Town of Burlington
Hazard Mitigation Plan 2025 Update

September 2025

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1. Introduction

The Town of Burlington prepared this Hazard Mitigation Plan (HMP) to create an action roadmap to reduce the impacts of natural hazards and climate change within the community. This Chapter further discusses HMP components and local goals for hazard mitigation. Appendix A contains the FEMA review checklist, which identifies where in the plan the specific HMP requirements are met.

1.1. What is Hazard Mitigation Planning?

Hazard mitigation planning is an iterative process that seeks to reduce the impact of natural hazards on people and property. Burlington has assessed a variety of natural hazards that pose a risk to the health and welfare of residents, identified specific vulnerabilities associated with those hazards including potential future impacts due to climate change, and identified local capabilities and specific mitigation actions to protect homes, businesses, and the critical infrastructure that keeps the town running. This process is tailored to address the issues affecting Burlington residents now and into the future and is crucial to building community resilience. Below are some key words necessary for understanding this Hazard Mitigation Plan. These definitions come from the Federal Emergency Management Agency (FEMA) or the 2023 ResilientMass Plan:

> **Natural Hazards** are a source of harm or difficulty created by a meteorological, environmental, or geological event (such as extreme wind events, tornadoes, winter weather as well as earthquakes, flooding, and fires). (FEMA)
> **Hazard mitigation** is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. An example of hazard mitigation is elevating or strengthening a bridge to reduce damage, disruption, or loss from a flood or earthquake. It also includes developing regulations to require new construction to include new methods and procedures to reduce risks from current hazards and increasing risks from climate change. (2023 ResilientMass Plan)

Vulnerability is a description of which community "assets" (people, structures, systems, natural resources, cultural resources, historic resources, the economy, and activities that have value to the community) are at risk from the effects of a natural hazard. (FEMA)

Impacts are the consequences or effects of each hazard on the participant's assets identified in the vulnerability assessment. For example, impacts could be described by referencing historical disaster damages with an estimate of potential future losses (such as percentage of damage vs. total exposure). (FEMA)

Climate Change refers to "changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events, and changes to other features of the climate system." (FEMA, U.S. Global Change Research Program, 4th National Climate Assessment).

Resilience is the capacity of individuals, communities, businesses, institutions, and governments to adapt to changing conditions and prepare for, withstand, and rapidly recover from disruptions to everyday life, such as hazard events. (2023 ResilientMass Plan)

1.2. Benefits of Hazard Mitigation Planning

Completing the HMP provides many benefits to Burlington:

Increasing public awareness of natural hazards that may affect the community reduces overall risk. By providing education and outreach, individuals can understand how natural hazards may affect their lives and what the region, the Town, and they as individuals can do and are doing to minimize impacts of those hazards.

Proactive planning creates efficiency beyond city limits. Developing an HMP allows state and local governments to work together and combine hazard risk reduction with other community goals and plans.

The community's greatest vulnerabilities can be prioritized to receive resources. Developing a plan of hazard mitigation measures considers a prioritization process that reflects the cost and benefit of safety, property protection, technical, political, legal, environmental, economic, social, administrative, and other community objectives, quantitatively and/or qualitatively.

The implementation of an HMP saves taxpayer money. According to FEMA, one dollar spent on federal hazard mitigation grants saves an average of six dollars on disaster response (NIBS, 2019).

Maintaining a FEMA compliant HMP also makes the municipality eligible for federal grant funding (FEMA, 2020). Hazard mitigation funding is available through the Federal Emergency Management Agency (FEMA). To be eligible for FEMA Grants, local governments must prepare an HMP that meets the requirements established in the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by the Disaster Mitigation Act of 2000. The HMP also ensures that federally funded projects reflect a community's priorities and offer solutions to specific threats.

1.3. Burlington's Natural Hazard Mitigation & Climate Adaptation Goals

Burlington's HMP Planning Committee (documented in Chapter 2) established the goals and objectives for natural hazard mitigation planning in Burlington. This effort included a review and update of the goals listed in the previous Hazard Mitigation Plan. The goals were restructured to better represent Burlington's local priorities and provide simplified messaging.

