCFF, MassDHCD
Structural projects	Explore funding options to maintain and replace equipment - especially equipment that is vital for the DPW to perform necessary work that facilitates safe travel of the roads.	Town	1 -3 years	High	less than $50,000	Town Public Works General Budget
Education, preparedness, and response	Communicate with National Grid on preventing pruning and pole replacements	National Grid	3- 5 years, ongoing	Medium	over $500,000	No funding required
Structural projects	Facilitate MA DCR & Office of Dam Safety discussion on Cheshire Reservoir Dam operations, Change agreement on operation of dam to the state take over maintenance & operation of dam; confirm hazard class, size and dam condition in EAP; provide training for volunteers	DCR, MA Dam Safety, Lake District, Town	1 -3 years	High	less than $50,000	No funding required
Education, preparedness, and response	Investigate utilizing GIS software to map out all the town assets, including drainage, streets, telephone polls, roadway signs, ecologically significant areas, etc.	Town	1 -3 years	Medium	less than $50,000	MassDOT, Federal Geographic Data Committee (FGDC)/ National Spatial Data Infrastructure (NSDI), EPA, DNR

Category of Action	Description of Action	Implementation Responsibility	Timeframe	Priority	Cost	Resources / Funding
Education, preparedness, and response	Raise awareness of impacts and financial aid on septic system repairs, updates, failure prevention	Town	5 - 10 years	Medium	less than $50,000	EOEEA MVP grant, MassDEP 604b grant, DPW general funds
Structural projects	Conduct needs and Cost Benefit Analysis of utilizing Adams WWTP for septic system management	Town	5 - 10 years	Low	less than $50,000	MassDEP 319 grant funds, Mass Community Septic Mgmt program,
Natural resource protection	Coordinate efforts with DCR and secure recurring state funds on invasive species management for rattle snakes, aquatic & shoreline invasive species at Cheshire Reservoir / Hoosac Lake	Town/DCR/Lake District	ongoing	Low	Between $50,000 - $499,999	MassWildlife Habitat Management Grant Program, MDAR, Mass Environmental Trust
Education, preparedness, and response	Ensure town staff/emergency services within town are prepared and have training to deal with snake bites and other dangerous wildlife interactions. Conduct educational campaign related to invasive species management control.	Town/DCR/Lake District	ongoing	Medium	less than $50,000	FEMA Emergency Management Performance Grant, Con Com volunteer hours
Structural projects	Stream gauges need to be updated - from a technological standpoint.	State	5 -10 years, ongoing	High	Between $50,000 - $499,999	MassDEP water quality monitoring grant, EOEEA MVP and state planning grants
Natural resource protection	Assess locations for invasives (Emerald Ash Borer, etc.) and develop invasives management plan and explore additional funding for Cheshire's Tree Warden to perform much needed brush clearing	Town	5 - 10 years, ongoing	Medium	Between $50,000 - $499,999	MassWildlife Habitat Management Grant Program
Natural resource protection	Apply for grant for NPS Study - focus on nutrient input & bacteria; secure funding for water quality testing.	Town, Partner w/ Lake District, Lanesborough	1 - 3 years	High	Between $50,000 - $499,999	319 Grant Program, EOEEA MVP

Category of Action	Description of Action	Implementation Responsibility	Timeframe	Priority	Cost	Resources / Funding
Natural resource protection	Develop a beaver management plan for Berkshire Village/Wells Rd and Work with Conservation Commission and DCR on control methods and approvals.	Town, Private	ongoing	Medium	Between $50,000 - $499,999	EOEEA Planning Grants
Local plans and regulations	Inquire to DOT how town can restrict hazardous materials travel.	Town, MA DOT	3 - 5 years	Low	less than $50,000	No funding required
Structural projects	Redesign the Transfer station site near the river to avoid adverse ecological impact	Town	1 -3 years	High	over $500,000	EOEEA MVP and Technical Assistance, Clean Water Act 319 Funding, MassdEP MS4 Assistance Grant, Town Capital Improvement Budget
Education, preparedness, and response	Explore ways to recruit, retain, and train emergency workers and volunteer staff and Develop Emergency Services Pathway at high school, with EMT and Jr. Firefighters.	Town	ongoing	High	Between $50,000 - $499,999	FEMA Emergency Management Performance Grant
Education, preparedness, and response	Purchase more portable pumps for the Fire Dept to assist with pumping flooded basements	Town	ongoing	Medium	less than $50,000	FEMA Emergency Management Performance Grant
Education, preparedness, and response	Obtain contact information from residents (particularly seniors) that might be 'isolated' after a hazardous event. Put flyers out and explore additional lines of communication to encourage all to sign up for CodeRED. Explore other avenues of communication for those with limited technological capabilities. Determine if detailed medical needs (oxygen, others) are part of the COA's Wellness Check program.	Town/COA, Em Man Comm	ongoing	Medium	less than $50,000	FEMA Emergency Management Performance Grant Council on Aging Budget

Category of Action	Description of Action	Implementation Responsibility	Timeframe	Priority	Cost	Resources / Funding
Education, preparedness, and response	Improve education and data collection. Add all homeowners in flood-prone inundation area's into CodeRED alert system.	Town	1- 3 years	Medium	less than $50,000	EOEEA MVP Program, FEMA Emergency Management Performance Grant
Education, preparedness, and response	Regionalize and increase municipal payments for Ambulance services. Tell Congress to increase Medicare/Medicaid reimbursement rates.	Private	ongoing	Medium	Between $50,000 - $499,999	District Local Technical Assistance Grant
Local plans and regulations	Create an agreement with the Hoosic Valley School District to use the High School/Middle School as an emergency shelter. Identify emergency shelter location that is easily accessible for all or most residents and can provide accommodations for evacuees (kitchen, sleeping arrangements, bathrooms, showers, back-up generator, stockpile of emergency supplies and other necessary equipment).	Town	1 - 3 years	High	less than $50,000	No cost required
Structural projects	Build new emergency operations center at old school (tear down old section).		5 - 10 years	High	over $500,000	EOEEA Grants and Technical Assistance, Town Capital Improvement Budget
Local plans and regulations	Establish protocols for opening and operating Community Center during flooding events		5 - 10 years	Low	less than $50,000	FEMA Emergency Operation Center Grant

CHAPTER 5: PLAN ADOPTION

44 CFR § 201.6(c)(5)

This Plan received official Approval Pending Adoption from FEMA on DATE and was formally adopted by the Cheshire Board of Selectmen on DATE. Subsequently it received final approval from FEMA on DATE.

CHAPTER 6: PLAN MAINTENANCE

44 CFR § 201.6(c)(4)

44 CFR § 201.6(c)(4) asks for a section of the HMCAP to describe the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle, process by which Cheshire will incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate, and how the community will continue public participation in the plan maintenance process (44 CFR § 201.6(c)(4)(iii)).

Plan Review and Updates

§201.6(c)(4)(i) (iii)

The Town of Cheshire will officially review needed updates for the plan on an annual basis. Specifically, the Hazard Mitigation and MVP Planning Committee will take the lead, inviting stakeholders, and partners to help maintain and update the mitigation action tables, complete site visits and produce reports of completed or initiated mitigation actions to incorporate into the next plan revision, research and document new disaster information, and participate in resiliency- and mitigation-related initiatives available to the region.

Bi-annual review is scheduled to occur once this HMCAP has been approved by FEMA. Under the leadership of the Select Board members and the Hazard Mitigation/MVP Planning Committee, the Town will track updates based on completed mitigation actions, new development, changing problem areas, and input from public involvement. As needed on an annual basis, these updates will be shared with BRPC, which maintains a county-wide GIS data.

In reaching out to the residents and neighbors of Cheshire, the Hazard Mitigation Planning Committee began building a network of interested residents that can enhance the next update. While the Hazard Mitigation Plan must be updated every five years, Cheshire will begin the process of organizing and identifying funding for the plan update 1.5 years before this plan expires. Recommendations listed in the FEMA Review Tool (following page) will be considered.

Incorporation with Other Planning Documents and in Future Planning

§201.6(c)(4)(ii)

The Town of Cheshire is a small, rural community with a limited number of formal planning documents. However the Town is proud to have completed a Master Plan in 2017, which provided a valuable and recent planning document. Many actions found herein build upon those voiced in 2016-17, particularly those focused on infrastructure, town services and natural resource protection. Cheshire's Open Space and Recreation Plan is slightly dated but provided background on efforts to conserve open space and protect natural resources, the results of which can support nature-based hazard mitigation., Numerous documents regarding management of Cheshire Reservoir, both the lake ecosystem and dam operations and maintenance, were also referenced to aid in assessing risk to the community.

This updated and localized HMCAP will be used in all future planning efforts in Cheshire including comprehensive plan updates, transportation plans, zoning changes, and the update of the Emergency Management Plan (as described in the Action Table) within 3-5 years. This HMCAP will also serve as the Town's Municipal Vulnerability Preparedness report.

The final adopted HMCAP will be become a formal planning document housed within the offices of Town department heads and will be made publicly available on the Town of Cheshire's website for reference and comment. Any regional plans developed by BRPC or the Commonwealth should refer to the publicly available Cheshire Hazard Mitigation and Climate Adaptation Plan to ensure consistency with the vision for community resilience to hazards.

FROM SECTION 2 OF THE LOCAL MITIGATION PLAN REVIEW TOOL ISSUED BY FEMA, Dated

PLAN ASSESSMENT – INSERT FEMA FINAL COMMENTS HERE

A. Plan Strengths and Opportunities for Improvement. This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Recommended Corrections:

- N/A

Major References:

Berkshire Regional Planning Commission (BRPC), 2012. *Berkshire County Hazard Mitigation Plan*, Pittsfield, MA.

Centers for Disease Control and Prevention (CDC), 2021. Vector-Borne Diseases. Retrieved from https://www.cdc.gov/ncezid/dvbd/about.html

Commonwealth of Mass., 2021. Resilient MA Climate Clearinghouse website, https://resilientma.org/. This website hosts relevant data used throughout this plan, including the NE CASC data.

Community Resilience Building, date unknown, *Community Resilience Building Workshop Guide,* www.CommunityResilienceBuilding.org.

Department of Conservation and Recreation, 2020. *Massachusetts State Forest Action Plan,* Clinton, MA.

Haight, Robert; Cleland, David; Hammer, Roger; Radeloff, Volker and Rupp, Scott; 2004. "Assessing Fire Risk in the Wildland-Urban Interface," *Journal of Forestry*.

Massachusetts Department of Public Health. Massachusetts Arbovirus Update Maps. Retrieved from https://www.mass.gov/info-details/massachusetts-arbovirus-update

Mass. Emergency Management Agency (MEMA) & the Exec. Office of Energy and Environmental Affairs (EOEEA), 2013. *Massachusetts State Hazard Mitigation Plan (SHMP),* Boston, MA.

Mass. Emergency Management Agency (MEMA) & the Exec. Office of Energy and Environmental Affairs (EOEEA), 2018. *Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP),* Boston, MA.

Resilient MA Climate Change Clearinghouse for the Commonwealth, resilientma.org, 2021.

APPENDIX A:

OUTREACH, PUBLIC PARTICIPATION

& SURVEY RESULT

Help Cheshire with our

Hazard Mitigation Plan

The Town of Cheshire is creating a
Hazard Mitigation and Municipal Vulnerability
Preparedness Plan to better prepare for natural disasters.
Help us out by taking less than 10 minutes on the survey below!


CHESHIRE HAZARD MITIGATION & MUNICIPAL VULNERABILITY PREPAREDNESS PLAN
WE WANT YOUR FEEDBACK!
FILL OUT THE SURVEY
It takes less than 10 minutes and helps the committee identify problem areas.
Go to www.surveymonkey.com/r/CheshireMVP
Paper copies available at the Senior Center, Town Clerk and Library
ATTEND THE LISTENING SESSION
To learn more about Cheshire's Hazard Mitigation and MVP planning. Come to the online listening session on
Monday, March 14 at 7pm.
To register email Courteny Morehouse at cmorehouse@berkshireplanning.org

Preparing for Natural Disasters –

We Want to Hear from You!

The Town of Cheshire has received grant funding from the State Municipal Vulnerability Preparedness (MVP) program to learn about our changing weather and develop a Natural Hazard Mitigation and Climate Adaptation Plan. As part of this project, we want residents to share with us their experiences of surviving past severe storm events in Cheshire. **Please fill out a short survey for us!** This online survey will only take a few minutes and can be found at www.surveymonkey.com/r/CheshireMVP. Paper copies of the survey can be found at the Cheshire Senior Center, Town Clerk's Office, and the Library. Your answers about past and recent storm occurrences will help us document storm events that have impacted Cheshire residents.

Warming trends are altering our weather patterns, creating unstable conditions that send us more severe storm events that challenge us as a community. Hazard mitigation is a term that describes an action taken to reduce the harm that natural disasters have on people and property – it is the up-front work to mitigate or reduce the impacts of a disaster when it strikes. Mitigation is pro-active, rather than reactive, and is an action taken to solve a problem on a permanent, long-term basis. An adopted Hazard Mitigation and Climate Adaptation Plan will make Cheshire eligible for state and federal funding to implement hazard actions. Examples of hazard actions that some Berkshire towns have taken to protect infrastructure or government operations include:

- Replacing undersized culverts with larger ones to reduce the risk of flooding or road washouts
- Upgrading road drainage systems to handle higher volumes of road runoff during severe storms
- Moving critical records and communication systems out of the basement to higher, less flood-prone floors
- Expanding emergency communication systems to alert people of impending storms or disasters
-

The Cheshire Hazard Mitigation Plan will lay out a strategy to help the Town lessen the impacts that natural disasters and changing weather patterns are predicted to have on residents and the natural world. As part of our work, the project will:

- Gather and assess the best scientific data that is relevant to Cheshire and the Berkshires
- Identify the strengths within the Town to meet and adapt to the challenges ahead
- Identify the weaknesses within the Town that hold us back from adapting to the challenges
- Prioritize realistic action steps that can be taken to create a more resilient community

If you have stories or photographs that might be informative, please contact the Town's consultant, Courteny Morehouse at cmorehouse@berkshireplanning.org or Town Administrator, Jennifer Morse at jmorse@cheshire-ma.gov. Updates of the project will be posted on the Town website and Facebook pages. **A public presentation to discuss initial findings of the project will be given on Monday, March 14 at 7pm.** To RSVP email Courteny Morehouse at cmorehouse@berkshireplanning.org. Registration link can also be found on the Town website.

Written by Lauren Gaherty and Courteny Morehouse from Berkshire Regional Planning Commission. BRPC is helping the Town of Cheshire put together their Hazard Mitigation and Climate Adaptation Plan.

Town of Cheshire
March 14, 2022

Please join us tonight: Cheshire Hazard Mitigation/MVP listening session. After registering , you will receive a confirmation email about joining the meeting. This Information and Listening Session will go over the planning process the Town of Cheshire is doing. The Hazard Mitigation Plan and Climate Adaptation plan works to prepare the Town of Cheshire for disasters before they happen. If you haven't already please take 10 minutes to fill out the survey to help the town better characterize hazards: www.surveymonkey.com/r/CheshireMVP

1

1 share

Cheshire Hazard Mitigation & Municipal Vulnerability Preparedness Survey

The Town of Cheshire needs your input on natural hazards and the impacts of changing weather. Please take a few minutes to answer a few questions. Natural hazards pose a risk to people and property, examples of which are flooding, severe rain or snow storms, tornados, drought and heat waves.
The Town of Cheshire is developing a Hazard Mitigation Plan & Municipal Vulnerability Preparedness Plan to: identify risks, both manmade and natural; reduce the loss of life, property, and infrastructure, and environmental and cultural resources from disasters and the impacts of changes in extreme weather events through a comprehensive mitigation program that includes planning, prevention and preparedness strategies. Your responses will help guide the Town through the planning process.
Survey can also be found online at: **https://www.surveymonkey.com/r/CheshireMVPSurvey**.

What is Hazard Mitigation & Municipal Vulnerability Preparedness?

Hazard Mitigation is the first step in identifying disasters and preparing for them through actions. It is the up-front work to mitigate or reduce the impacts of a extreme weather when it strikes. Municipal Vulnerability Preparedness or MVP planning focus specifically on climate related impacts with the goal of implementing actions to help better prepare for future climate conditions. The mitigation actions are pro-active, rather than reactive, and is an action taken to solve a problem on a permanent, long-term basis.

Some possible MVP actions include:

- Replacing an undersized culvert or bridge with a larger one to reduce the risk of flooding or road washout
- Upgrading road storm drain systems to handle higher volumes of water
- Making a plan of action to control invasive species such as water chestnut and phragmites around Lake Hoosac
- Having communications systems and plans in place to shelter people during heat waves or severe storms
- Addressing issues with the dam to prevent failure
- Creating forestry management plan for drinking water resource area to ensure clean drinking water.

A Hazard Mitigation & MVP Plan is the final product of this “pre-disaster” planning effort. Once complete the Hazard Mitigation and MVP Plan goes to both FEMA and Massachusetts State Executive Office of Energy & Environmental Affairs for approval. Having a preparedness plan in place serves as a guide for future hazard mitigation actions and makes the Town more competitive for some federal and state grant funding programs.

Interested in learning more? Join us **Monday, March 14 at 7pm** for a Public Listening Session. Register by emailing Courteny Morehouse – cmorehouse@berkshireplanning.org

Questions:

1. What street/area of Cheshire do you live in? ____

2. Have you witnessed severe natural weather or disasters in Cheshire?

   ☐ Yes
   ☐ No

3. If yes to Question 2, when and where did the events occur? Please be as specific as possible to help town officials understand how events impacted you.

   ____

   ____

   ____

   ____

4. What hazards concerns regarding changing weather patterns and hazards in Cheshire? Choose and rank the top three *hazards, by placing a number 1, 2 or 3 in the box next to the top hazards. Place a 1 next to the hazard of greatest concern to you, 2 next to your second greatest concern, and 3 next to your third greatest concern.*
   a. Flooding or washouts of roads due to storms
   b. Flooding or washout due to dam failure
   c. Severe winter weather (snow, blizzards, ice storms, etc.)
   d. Other severe storms (high winds, thunderstorms, hurricanes/tropical storms)
   e. Extreme heat
   f. Extreme cold
   g. Drought
   h. Tornadoes
   i. Landslide or earthquake
   j. Freeze/thaw cycle (mud season)
   k. Vector-borne diseases (rodents, ticks, mosquitos, etc.)
   l. Poor forest health – dead trees
   m. Invasive species
   n. Habitat loss

5. What are your greatest concerns about the hazards that you ranked in Question 4? *Choose and rank the top three hazard impacts, with 1 being of greatest concern, 2 the next greatest concern, and 3 the next concern.*

   a. Not being informed in impending disasters

b. Injury or loss of life
c. Loss/damage to property
d. Loss of electricity
e. Becoming isolated/stranded
f. Loss of communication
g. Inability to access health care
h. Loss of work
i. Decreased quality of life
j. Other

6. If you listed "Other" in Question 5 as a top three hazard impact, please describe what your concern is.

____

____

____

____

7. Are there areas of Cheshire that you believe are most at risk? If so please provide additional information below.

____

____

____

8. Have you ever had issues with your private well (for example running dry or contamination)? Or do you know of issues with private wells in your area? If so, in the box below please provide information on when and for how long this occurred?

____

____

9. If you would like to provide more information about the issues you've raised in this survey, please provide your email or phone number below and we will contact you to discuss the issues in more detail.

____

10. If you would like to be kept apprised of how the hazard mitigation project is progressing, please provide your email or phone number below and we will add you to the project's public announcements notification list.

____

Please return your completed survey to Town Clerk, Senior Center or Library Staff.

THANK YOU!

Cheshire Hazard Mitigation and MVP Planning

Public Listening & Info Session

Courteny Morehouse
Berkshire Regional Planning Commission
March 14, 2022

BRPC

1

Goals for Tonight's Meeting

1. Introduce Hazard Mitigation (HM) and Municipal Vulnerability Preparedness (MVP) Planning
2. Review hazards impacting Cheshire
3. Gather input on hazards and infrastructural, societal and environmental vulnerabilities

2

Hazard Mitigation & Vulnerability Preparedness Plan

HAZARD MITIGATION (HM)
- FEMA
- Reduce loss of life and property by mitigating impact of hazards

\+

MUNICIPAL VULNERABILITY PREPAREDNESS (MVP)
- MA EOEEA
- Plan and take action to become more resilient to the climate change

=

COMBINED HAZARD MITIGATION & MUNICIPAL VULNERABILITY PREPAREDNESS PLAN

BRPC

3

Hazards to Consider Evaluating

BRPC

4

Notable Berkshire Events

Hoosic River Floods – 100-year storms
- 1938 -- Adams & North Adams – 2 deaths, many injuries
- 2011 -- Loss of The Spruces

Dam failures
- 1886 -- Mud Pond Dam – Lee – 7 deaths; 1968 – 2 deaths
- 1901 -- Basset/Dean's Dam – Adams – 1 death

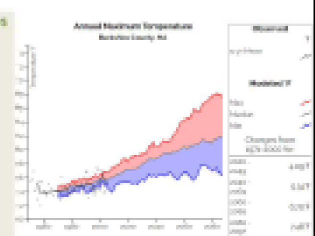
Tornadoes
- 1973 -- W. Stockbridge – 4 deaths, 36 injured
- 1995 -- Great Barrington – 3 killed, 24 injured

Tick-borne Lyme -- disease 95% increase 2005-2016 in County

Wildfires -- 2015 (272 acres); 2021 (947 acres)

5

What is Happening Now?



BRPC

6

Invasive Species, Pests, & Vector-Born Illnesses

Japanese knotweed, a plant well adapted to tropical climates, crowd out native wetland species and are the perfect habitat for ticks.

The life cycle of ticks are strongly influenced by temperature. Warmer winters mean less winter die off in tick populations that carry lyme disease and other tick-borne illnesses.

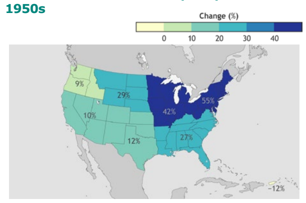
- Non-native likely favored warmer weather due to ability to adapt easily to new environments and tolerance for extreme, fluctuating, and disturbed conditions
- Extreme weather events may increase the dispersal of invasive species to new regions via transportation of seeds, larvae and small animals
- Freezing winter temperatures are critical in limiting outbreaks and expansion of invasive plants and forest pests
- Pests such as ticks and mosquitos better adapted to more temperate and humid environments, more likely to thrive in the longer "shoulder" seasons

BRPC

7

Storms are becoming more Extreme, Frequent, and Lasting Longer

55% Increase in Ext eme precip ta on s nce 1950s



Increased # of precip tat on events s nce 1970s

BRPC

8

Stream Flashiness

- Stream flashiness reflects the frequency and rapidity of short term changes in stream flow in response to storm events
- Flashiness can cause:
  - Erosion
  - Loss of aquatic habitat/life
  - Lead to culvert blowout

Cheshire's Windsor Road washout

Black Brook Rd. in Savoy four years after Irene.

BRPC

9

Flooding & Storms

Flooding at Main St. in Cheshire during Hurricane Irene

Central Cheshire Green areas are in the Flood Zone

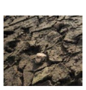
BRPC

10

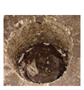
Changes to Winter Weather

Warmer t mperat res lead to...

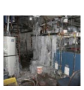
LESS SNOWPACK



Dryer spring soils



Less groundwater recharge

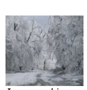


Increased risk of frozen pipes

MORE RAIN-ON-SNOW EVENTS

Increased runoff

ICE RISKS



Increased ice storms

Increased ice jams

BRPC

11

Freeze/Thaw Cycles

Route 8 near Kitchen Brook. Freeze thaw cycles can cause ice jams as rapid decrease in temperature paired with rain storms flood infrastructure

- Warmer weather impacts winters the most as there is an increase in swing between cold and warm weather conditions
- Impacts of an increase in freeze/that cycles include:
  - Change in snow pack quality (icier and harder)
  - Root death: depletion of soil structure and nutrients
  - More potholes: roads that are more expensive to repair

BRPC

12

Drought

Springfield Park Bush Fire in April 2017 during the Massachusetts 48-week drought.