Protect Health and Safety: Ensure that people, structures, systems, natural/cultural/historic resources and the overall health and safety of Burlington are protected from natural hazards.
Increase Outreach and Education: Increase awareness and support for natural hazard mitigation among private organizations, businesses, and area residents through outreach and education.
Increase Response Capacity: Increase Burlington's community's capacity for responding to a natural hazard event.
Protect Priority Populations: Implement a broad range of mitigation measures that protect the Town's priority populations.
Consider the Economy: Develop a mitigation strategy that considers area businesses and protects the economic vitality of the Town.
Integrate Climate Change: Implement mitigation strategies to protect the community from the impacts of climate change.
Encourage Smart Development: Discourage future development in hazard prone areas, such as floodplains.
Increase Coordination: Increase coordination between the Federal, State, regional and local levels of government.
Keep the Plan Relevant: Update and maintain the Plan as resources permit.
Be Sustainable: Encourage sustainability of the Town.

2

2. Planning Process

The Burlington HMP has been informed through a variety of methods, including data collection and analysis, public input during HMP workshops and outreach events, and meetings with the steering committee and Local Hazard Mitigation Committee. The subsequent pages describe the involvement of the committees and public in the HMP planning process in more detail.

2.1. Overview of Plan Development

The HMP planning process proceeded according to the timeline shown in Table 2.1.

Table 2.1: HMP Planning Timeline

	2024										2025								
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Task 1 – Coordinate with the Town and HMP Committee																			
Task 2 - Update Hazard Profiles																			
Task 3 - Update Critical Facility Inventory																			
Task 4 - Update Hazard Vulnerability																			
Task 5 - Update Mitigation Goals																			
Task 6 - Update Actions																			
Task 7 - Plan Review, Evaluation, And Implementation																			
Task 8 Plan Maint.																			
Task 9 Public Review of Draft Plan																			
Task 10 - Review and Approval																			

2.2. Engagement and Outreach

The goal of public engagement for this HMP process was to center the experiences of those who are most vulnerable to natural hazards in Burlington. To truly mitigate hazards, the Town must develop strategies for protecting and supporting those who are most exposed. Priority populations include people or communities who may be disproportionately impacted by climate change due to life circumstances that systematically increase their exposure to climate hazards or make it harder to respond. In addition to factors such as income, race, and language barriers, other factors like physical ability, access to transportation, health status, and age shape whether someone or their community will be disproportionately affected by climate change. This is because of underlying contributors such as racial inequality, financial insecurity, or accessibility barriers that create vulnerability.

To better understand the experiences of the residents and businesses of Burlington, the engagement strategy included multiple approaches.

2.2.1. | Steering Committee (STC)

The Town of Burlington's STC for the development of the HMP led by Liz Bonventre, Planning Director. The STC played an important role in identifying critical infrastructure, involving key stakeholders, and documenting the Town's capacity to mitigate hazards alongside ongoing operations. To assist in drafting the plan, the STC also suggested and made available reports, maps, and other pertinent information related to natural hazards in Burlington.

The members of the Steering Committee are listed in Table 2.2.

Table 2.2 Steering Committee Members

Name	Title/Affiliation
Elizabeth Bonventre	Planning Director
Caleb Zimmerman	Assistant Director of Planning
Eileen Coleman	Conservation Agent
Andy Connerty	Fire Chief
Christine Mathis	Environmental Engineer, Board of Health

The STC met 6 times to guide the planning process and make final planning decisions. For details on meeting topics, see Table 2.3.

Table 2.3: Steering Committee Meeting Schedule

Meeting	Date	Meeting Topics
Kickoff Meeting	February 2, 2024	• Overview of Hazard Mitigation Planning • Scope and Schedule • Outreach Strategy • Questions/ Discussion/ Action Items
Steering Committee Meeting #1	March 5, 2024	• Overview of work in progress • Chapter 3 Hazard Profiles • Stakeholder Outreach and Engagement Plan • Capabilities Assessment • Next Steps
Steering Committee Meeting #2	May 5, 2024	• Overview of work in progress • Mitigation Goals • Past Mitigation Actions • Outreach and LHMC Meetings • Next Steps
Steering Committee Meeting #3	June 20, 2024	• Overview of Work in progress • Hazard Mitigation Goals • Capabilities Assessment • Asset Inventory • Outreach and LHMC Meetings • Next Steps
Steering Committee Meeting #4	July 11, 2024	• Overview of work in progress • Outreach and LHMC Meetings • Mitigation Actions • Plan Evaluation and Maintenance • Next Steps
Steering Committee Meeting #5	January 21, 2025	• Overview of work in progress • Prioritization Criteria and Process for Prioritizing Mitigation Actions • Asset Inventory Discussion • Next Steps
Steering Committee Meeting #6	October 7, 2025	• Public Comment on Draft Plan

2.2.2. | Local Hazard Mitigation Committee (LHMC)

Town Staff with subject matter expertise and local knowledge and experience were invited to join the LHMC and attend a series of two workshops. These stakeholders included municipal staff who are part of regular Development Coordination Meeting (DCM) meetings.

Table 2.4: Local Hazard Mitigation Committee (LHMC)

Name	Title/Affiliation
Andrew Connerty	Fire Chief and Director of Emergency Management
Elizabeth Bonventre	Planning Director
Christine Mathis	Environmental Engineer, Board of Health
Eileen Coleman	Conservation Agent
Meghan Cavalier, PE	Assistant Town Engineer
Martin Allen	Senior Building Inspector
Peter Abaskarhoun	Sergeant, Burlington Police Department
Caleb Zimmerman	Planner/Development Coordinator
Lucy Hansen	Assistant Conservation Agent
Gage Morin, FE	Civil Engineer

Municipal staff participated in these workshops and helped align the HMP update with the operational policies and hazard mitigation strategies at different levels of government and implementation. A summary of key topics from each workshop is included on the following table.

To enhance accessibility, stakeholder workshops were conducted as of online sessions. LHMC workshops were organized around topic areas that included:

- Asset, vulnerability, and impact identification
- Mitigation action development
- Mitigation action prioritization

Table 2.5 LHMC Meeting Schedule

Meeting	Date	Meeting Topics
LHMC Workshop #1	February 22, 2024	• Overview of plan • Discussion of natural hazards • Asset inventory • Identify vulnerabilities.
LHMC Workshop #2	May 7, 2024	• Review climate adaptation strategies and mitigation goals. • Solicit feedback on how well these goals protective of all groups. • Initial discussion to identify mitigation actions. Incorporate input from public surveys.
LHMC Workshop #3	January 21, 2025	• Review mitigation actions. • Assign prioritization using STAPLEE.
LHMC Workshop #4	October 7, 2025	• Public Comment on Draft Plan

2.2.3. | Public Engagement

To gather information from the community and educate community members on hazard mitigation, the Town pursued the following approach:

Getting the Word Out (Survey): This first step involved posting an online survey to capture initial input. The online survey allowed residents to engage with the project on their own time, and as their schedule allowed. Materials were posted for four weeks in June on the Town website and advertised through email blasts, social media posts on the Town Departments' Facebook pages and distributed at the fire station, library, and town hall. The Town also reached out to the Council on Aging, the Burlington Chamber of Commerce (BACC) and Burlington Cable Access Television (BCAT. The BACC posted survey information on their website and social media and sent out a news release, and the BCAT posted survey and project information on their website. Survey information was also posted to the Fire Department's webpage. The online survey received 63 responses. A summary of the survey questions and responses is included in Appendix B.

Responses indicated that changes to groundwater were the weighted top hazard of concern for respondents, as shown in Figure 2.1, based on weightings from 9 (highest concern if listed first) to 1 (lowest concern if listed last), followed by extreme heat, inland flooding, hurricanes/tropical storms, and winter storms/nor'easters.