- Despite more intense rain events, the increased temperature evaporates moisture more quickly
- Droughts can:
  - Spark wildfires
  - Lead to toxic algae outbreaks
  - Dry out soils which will decrease plant growth and productivity
  - Reduce water availability and habitat for aquatic species

BRPC

13

Hazard Mitigation & MVP Planning Proposed Timeline

Key Elements/Deliverables	Dates (2022)
2 Public Info/Lis en ng Sessions	March & July
Town Wide Workshop (MVP)	June
Public Comment Pe iod on HM/MVP Plan	July
Final Plan Adopt on	September

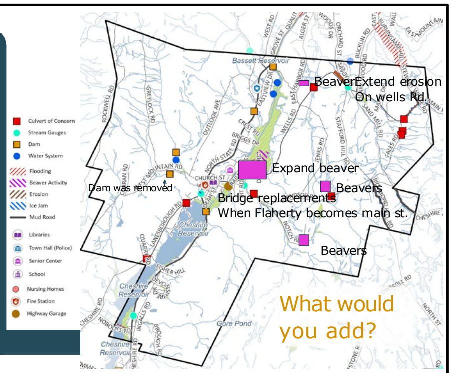
***Opportunit es to engage in all of these steps! Update w ll be posted to Town webs te**

BRPC

14

Cheshire Areas of Concern

What have been Cheshire's biggest storms, floods, natural disasters?



15

Questions & Input

Interested in participating?
Contact Courteny Morehouse at
cmorehouse@berkshireplanning.org

www.berkshireplanning.org

Help us out! Fill out the survey at
surveymonkey.com/r/CheshireMVP

16

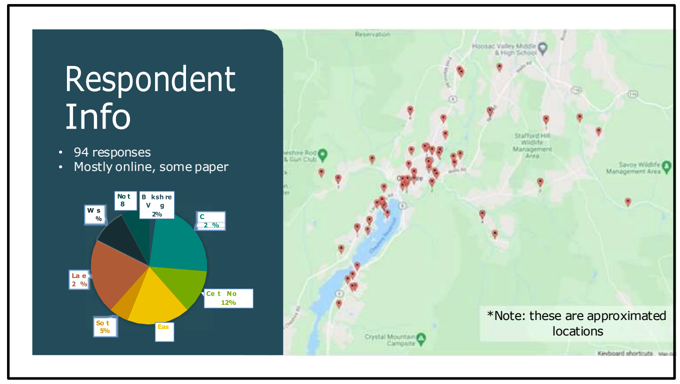
Participants (16)

Find a participant

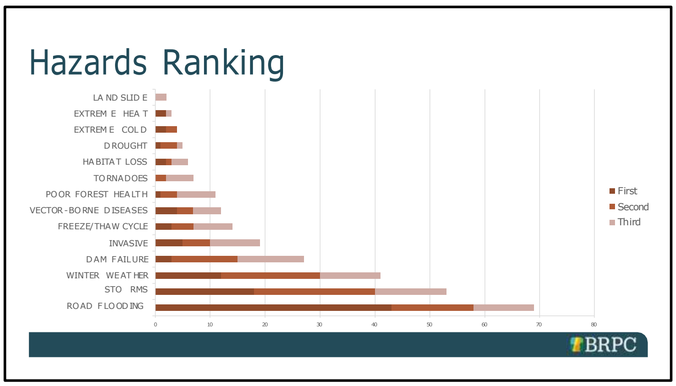
- CM Courteny Morehouse, Berkshire Pla... (Host, me)
- ES Edward Skowron
- RB Robert Balawender
- WL WILLIAM LEWIS
- AL Ali Lancia
- B Brian Rhodes
- EQ Eileen Quinn
- JK Jan Kuniholm
- JM Jennifer Morse
- JK Joan Kurpaska
- LK liseann karandisecky
- MF Michelle Francesconi
- PT Peter Traub
- RN robert navin
- SM Sandra Miller
- WM William Moriarty


Survey says…
Hazard Mitigation & MVP Survey Results
Cheshire, MA
Courteny Morehouse
BRPC
Berkshire Regional Planning Commission

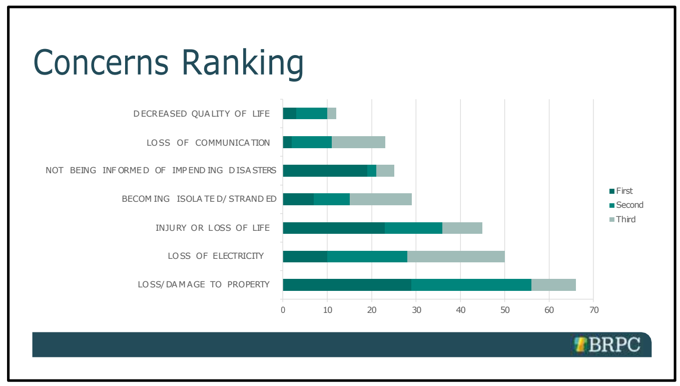
1


Respondent Info
• 94 responses
• Mostly online, some paper
*Note: these are approximated locations

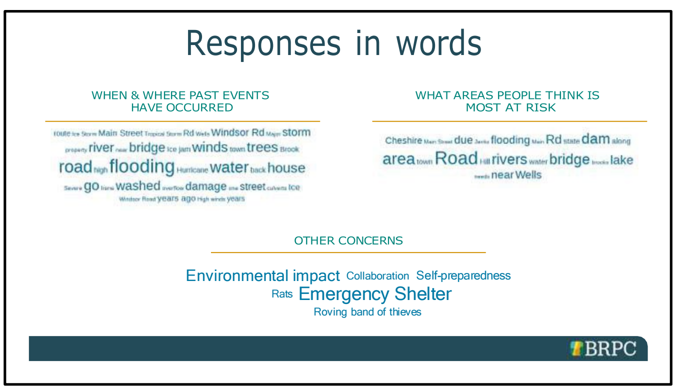
2


Hazards Ranking
LANDSLIDE
EXTREME HEAT
EXTREME COLD
DROUGHT
HABITAT LOSS
TORNADOES
POOR FOREST HEALTH
VECTOR-BORNE DISEASES
FREEZE/THAW CYCLE
INVASIVE
DAM FAILURE
WINTER WEATHER
STORMS
ROAD FLOODING
First
Second
Third
BRPC

3


Concerns Ranking
DECREASED QUALITY OF LIFE
LOSS OF COMMUNICATION
NOT BEING INFORMED OF IMPENDING DISASTERS
BECOMING ISOLATED/STRANDED
INJURY OR LOSS OF LIFE
LOSS OF ELECTRICITY
LOSS/DAMAGE TO PROPERTY
0
10
20
30
40
50
60
70
First
Second
Third
BRPC

4


Responses in words
WHEN & WHERE PAST EVENTS HAVE OCCURRED
WHAT AREAS PEOPLE THINK IS MOST AT RISK
OTHER CONCERNS
Environmental impact Collaboration Self-preparedness
Rats Emergency Shelter
Roving band of thieves
BRPC

5


Thoughts?
www.berkshireplanning.org

6

Cheshire's Hazard Mitigation & Municipal Vulnerability Plan Listening Session Coming Up:

Since Fall 2021, the Cheshire has been putting together a Hazard Mitigation and Municipal Vulnerability Preparedness (MVP) Plan. This plan addresses the impact of natural disasters and changing weather patterns. To date, a Core Team has formed including folks from Fire and Police, Town Administration, the Hoosac Lake District, and Highway Dept. This group of folks has met almost every other week for the past year to identify hazards and vulnerabilities and develop a plan.

In early June, the Core Team organized a stakeholder workshop and brought in key leadership including the water department, Hoosac Valley School District, Lake District representatives, Select Board members, emergency personnel, Conservation Commission, Planning Board, and Finance Committee. Holed up in the Fire Department's Training Room on a beautiful day for this all-day event, participants came up with a prioritized list of actions that would better prepare the Town during the next big storm or other disaster.

Actions identified and included in an adopted final plan make Cheshire eligible for grant funding both at the State level through the MVP Program and for federal FEMA grants. But first, we need your input! The Core Team chose three top priorities for the Town when it comes to hazard resilience. It's crucial that we get your vote and feedback on these actions. Your input will go into the plan and help decide what actions the Town finds funding for. To do this we invite you to come to one of the upcoming public listening sessions.

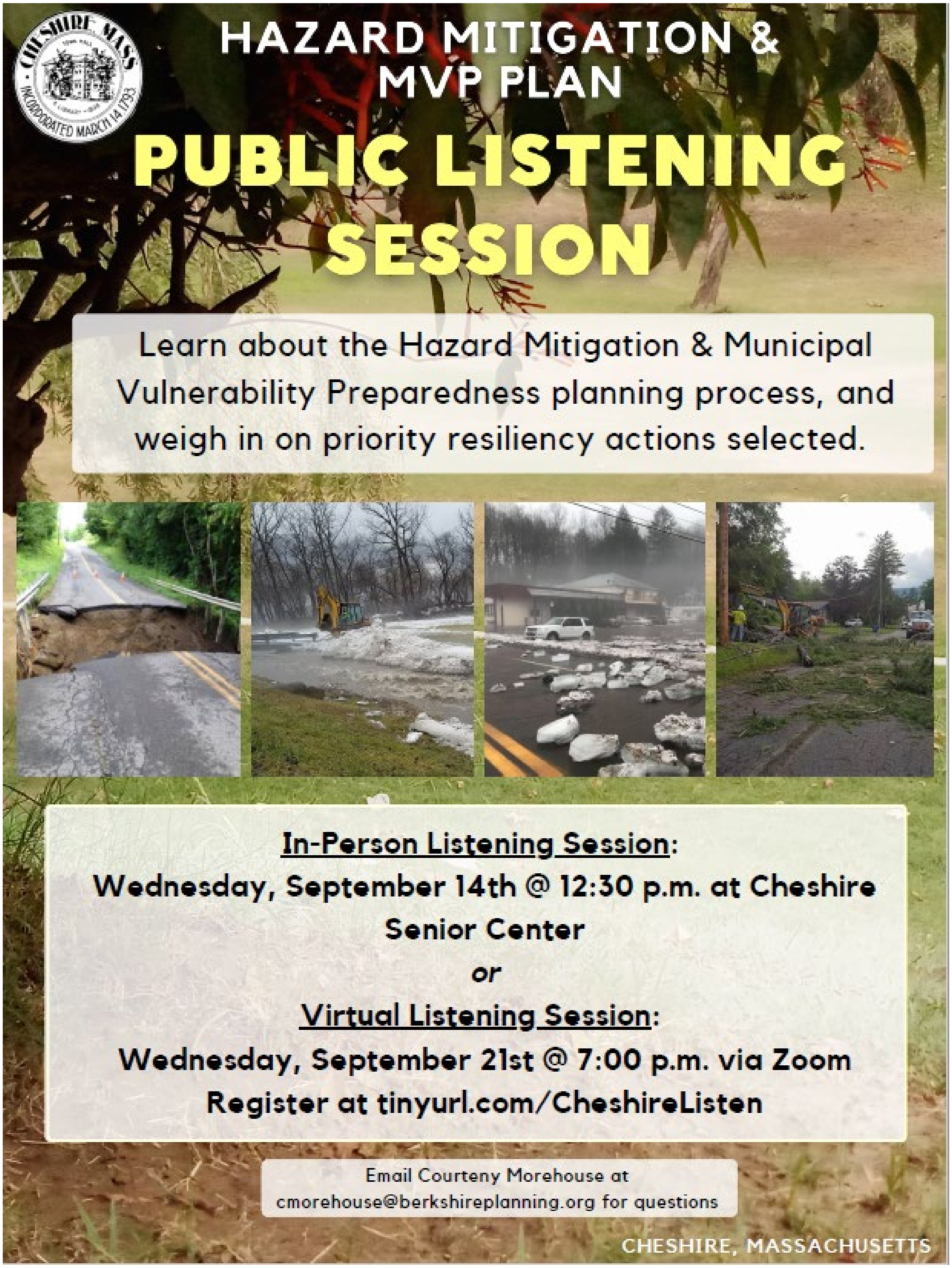
Two Upcoming Listening Sessions

- In-person: September 14th at 12:30 pm at the Senior Center
- Online - September 21st at 7pm via Zoom. Register with the following link: https://tinyurl.com/CheshireListen

You'll learn more about the planning process and have an opportunity to give us your feedback. We hope to see you there!

Dedicated community members, leaders come together to create a plan.