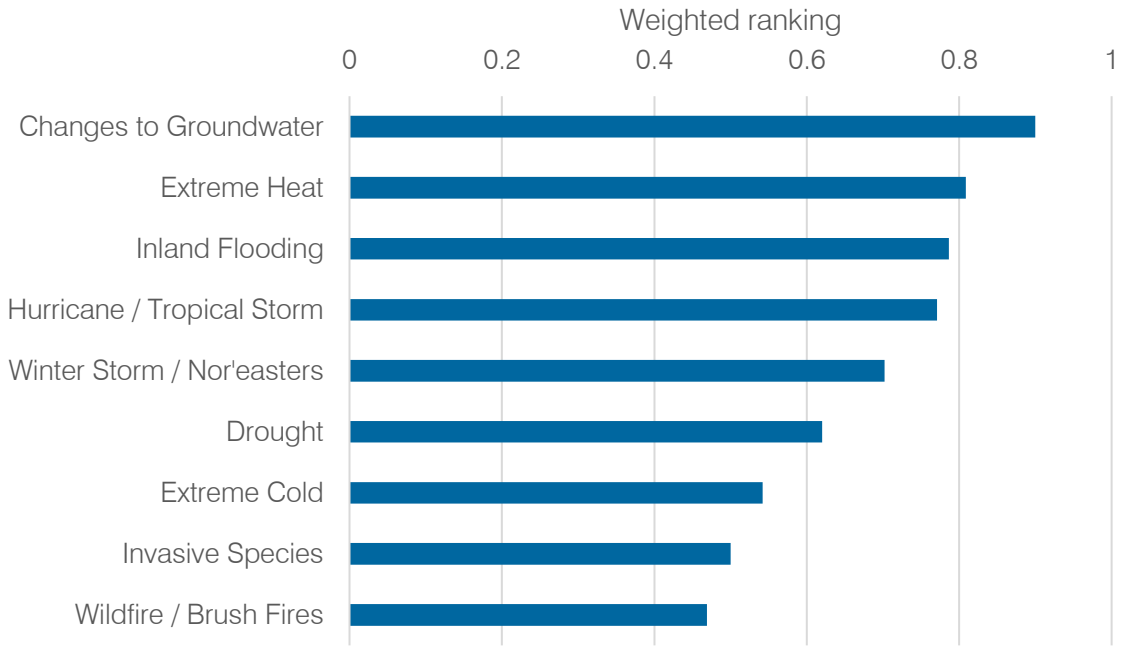


Figure 2.1 Survey Responses: "What natural hazards are you most concerned about?"

Weighted from 9 (Highest concern) to 1 (Lowest concern) based on rankings and summed

The natural hazard impacts that have most frequently affected Burlington residents are power outages, damage to their homes, and contaminated drinking water, as shown in Figure 2.2. While power outages were reported with greatest frequency, when asked about specific experiences with natural hazards, residents overwhelming reported facing groundwater issues. Many residents have poor drainage in their yards and have needed to purchase sump pumps to protect their basements from groundwater flooding. Multiple businesses on Cambridge Street have flooded during heavy rains due to poor parking lot drainage. The Fox Hill neighborhood, Sandy Brook and Long Meadow Brook areas, and Garrity Road/Middlesex Turnpike area were also especially noted for poor drainage.

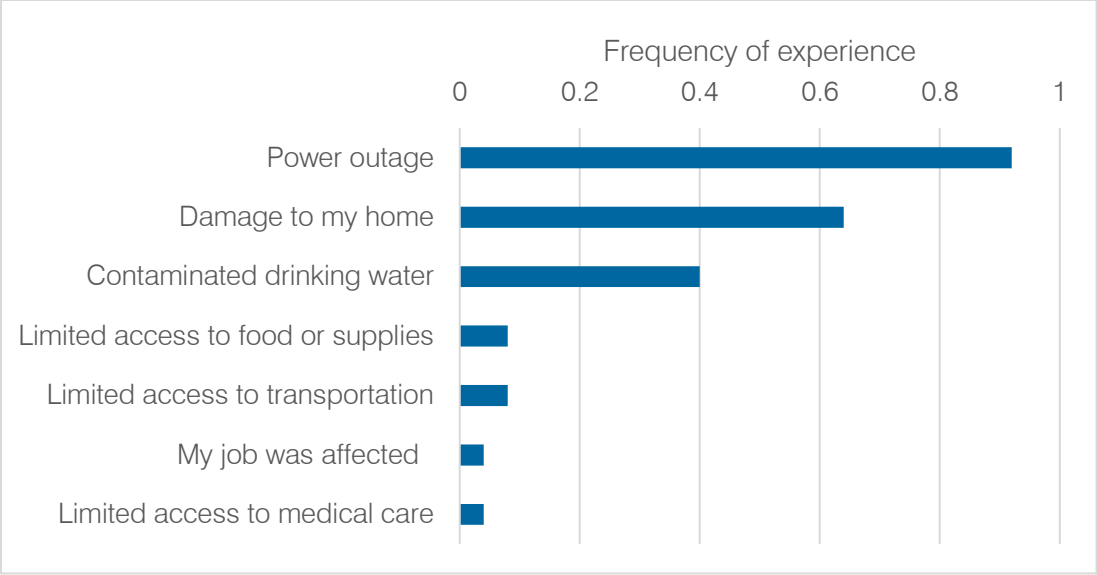


Figure 2.2 Survey Responses: "If any, what problems from natural hazards have you experienced in Burlington?"

To prepare themselves and their community for natural hazard events, the action that had the greatest frequency of response was maintaining an emergency kit. The next most common actions were checking on vulnerable neighbors to provide support and keeping a back-up generator.