Cheshire Lions Club - The Cheshire Lions Club remains an active contributor to our community during these trying times. We are always looking for new members. Among our contributions, we support ongoing eye research efforts. We have also supported numerous local organizations such as the Youth Center, the Friends of the Cheshire Council on Aging, the Cheshire Fire Department and various charitable organizations and athletic teams. We donate annual scholarships to Cheshire graduates from Hoosac Valley High School, McCann Technical School and BART. Every year, during the Christmas season, we conduct our Give A Gift program to provide those in need, local families and seniors, with Christmas gifts. Our club also installs and cares for the American flags located throughout the town. If you are interested in joining or would like more information or have any questions, please contact Ed St. John at 413-743-5603 or email to estjohn1@roadrunner.com.


HAZARD MITIGATION & MVP PLAN
PUBLIC LISTENING SESSION
Learn about the Hazard Mitigation & Municipal Vulnerability Preparedness planning process, and weigh in on priority resiliency actions selected.
In-Person Listening Session:
Wednesday, September 14th @ 12:30 p.m. at Cheshire Senior Center
or
Virtual Listening Session:
Wednesday, September 21st @ 7:00 p.m. via Zoom
Register at tinyurl.com/CheshireListen
Email Courteny Morehouse at cmorehouse@berkshireplanning.org for questions
CHESHIRE, MASSACHUSETTS

Attend the Listening Session

Hazard Mitigation & MVP Plan

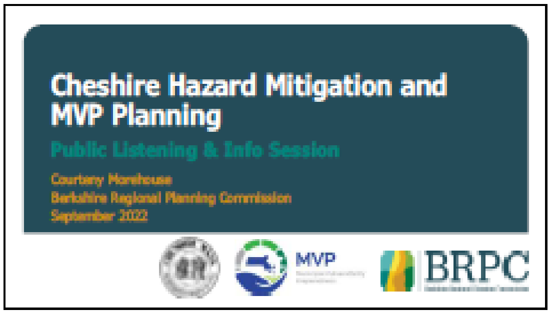
Hear about updates to Hazard Mitigation/MVP planning process and weigh in on priority actions selected.

In-Person Public Listening Session:
Wednesday, 9/14/22 @ 12:30 p.m. at the Senior Center (119 School Street).

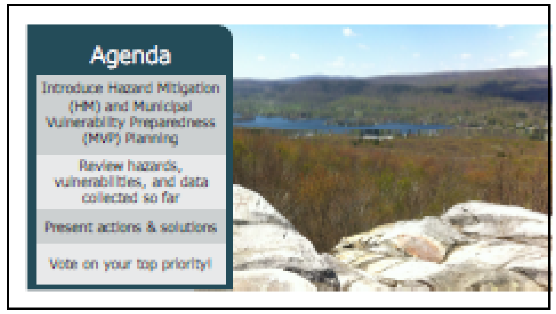
Virtual Public Listening Session:
Wednesday, 9/21/22 @ 7:00 p.m. via Zoom. Register at tinyurl.com/CheshireListen.


Town Calendar
September
S M T W T F S
1 2 3
4 5 6 7 8 9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30
Council on Aging Meeting
September 21, 2022 - 1:30pm
Finance Committee Meeting
September 21, 2022 - 5:30pm
Board of Health Meeting/Office Hours
September 26, 2022 - 6:00pm
Special Town Meeting
September 26, 2022 - 7:00pm
+ All Events
Appalachian Trail Community™
Citizen Action Center
Online Payments
Minutes & Agendas
Municipal Directory
Bylaws
Forms/Permits
Fees
Town News
Photos
Community Happenings
Special Town Meeting »
A Special Town Meeting will be held on Monday September 26, 2022 at 7:00 PM in the Cheshire Elementary School Cafeteria...
Hazard Mitigation & MVP Plan Listening Sessions »
Hazard Mitigation & MVP Plan - Public Listening SessionLearn about the Hazard Mitigation &...
Drought Conditions - Mandatory Water Restrictions »
NOTIFICATION OF WATER USE RESTRICTIONSEffective Monday August 15, 2022 until further notice the following ...
+ VIEW ALL


CHESHIRE, MA
HAZARD MITIGATION & MUNICIPAL VULNERABILITY PREPAREDNESS PLAN
ATTEND THE LISTENING SESSION
Hear about updates to Hazard Mitigation/MVP planning process and weigh in on priority actions selected
In-Person Public Listening Session:
Wednesday, 9/14/22 @ 12:30 p.m. at the Senior Center (119 School Street).
Virtual Public Listening Session:
Wednesday, 9/21/22 @ 7:00 p.m. via Zoom. Register at tinyurl.com/CheshireListen.


Cheshire Hazard Mitigation and MVP Planning
Public Listening & Info Session
Courtney Morehouse
Berkshire Regional Planning Commission
September 2022
MVP
BRPC

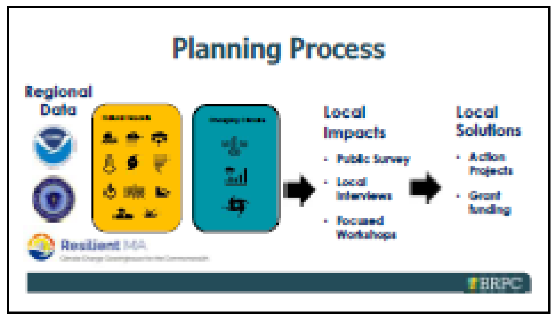
1


Agenda
Introduce Hazard Mitigation (HM) and Municipal Vulnerability Preparedness (MVP) Planning
Review hazards, vulnerabilities, and data collected so far
Present actions & solutions
Vote on your top priority!

2


Combined
Hazard Mitigation & MVP Plan
HAZARD MITIGATION (HM)
MUNICIPAL VULNERABILITY PREPAREDNESS (MVP)
COMBINED HAZARD MITIGATION & CLIMATE ADAPTATION PLAN
BRPC

3


Planning Process
Regional Data
Local Impacts
Public Survey
Local Interviews
Focused Workshops
Local Solutions
Action Projects
Grant funding
Resilient MA
BRPC

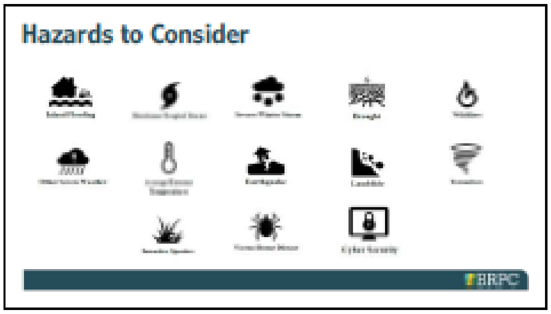
4


Hazard Mitigation & MVP Planning Timeline
Key Elements/Deliverables
Dates (2022)
2 Public Info/Listening Sessions
March & September 2022
MVP Workshop
June 3rd, 2022
Public Comment Period on HM/MVP Plan
February 2023
Final Plan Adoption
June 2023
BRPC

5


FEMA Mitigation Grants
Flood Mitigation Assistance (FMA)
- Elevation and acquisition of homes
Building Resilient Infrastructure & Communities (BRIC)
-Capacity Building
Hazard Mitigation Grant Program (HMGP)
- Structural and drainage upgrades

6

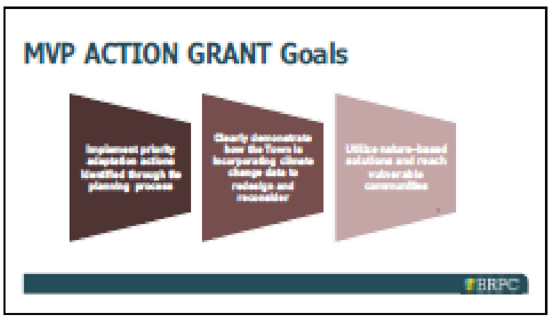


Hazards to Consider
BRPC

7

Notable
Berkshire Events
Hoosic River Floods – 100-year storms
Dam failures
Tornadoes
Microburst – 2016 through Cheshire
Wildfires

8

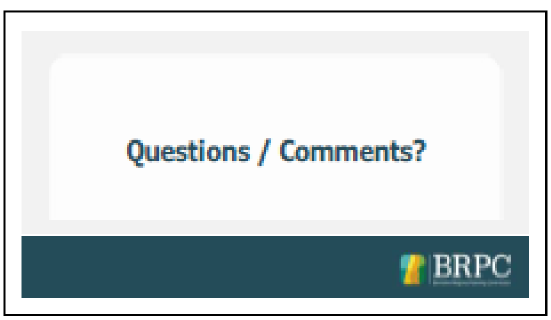


MVP ACTION GRANT Goals
Implement priority adaptation actions identified through the planning process
Clearly demonstrate how the Town is incorporating climate change data to redesign and reconsider
Utilize nature-based solutions and reach vulnerable communities
BRPC

9

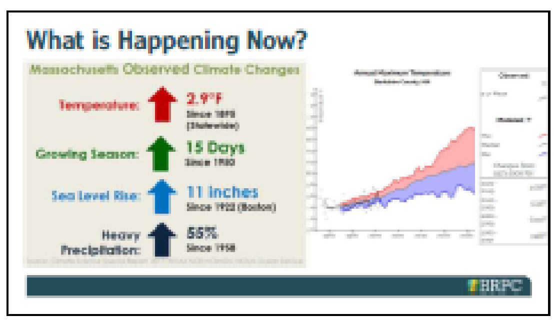
Example Projects
CULVERT REPLACEMENT IN WINDSOR
RURAL DIRT ROAD ASSESSMENT RECOMMENDATIONS REPORT
BRPC

10



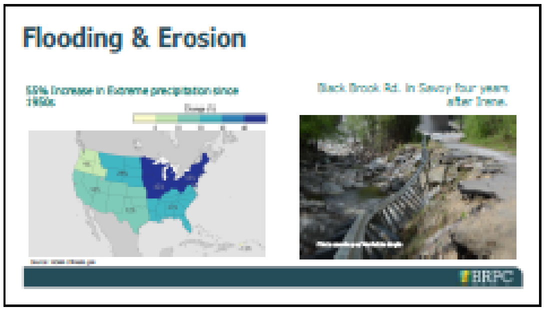
Questions / Comments?
BRPC

11



What is Happening Now?
Massachusetts Observed Climate Changes
Temperature:
2.9°F
Growing Season:
15 Days
Sea Level Rise:
11 Inches
Heavy Precipitation:
55%
BRPC

12



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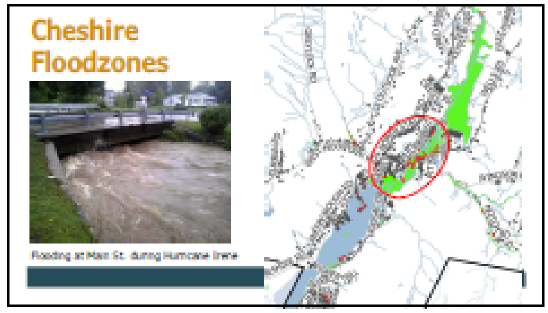

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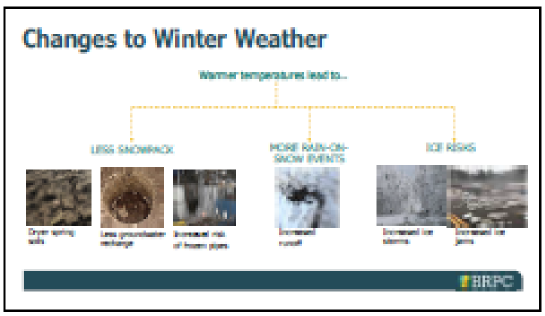

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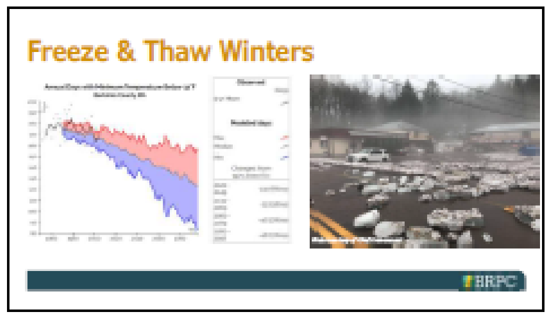

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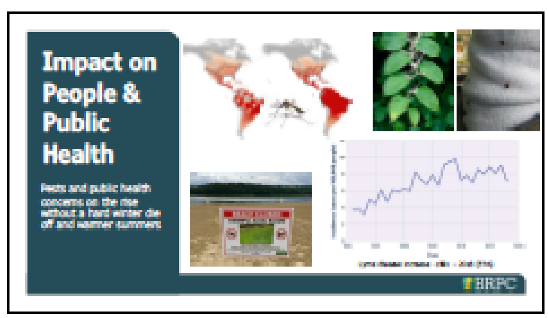


18

Cheshire HM/MVP Listening Session

Wednesday, September 21, 2022

Attendance:

Bill Moriarty

Bob Navin

Courteny Morehouse

Justin Gilmore

Liseann Karandisecky

Peter Traub

Polling - What is most important to you?

Categoires of Concern	Number of Votes
Emergency Preparedness	1
Road Infrastructure	2
Dam Infrastructure	1
Hoosac Lake Health	0

Priority Actions	Number of Votes
Increase Emergency Preparedness	1
Culverts and Bridges Study	3
Address Dam Issues	0

APPENDIX B: COMMUNITY RESILIENCE BUILDING WORKSHOP

	Name	Title	Email	Initial Outreach	Follow-up	RSVP 5/14	RSVP 6/3
Town Offices							
Town Admin	Jenn Morse					Yes	Yes
Police	Sargeant Mike Alibozek		malibozek@cheshire-ma.gov	Courteny	Jenn	Yes	Yes
Fire	Chief Tom Francesconi		tfrancesconi@cheshire-ma.gov	Courteny	NA	Yes	Maybe
Highway	Bob Navin		highway@cheshire-ma.gov	Courteny	NA	Yes	Yes
Hoosac Lake Prudential	Liseann Karadisecky		hld.cheshire@gmail.com	Courteny		Yes	Yes
EMD	Corey Swistak		cswistak@cheshire-ma.gov	Courteny	Jenn		Yes
Ambulance	Sean Sanderson				Sargeant Mike Alibozek		Yes
Board of Health	CJ Garner		cgarner@cheshire-ma.gov		Jenn will get other emails		No
Board of Health	Mike Kruszyna		mkruszyna@cheshire-ma.gov	Courteny	Jenn		No
Select Board	Shawn McGrath		smcgrath@cheshire-ma.gov	Courteny	Jenn	Yes	Yes
Council on Aging	Bob Balewander		dbalawend@aol.com	Courteny	Courteny	No	
Planning Board	Peter Traub		phtraub@nycap.rr.com	Courteny	Jenn	No	Yes
ZBA Chair	Steve Marko		sgmarko@roadrunner.com	Courteny	Jenn	Yes	Yes
Conservation Commission	Ron DeAngelis		rdeangelis@cheshire-ma.gov	Courteny	Jenn		Yes
Water Dept.	Travis Delratez		water@cheshire-ma.gov	Courteny	Jenn		Yes
Finance	John Tremblay		jtcheshire13@gmail.com	Courteny	Jenn	No	Yes
Neighborhoods/Vulnerable							
Berkshire Village (Dublin Rd.	Don Mayotte	Community Manage	dmayotte@kodiakpm.com	Courteny	Jenn	No	
Historical Society	Barry Emery	Town Historian	emery395@gmail.com	Courteny -	Jenn	No	Yes
Hoosac School District	Aaron Dean	Superintendent	deana@acrsd.net	Courteny	Jenn		Yes
Hoosac School District	Lisa Bresett	Asst. Superintendent	bresettl@acrsd.net	Courteny	Jenn		
Hoosac Lake District	Francis Willet		francis.willett@hoosaclakedistrict.c	Courteny	Liseann will followup	Yes	
Hoosac Lake District	Ed Bassi						Maybe
Hutchison Development	Jeff Warner	Superintendent			Sargaent Mike		Yes
East Cheshire	Ted Jayko		Who?	Sargeant Mike			
East Cheshire	Bob Balawender		dbalawend@aol.com	Courteny	Courteny	No	
State/Regional Agencies							
DCR	Becky Barnes	Region 5 Trails	rebecca.barnes@state.ma.us	Courteny	Bob Navin	No	No
Mass DOT	Francisca Heming	Head of District 1	francisca.heming@state.ma.us	Courteny	Courteny		
Mass DOT	Amer Raza	Design Engineer	amer.raza@state.ma.us	Courteny	Courteny		
Mass DOT	Mike Fabiano	Civil Engineer	michael.fabiano@state.ma.us	Courteny	Courteny		
Community Organizations/Nonprofits/Business							
First Baptist	Chris Adorno	Pastor	Pastorchrisch@gmail.com	Courteny	Chief Francesconi	No response	
Saint Mary Church	Michelle Francesconi	Business Manager	Michelle@saintmaryscatholic.com	Courteny	Chief Francesconi	Yes	Yes
United Methodist Church	Christa Levesque	Pastor	Levesque.christa@gmail.com	Courteny	Chief Francesconi	No response	
Hoosic River Watershed	Arianna Collins	ED	a.collins@hoorwa.org	Courteny	Courteny	No	No
Appalachian Trail Conservancy	Cosmo Catalano	Volunteer Trail Monitor	cosmo@cosmocatalano.com	Courteny	Courteny	No	Maybe
Whitney's Farm Stand	Eric Whitney		whitneysfarm@gmail.com	Courteny	Sargeant		Maybe
Berkshire Outfitters	Steve Blazejewski		berkshireoutfitters@gmail.com	Courteny		No	NR
Cheshire Liquor Center - Rental	Jay Patel	Owner	cheshireliquor@gmail.com	Courteny	Jenn		
Nearby Communities/Towns							
Lanesborough	Select Board			Michelle, Courteny,			
Lanesborough	Con Com			Michelle, Courteny,			
Adams	Select Board			Michelle, Courteny,			
Windsor	Select Board			Michelle, Courteny,			
Savoy	Select Board			Michelle, Courteny,			

Hello,

Cheshire is holding a Municipal Vulnerability Preparedness (MVP) Workshop as part of their Hazard Mitigation and MVP Planning Process.

The goal of this event is to identify the top hazards impacting the Town and prioritize action items to address those challenges. The solutions proposed will help Cheshire procure implementation project funding from the state's MVP program and FEMA's Hazard Mitigation grants and is a requirement for Cheshire to become an MVP Certified community. You can learn more about the Massachusetts MVP Program here.

The workshop will be held **Saturday, May 14, 9am – 3pm at the Cheshire Community Center.**

This is an all-day event in which community participation is crucial to building solutions that work for all of Cheshire. Lunch and snacks will be provided!

Please RSVP by May 6th to Courteny Morehouse at Berkshire Regional Planning Commission, the contractor helping us with this planning process by email at cmorehouse@berkshireplanning.org or call 413-442-1521 x26 if you have any questions.

We hope you can attend,

Courteny Morehouse

On behalf of Cheshire's Hazard Mitigation and MVP Planning Committee:
Jennifer Morse, Town Administrator
Chief Tom Francesconi, Fire Dept.
Bob Navin, Director Highway Dept.
Liseann Karandisecky, Chair of Lake Hoosac Prudential Committee
Sargeant Mike Alibozek, Police Dept.

I'm following up to the email about the Municipal Vulnerability Preparedness (MVP) Workshop Cheshire is holding as part of their Hazard Mitigation and MVP Planning Process.

The goal of this event is to identify the top hazards impacting the Town and prioritize action items to address those challenges. The solutions proposed will help Cheshire procure implementation project funding from the state's MVP program and FEMA's Hazard Mitigation grants and is a requirement for Cheshire to become an MVP Certified community. You can learn more about the Massachusetts MVP Program here.

We'd love to have you or someone else there to represent [ORG] because [REASON].

The workshop will be held **Friday, June 3, 9am – 3pm at the .** Lunch and refreshments will be provided.

This is an all-day event in which community participation is crucial to building solutions that work for all of Cheshire.

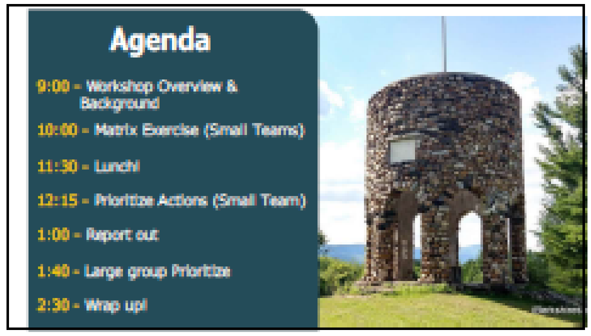
Please **RSVP by this Friday May 27th** or let me know if you have any questions.
We hope you can attend,

Courteny Morehouse

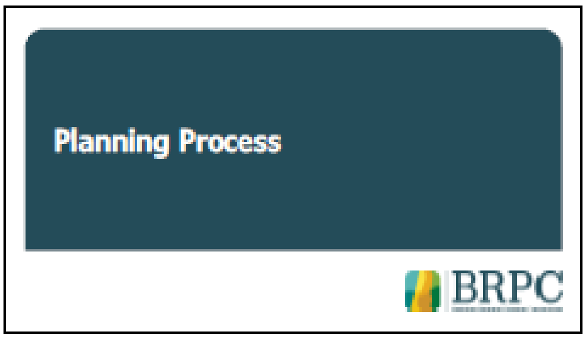
On behalf of Cheshire's Hazard Mitigation and MVP Planning Committee:
Jennifer Morse, Town Administrator
Chief Tom Francesconi, Fire Dept.
Bob Navin, Director Highway Dept.
Liseann Karandisecky, Chair of Lake Hoosac Prudential Committee
Sargeant Mike Alibozek, Police Dept.


Cheshire Hazard Mitigation and MVP Planning
Workshop
Courteny Morehouse
Berkshire Regional Planning Commission
June 3, 2022
BRPC

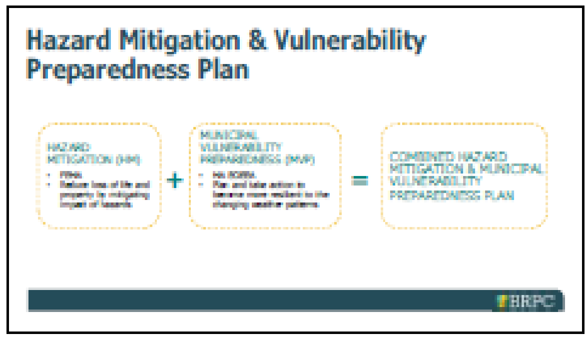
1


Agenda
9:00 - Workshop Overview & Background
10:00 - Matrix Exercise (Small Teams)
11:30 - Lunch!
12:15 - Prioritize Actions (Small Team)
1:00 - Report out
1:40 - Large group Prioritize
2:30 - Wrap up!

2


Planning Process
BRPC

3


Hazard Mitigation & Vulnerability Preparedness Plan
HAZARD MITIGATION (HM)
MUNICIPAL VULNERABILITY PREPAREDNESS (MVP)
COMBINED HAZARD MITIGATION & MUNICIPAL VULNERABILITY PREPAREDNESS PLAN
BRPC

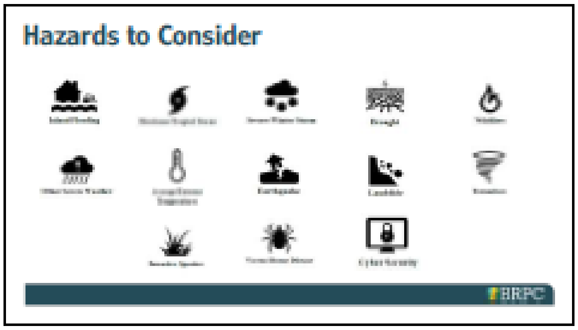
4


Hazard Mitigation Planning
IDENTIFY AND PRIORITIZE NATURAL HAZARDS
EXAMINE THE POTENTIAL IMPACTS ON PEOPLE, ENVIRONMENT, AND BUILT INFRASTRUCTURE
DEVELOP STRATEGIES TO PREVENT OR MINIMIZE THOSE IMPACTS
BRPC

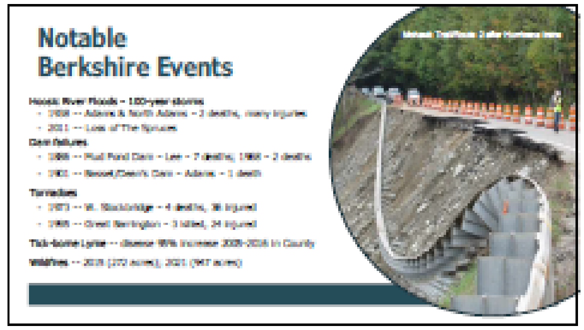
5


FEMA Mitigation Grants
Flood Mitigation Assistance (FMA)
- Elevation and acquisition of homes
Building Resilient Infrastructure & Communities (BRIC)
-Capacity building
Hazard Mitigation Grant Program (HMGP)
- Structural and drainage upgrades