Figure 2.3 Survey Responses: "If anything, what do you do to prepare for a natural hazard event?"

In addition, to prepare their properties for natural hazard events, the actions that had the greatest frequency of response were purchasing a homeowners/renters insurance policy and trimming or removing trees close to their homes. Other respondents reported installing sump pumps, buying generators, and installing flood protection measures. Purchasing flood insurance was less common, as were replacing windows or roofing with more weather-resistant materials.

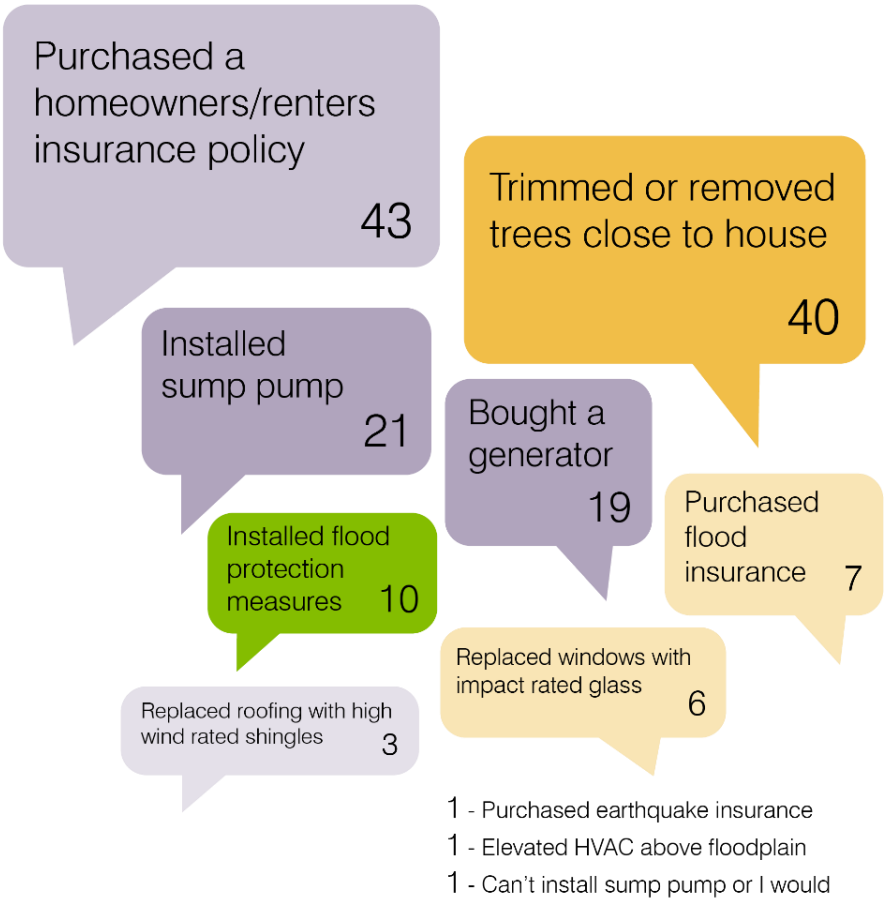


Figure 2.4 Survey Responses: "What actions have you taken to reduce the risk of natural hazards for your property?"

When asked what level of importance it is for the Town to prioritize maintaining and preparing different sites against natural hazards, residents ranked roads, waste and water utilities, residential neighborhoods, police/fire stations, and schools in their top five.

Residents also reported that their preferred ways of receiving information about hazard mitigation in Burlington are predominantly email updates from the Town, followed by online fact sheets, social media postings, pre-recorded videos posted online, and interactive online webinars.

Public Meeting: Community input was also collected through public meetings with the help of the STC. Public Meetings were announced to community members through virtual, hard copy, and

community outreach network methods, at the same time and in the same methods that the survey was promoted. These included notices in the press and posting on the town's website.

The first public meeting was held in-person on June 26, 2024, from 6:00 to 8:00 PM, and was primarily focused on informing the public about the history and purpose of the HMP update, FEMA mitigation funding programs, project work plan, and the overall planning process. The meeting included a discussion of local vulnerabilities, strengths, historic hazard impacts on the community, and potential adaptation action items.

The second public meeting was held as the draft review period was open on xxx To be Updated after review period xxxx, to present the initial results and review the draft HMP Update. Attendees were invited to submit comments on the draft plan and in the following two weeks through an online comment form.