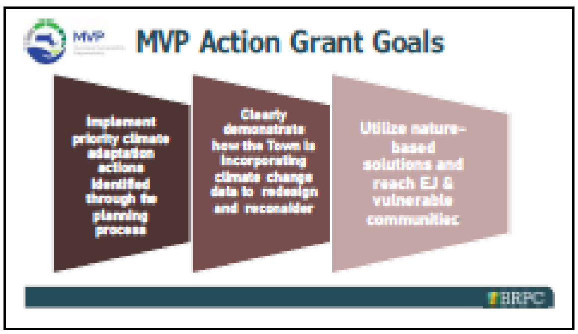
6


Hazards to Consider
BRPC

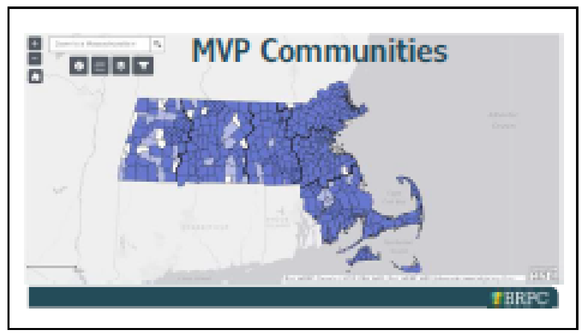
7


Notable
Berkshire Events

8


MVP
MVP Action Grant Goals
Implement priority climate adaptation actions identified through the planning process
Clearly demonstrate how the Town is incorporating climate change data to redesign and reconsider
Utilize nature-based solutions and reach EJ & vulnerable communities
BRPC

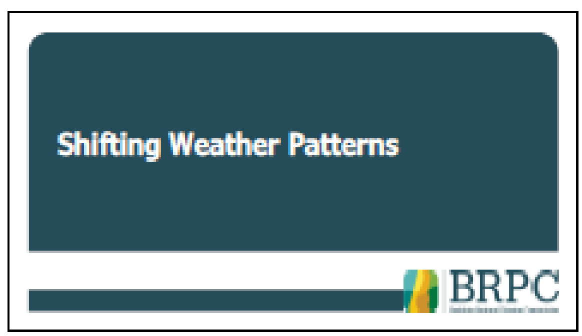
9


MVP Communities
BRPC

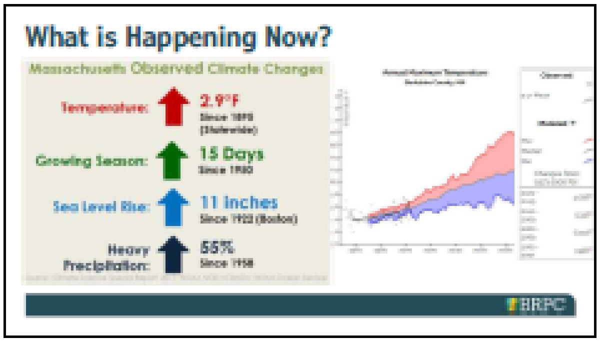
10


Example Projects
BRPC

11


Shifting Weather Patterns
BRPC

12



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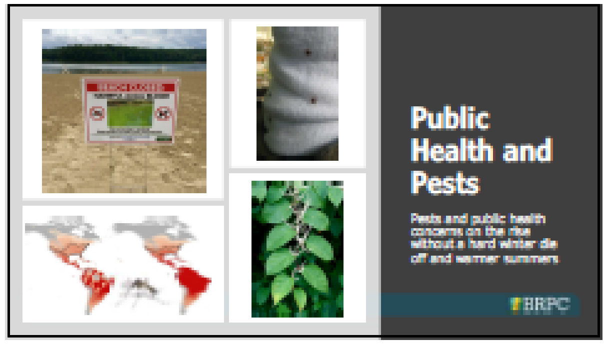

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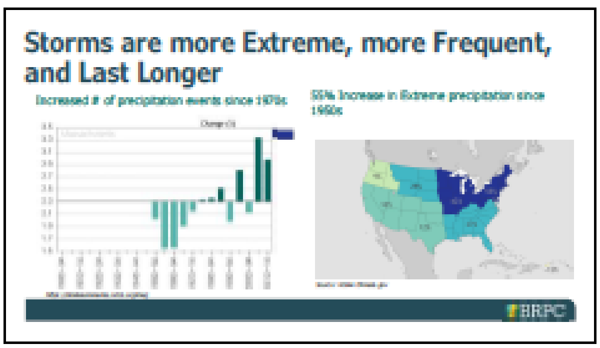

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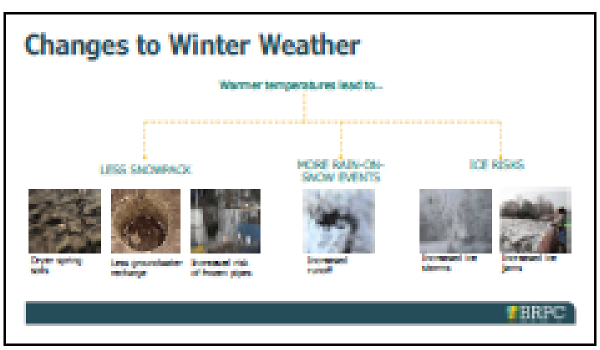

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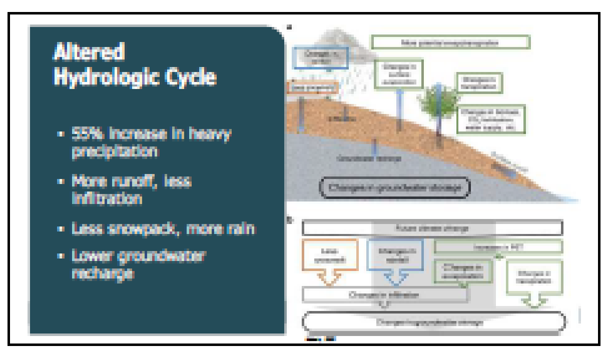

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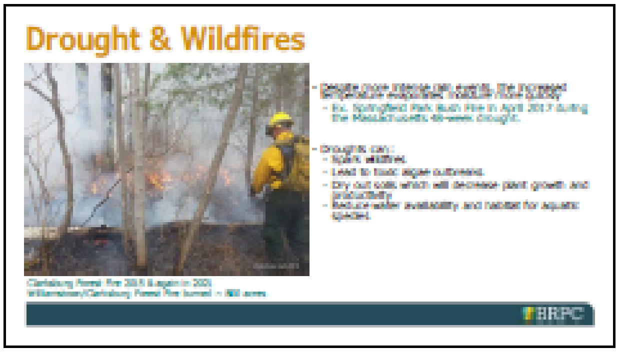

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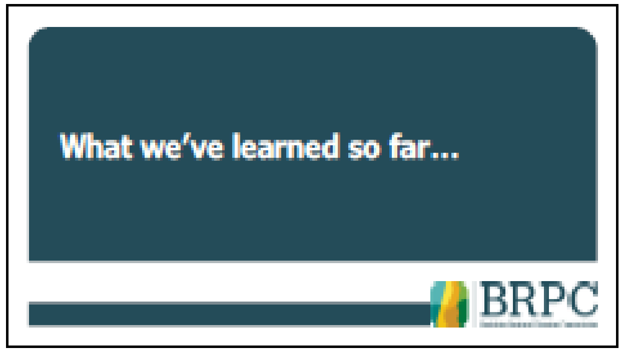

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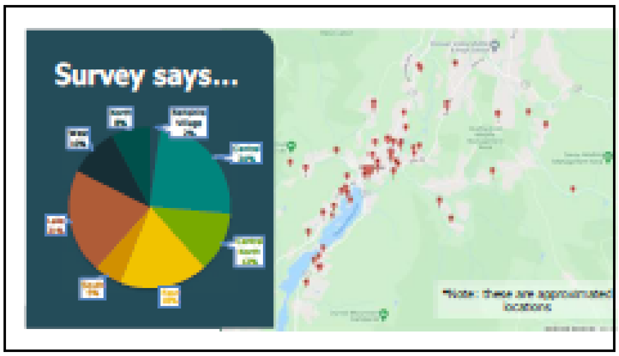

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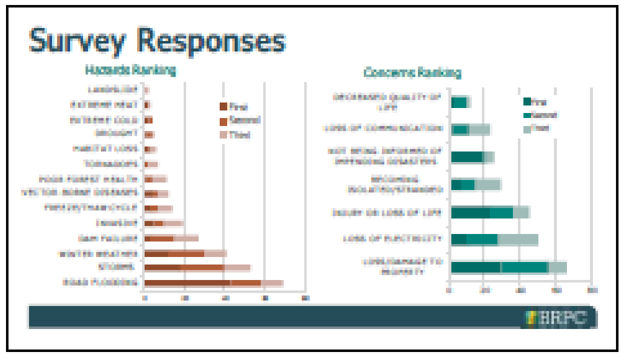

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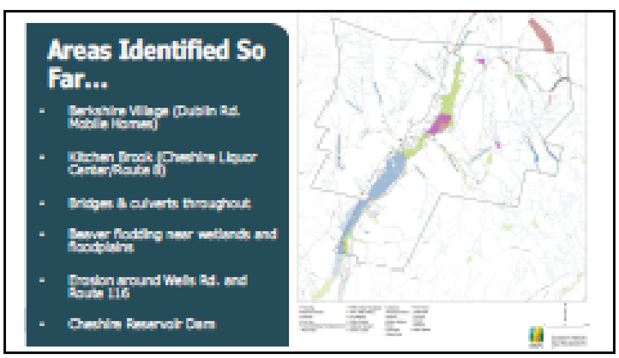

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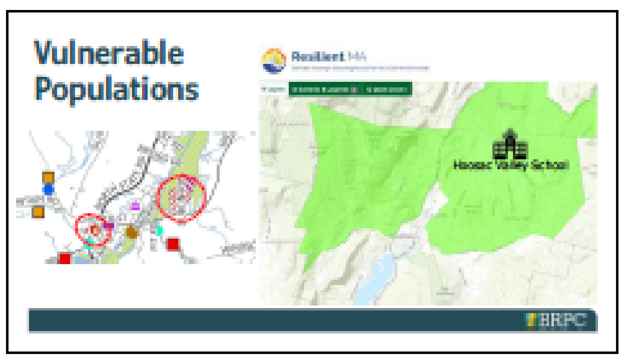

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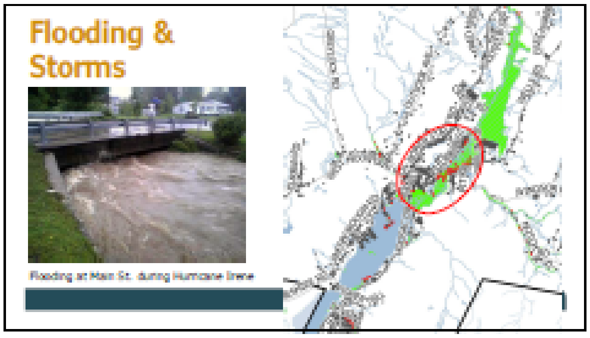

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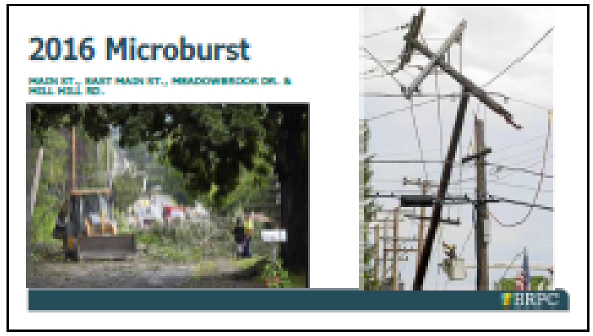

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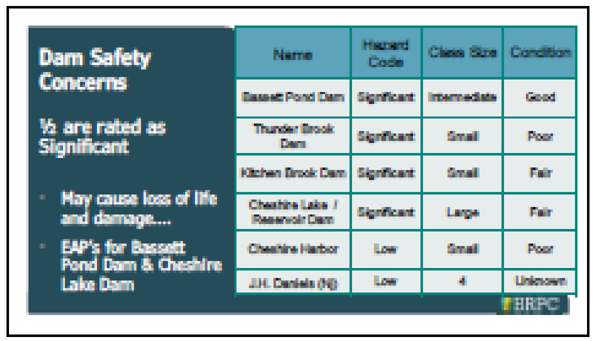
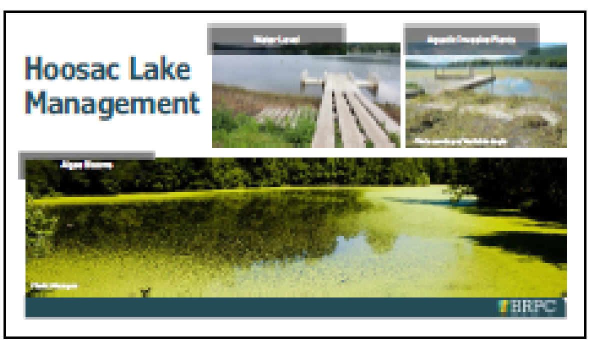


Name	Hazard Code	Class Size	Condition
Bassett Pond Dam	Significant	Intermediate	Good
Thunder Brook Dam	Significant	Small	Poor
Kitchen Brook Dam	Significant	Small	Fair
Cheshire Lake / Reservoir Dam	Significant	Large	Fair
Cheshire Harbor	Low	Small	Poor
J.H. Daniels (NJ)	Low	4	Unknown

28



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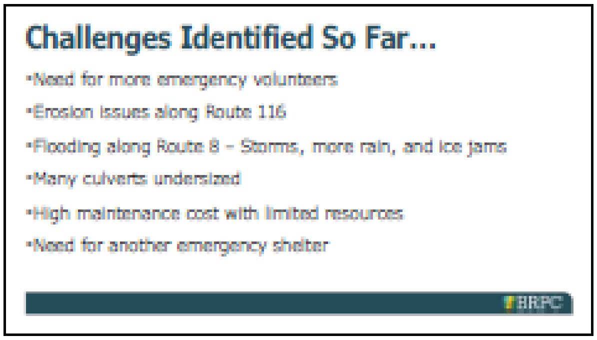
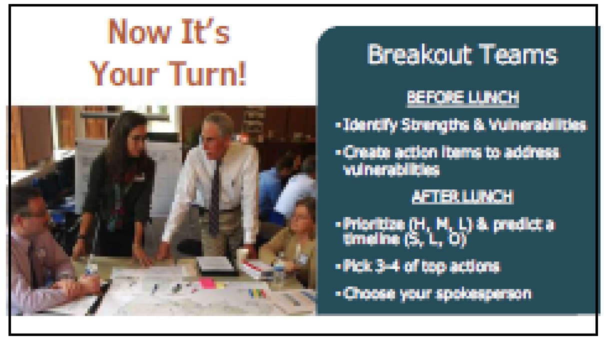

Challenges Identified So Far…
•Need for more emergency volunteers
•Erosion issues along Route 116
•Flooding along Route 8 – Storms, more rain, and ice jams
•Many culverts undersized
•High maintenance cost with limited resources
•Need for another emergency shelter
BRPC

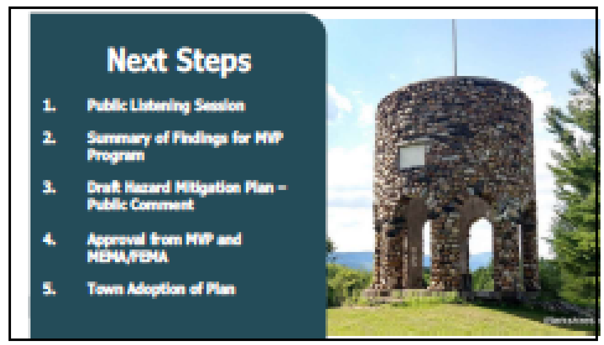
31


Now It's Your Turn!
Breakout Teams
BEFORE LUNCH
•Identify Strengths & Vulnerabilities
•Create action items to address vulnerabilities
AFTER LUNCH
•Prioritize (H, M, L) & predict a timeline (S, L, O)
•Pick 3-4 of top actions
•Choose your spokesperson

32


All together now!
Large Group
• Share key takeaways & 3-4 priority actions
• Vote on top priority actions

33


Next Steps
1. Public Listening Session
2. Summary of Findings for MVP Program
3. Draft Hazard Mitigation Plan – Public Comment
4. Approval from MVP and MEMA/FEMA
5. Town Adoption of Plan

34


Thank you!
Courteny Morehouse
cmorehouse@berkshireplanning.org
www.berkshireplanning.org

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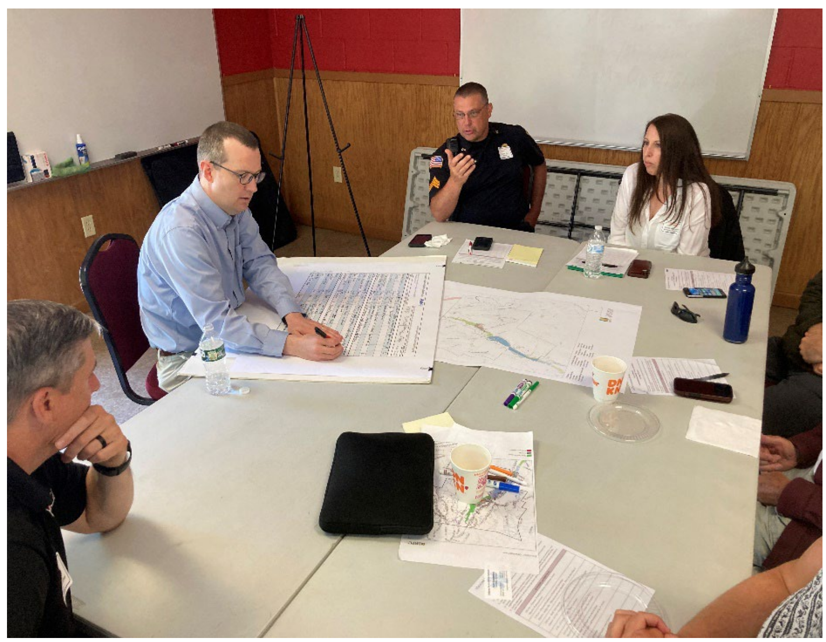
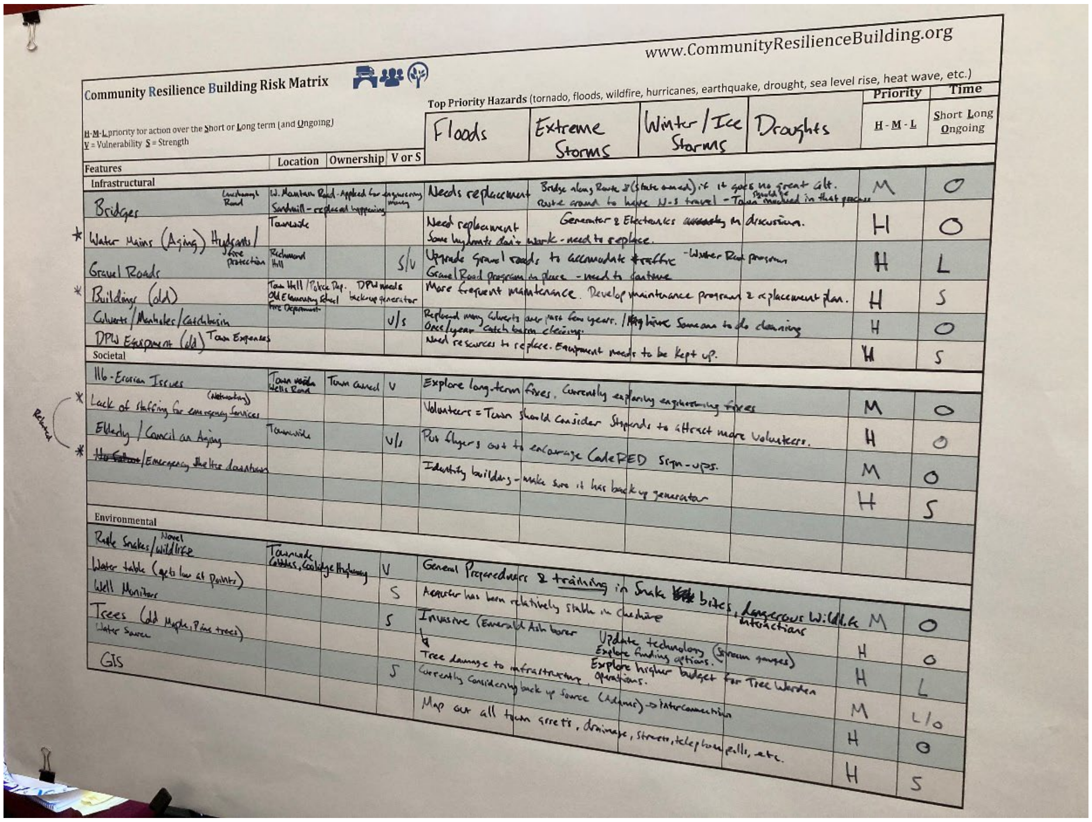
Town of Cheshire
Community Resilience Building Workshop, June 3, 2022

~ Sign In ~

Name	Affiliation	Title
Sean Sanderson	Adams Ambulance	General Manager
Aaron Dean	HVRSD	Superintendent
Stephen Marks	Cheshire ZBA	Chairman
Shawn McGrath	Selectboard	Vice-chair
Jenn Morse	Cheshire	T. Admin
John Tremblay	Finance Comittee	Chair
Ron DeMarco	Town	Con Com/Select B.
Rob Navin	Highway Dept	Superintendent
Corey J Swistak	Fire / Acting EMD	Asst. Chief
MICHELLE FRANCESCONI	BOARD OF SELECTMEN/ ST. MARY OF THE ASSUMPTION	CHAIRMAN OF BOS/ BUSINESS MANAGER
TRAVIS.DelRATEZ	WATER DEPT	SUPERINTENDENT
Francis Willett	Hoosac Lake District	Prudential Committee
Liseann Karandisecky	Hoosac Lake District	Prudential Chairman
Barry Emery	resident/historian	
Michael Ambozek	Cheshire Police Dept	Sergeant


Cheshire
HIGHWAY
DEPT.





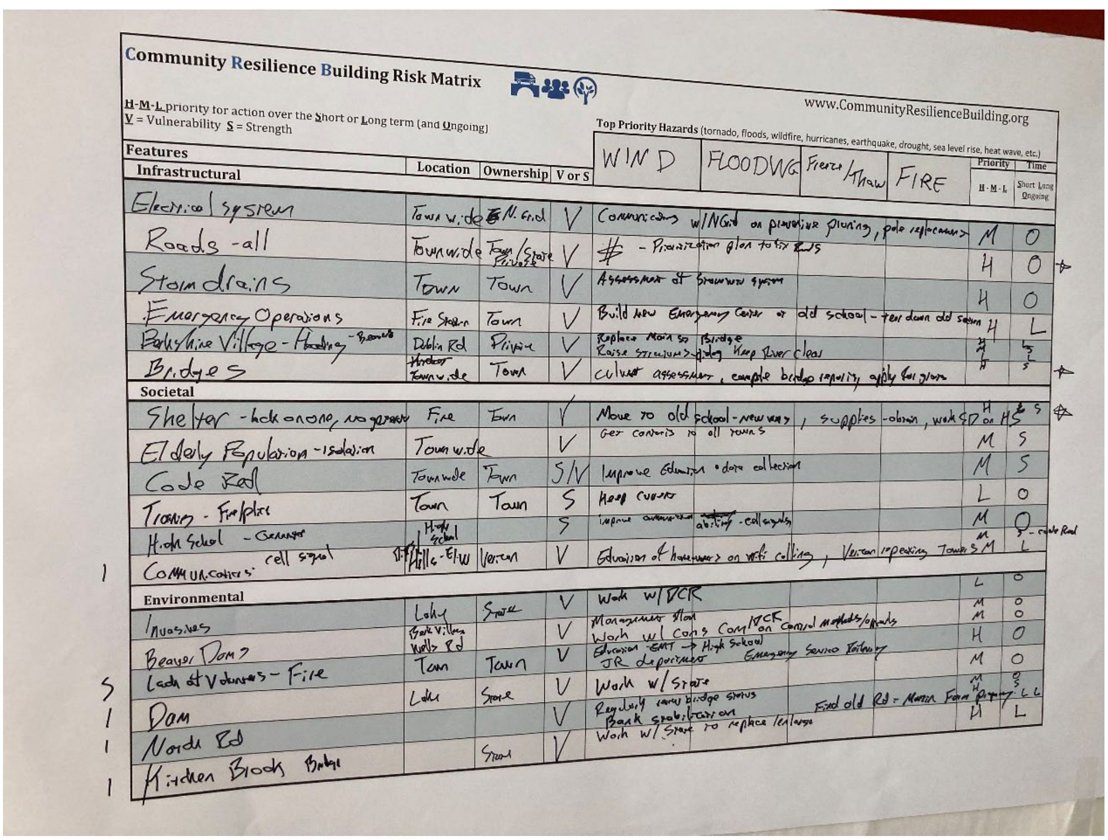
Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.org