Figure 2.5: Public Engagement Images for Social Media and Print

Stakeholder Outreach: Planning staff reached out the following organizations for support with survey outreach and for review of the draft plan: the Conservation Commission, Fire Chief, Director of the Department of Public Works, the Board of Health, Burlington Planning Board, Board of Selectmen, Council on Aging, Burlington Chamber of Commerce, and Burlington Cable Access Television. The following stakeholders were sent draft final plans and notice of the public workshop to review the plan – the Towns of Bedford, Billerica, Wilmington, Lexington and the City of Woburn and the Mystic Regional Emergency Planning Council.

2.3. Review of Existing Plans, Studies, Reports & Technical Information

2.3.1. | Plans Related to Hazard Mitigation

The Town of Burlington has undertaken significant long-range planning efforts related to hazard mitigation, climate resilience, and sustainability. Key focus areas of these efforts include developing plans to reduce the impact of extreme events, preparing the community for extreme events and chronic impacts, and mitigating risks to the built and natural environments from natural hazards. There are a variety of ordinances and regulations, as well as committees and task forces, that further the Town's efforts to proactively address natural hazards and climate change, which are discussed in Chapter 5 in the Capabilities Assessment.

Local Plans

Town of Burlington Master Plan (2023): In the Burlington Master Plan, which lays out Burlington's planning visions for land use, transportation, housing economic development, natural and cultural resources, open space and recreation, Town Center, services and facilities, and implementation, hazard mitigation is a demonstrated priority in goals to strengthen the resilience of floodplain areas via infrastructure upgrades and to increase funding to the Emergency Management Department, which can then identify priority emergency routes and provide emergency shelter services. One of the goals for the Natural Resources Chapter was to incorporate resiliency into local planning efforts, including a recommendation to perform a local resiliency study, and to improve design standards for local infrastructure.

Town of Burlington Comprehensive Emergency Management Plan (2022): The Emergency Management Plan establishes an emergency management system framework for the responsibilities of Town departments, state/regional/federal agencies and organizations, private sector partners, and community organizations. It describes the policies in place for emergency preparedness, emergency management, and short-term recovery.

Town of Burlington Community Resilience Building Summary of Findings (2019): This report is a community-focused hazard vulnerability assessment and resilience plan. The top hazards within Burlington were identified as flooding, extreme snow, heating, and drought. The Town describes municipal vulnerabilities and strengths and came up with key actions to address flood management, transportation corridor management, emergency management and preparedness, and social vulnerability.

Regional Plans

Identifying and Prioritizing Flood-Prone Sites, Resilient Mystic Collaborative's Upper Mystic Working Group's Regional Flood Management Phase 4 Plan (2024): As part of the most recent phase in the Upper Mystic Regional Flood Management program, designed to secure MVP funding for flood resilience projects, this plan identifies and

prioritizes the most flood-prone facilities of each municipality. It also proposes preliminary flood mitigation strategies for the prioritized flood-prone facilities. For Burlington, the plan identifies Beacon Village as a priority asset for mitigation strategies, advising green infrastructure installations and retrofitting of a central pond for flood detention.

2.3.2. | FEMA Guidance

All aspects of the planning process were created and implemented in accordance with the updated FEMA Local Mitigation Planning Policy Guide (FEMA, 2023) and FEMA Local Mitigation Planning Handbook (FEMA, 2023).

3

3. Risk Assessment: Community Assets

Assets are broadly defined as anything that is important to the character and function of a community (FEMA, 2023). Assets can be built, natural, or non-physical elements. They range from emergency facilities and critical infrastructure to community events that help shape collective identity and social cohesion. Below are asset categories, community lifelines, and the list of assets in Burlington. This analysis is the first step in the risk assessment to identify local vulnerabilities to natural hazards (Chapter 4) and develop a plan for future resilience (Chapter 6).

3.1. Asset Categories

The following sections discuss categories of community assets and how community assets are categorized into community lifelines.

3.1.1. | Overarching Categories

Assets are organized into the following five categories (FEMA, 2022). These categories represent the wide variety of perspectives, purposes, and goals that assets can include.

While assets may fall into multiple categories, they will be listed under just one. The categories are used for organizational purposes only and will not impact on the mitigation actions or vulnerability assessments of any assets.