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	Floods	Extreme Storms	Winter / Ice Storms	Droughts	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Bridges (Lockhart Road)	W. Mountain Road - Applied for engineering money; Sandmill - replacement happening			Needs replacement	Bridge along Route 8 (state owned) if it goes no great alt. route around to have N-S travel - Town should be involved in that process			M	O
* Water Mains (Aging) Hydrants / fire protection	Townwide			Need replacement. Some hydrants don't work - need to replace.	Generator & Electronics currently in discussion.			H	O
Gravel Roads	Richmond Hill		S/V	Upgrade gravel roads to accommodate traffic - Water Road program. Gravel Road program in place - need to continue				H	L
* Buildings (old)	Town Hall / Police Dep. Old Elementary School Fire Department	DPW needs backup generator		More frequent maintenance. Develop maintenance program & replacement plan.				H	S
Culverts / Manholes / Catchbasin			V/S	Replaced many culverts over past few years. / May have someone to do cleaning. Once/year catch basin cleaning.				H	O
DPW Equipment (old) Town Expenses				Need resources to replace. Equipment needs to be kept up.				H	S
Societal									
116 - Erosion Issues	Town wide Wells Road	Town owned	V	Explore long-term fixes. Currently exploring engineering fixes				M	O
* Lack of staffing for emergency services (Networking)				Volunteers = Town should consider stipends to attract more volunteers.				H	O
Elderly / Council on Aging	Townwide		V/S	Put flyers out to encourage CodeRED sign-ups.				M	O
* ~~No School~~ / Emergency Shelter downtown				Identify buildings - make sure it has backup generator				H	S
Environmental									
Rattle Snakes / Novel wildlife	Townwide Cobbles, Coolidge Highway		V	General Preparedness & training in Snake bites, dangerous wildlife interactions				M	O
Water table (gets low at points)			S	Aquifer has been relatively stable in Cheshire				H	O
Well Monitors			S	Invasive (Emerald Ash borer)	Update technology (stream gauges) Explore funding options.			H	L
Trees (old Maple, Pine trees)				Tree damage to infrastructure,	Explore higher budget for Tree Warden operations.			M	L/O
Water Source			S	Currently considering back up source (Adams) -> interconnection				H	O
GIS				Map out all town streets, drainage, streams, telephone polls, etc.				H	S



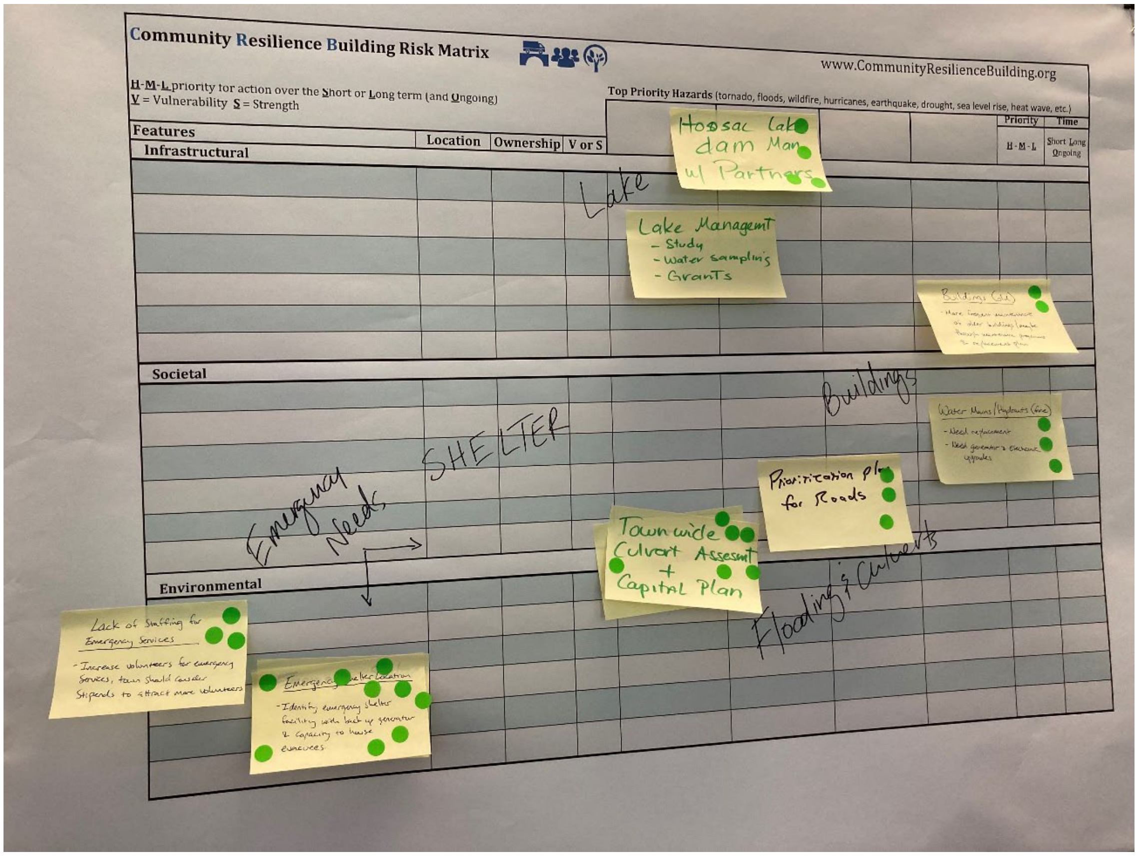
Community Resilience Building Risk Matrix

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

www.CommunityResilienceBuilding.org

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

Features	Location	Ownership	V or S	WIND	FLOODING	Freeze / Thaw	FIRE	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Electrical system	Town wide	N. Grid	V	Communications w/ N Grid on preventive planning, pole replacements				M	O
Roads - all	Townwide	Town / State Private	V	$ - Prioritization plan to fix roads				H	O
Storm drains	Town	Town	V	Assessment of Stormwater system				H	O
Emergency Operations	Fire Station	Town	V	Build new Emergency Center at old school - tear down old school				H	L
Berkshire Village - Flooding - Beavers	Dublin Rd	Private	V	Replace Main St Bridge; Raise structures - [illegible] Keep River clear				H M	S L
Bridges	~~Harbor~~ Townwide	Town	V	culvert assessment, complete bridge repairs, apply for grants				H	S
Societal									
Shelter - lack one one, no generator	Fire	Town	V	Move to old school - new ways, supplies - obtain, work SD on HS; Get contracts to all towns				H	S
Elderly Population - isolation	Townwide		V					M	S
Code Red	Townwide	Town	S/V	Improve Education • data collection				M	S
Towers - Fireplace	Town	Town	S	Keep current				L	O
High School - Generator	High School		S	improve communication ability - cell signals				M	O - code Red
1 Communications: cell signal	Hills - El.W	Verizon	V	Education of homeowners on wifi calling, Verizon repeating Towers				M	L
Environmental									
Invasives	Lake	State	V	Work w/ DCR; Management Plan				L M	O
Beaver Dams	Berk Village Wells Rd		V	Work w/ Cons Com/DCR on control methods/options				H	O
5 Lack of Volunteers - Fire	Town	Town	V	Education - EMT -> High School JR department	Emergency Service Pathway			M	O
1 Dam	Lake	State	V	Work w/ State				M	O
1 North Rd			V	Regularly survey bridge status; Bank stabilization		Find old Rd - Martin Farm property		H	L
1 Kitchen Brook Bridge		State	V	Work w/ State to replace / enlarge					


Community Resilience Building Risk Matrix
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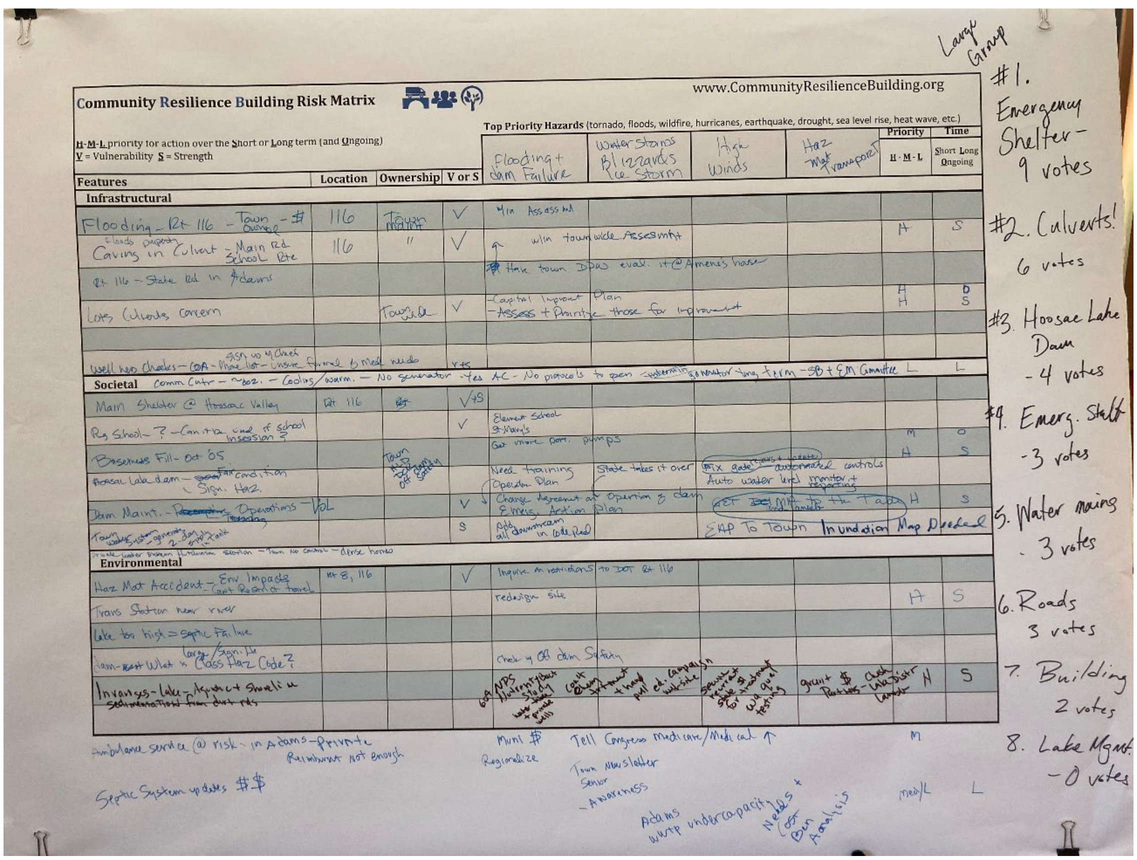
H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength
Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)
Priority
Time
H-M-L
Short Long Ongoing
Features
Location
Ownership
V or S
Infrastructural
Societal
Environmental
Hoosac Lake dam Man w/ Partners
Lake
Lake Managemt
- Study
- Water sampling
- Grants
Buildings
SHELTER
Emergency Needs
Prioritization plan for Roads
Town wide Culvert Assesmt + Capital Plan
Flooding & Culverts
Lack of Staffing for Emergency Services
Emergency Shelter Location


Community Resilience Building Risk Matrix
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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.)
Flooding + dam Failure
Water storms Blizzards Ice Storm
High Winds
Haz Mat Transport
Priority
Time
H-M-L
Short Long Ongoing
Features
Location
Ownership
V or S
Infrastructural
Societal
Environmental
Large Group
#1. Emergency Shelter - 9 votes
#2. Culverts! 6 votes
#3. Hoosac Lake Dam - 4 votes
#4. Emerg. Staff - 3 votes
5. Water mains - 3 votes
6. Roads 3 votes
7. Building 2 votes
8. Lake Mgmt. - 0 votes