- People (including underserved communities and socially vulnerable populations): "Assets that serve populations that are more vulnerable to disaster (e.g., elderly, children, visiting populations) and/or serve densely populated areas."
- Structures (including facilities, lifelines, and critical infrastructure): "Built facilities that provide community lifeline services. A community lifeline enables the continuation of critical government and business functions and is essential to human health and safety or economic security."
- Systems (including networks and capabilities): "A collection of components that perform a critical service for the community. Systems are linear type assets. Systems may include horizontal assets associated with linear type assets."

- Natural resources: "Natural Resources are areas that provide protective functions to reduce magnitude of hazard impact and increase resiliency, sensitive habitat that are vulnerable to hazard events, and the protection of areas that are important to community objectives, such as the protection of sensitive habitat, provide socio-economic benefits, etc.
- Historical and Cultural Resources: "Assets that possess historical, cultural, archaeological or paleontological significance, including sites, contextual information, structures, districts, and objects significantly associated with or representative of earlier people, cultures, maritime heritage, and human activities and events."
- Economic Assets: Economic assets are defined as entities that produce a financial benefit for the owner or community.
- Community Assets: "Activities that benefit the community by increasing community morale and well-being. Activities may include education and knowledge transfer."

3.1.2. | Community Lifelines

"Community Lifelines" is FEMA's term for assets of a community that the community cannot survive without. "A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security (FEMA, 2020)."

For the purposes of hazard mitigation planning and the asset inventory, community lifelines are used to categorize all assets in terms of these critical functions. Not all assets are community lifelines.

A subset of the Town of Burlington's assets falls into one of eight lifelines that have been classified and described as follows (FEMA, 2019).

Law enforcement and government services, as well as the associated assets that maintain communal security, provide search and rescue, evacuations, and firefighting capabilities, and promote responder safety.

Support systems that enable the sustainment of life, such as water treatment, transmission, and distribution systems; food retail and distribution networks; and wastewater collection and treatment systems.

Infrastructure and service providers for medical care, public health, patient movement, fatality management, behavioral health, veterinary support, and health or medical supply chains.

Service providers for electric power infrastructure, composed of generation, transmission, and distribution systems, as well as gas and liquid fuel processing, transportation, and delivery systems. Disruptions can have a limiting effect on the functionality of other community lifelines.

Infrastructure owners and operators of broadband internet, cellular networks, landlines, cable services, satellite communications services, and broadcast networks (radio and television). Communications systems encompass a large set of diverse modes of delivery and technologies, often intertwined but largely operating independently. Services include elements such as alerts, warnings, and messages, as well as 911 and dispatch. Also includes accessibility of financial services.

Multiple modes of transportation often serve complementary functions and create redundancy, adding to the inherent resilience in overall transportation networks. Transportation infrastructure generally includes highways/roadways, mass transit, railway, aviation, maritime, pipeline, and intermodal systems.

Systems that mitigate threats to public health/welfare and the environment. This includes assessment of facilities that use, generate, and store hazardous substances, as well as specialized conveyance assets and efforts to identify, contain, and remove incident debris, pollution, contaminants, oil or other hazardous substances.

Systems for Potable Water and Wastewater Management. This includes potable water intake, treatment, storage, and distribution. It also includes Wastewater collection, storage, treatment, and discharge.

3.2. Town of Burlington Assets

Assets in the Town of Burlington have been identified utilizing the newest MassGIS data, the most up-to-date MassGIS L3 Parcel data, the asset inventory presented in the 2016 Hazard Mitigation Plan, and input collected from the planning committee. This section describes community assets and provides summary tables of assets by category including more detail on the general types of assets within that category, how many assets there are, and which assets are considered community lifelines.

3.2.1. | People Assets

Populations

According to the latest U.S. Decennial Census, the Town of Burlington has (Bureau, 2024):

- A population of 26,377
- A median age of 43.9
- A race and ethnicity mix of 70% White, 4.7% Black or African American, and 17.8% Asian
- A median household income of $133,936
- 73.5% owner-occupied housing units
- 873 Veterans
- 5.2% of people living below the poverty line
- An educated population (79.8% of people aged 25-34 hold a bachelor's degree or higher)

There are multiple mapped Environmental Justice populations in the Town of Burlington (EOEEA, 2024). These populations are shown in gold on the map in Figure 3.1 below. In these communities, minorities comprise at least 25% of the population. Additionally, many households in these communities, as much as 9%, experience language isolation (EOEEA, 2024). Other priority populations in Burlington include seniors, veterans, and those with special needs.

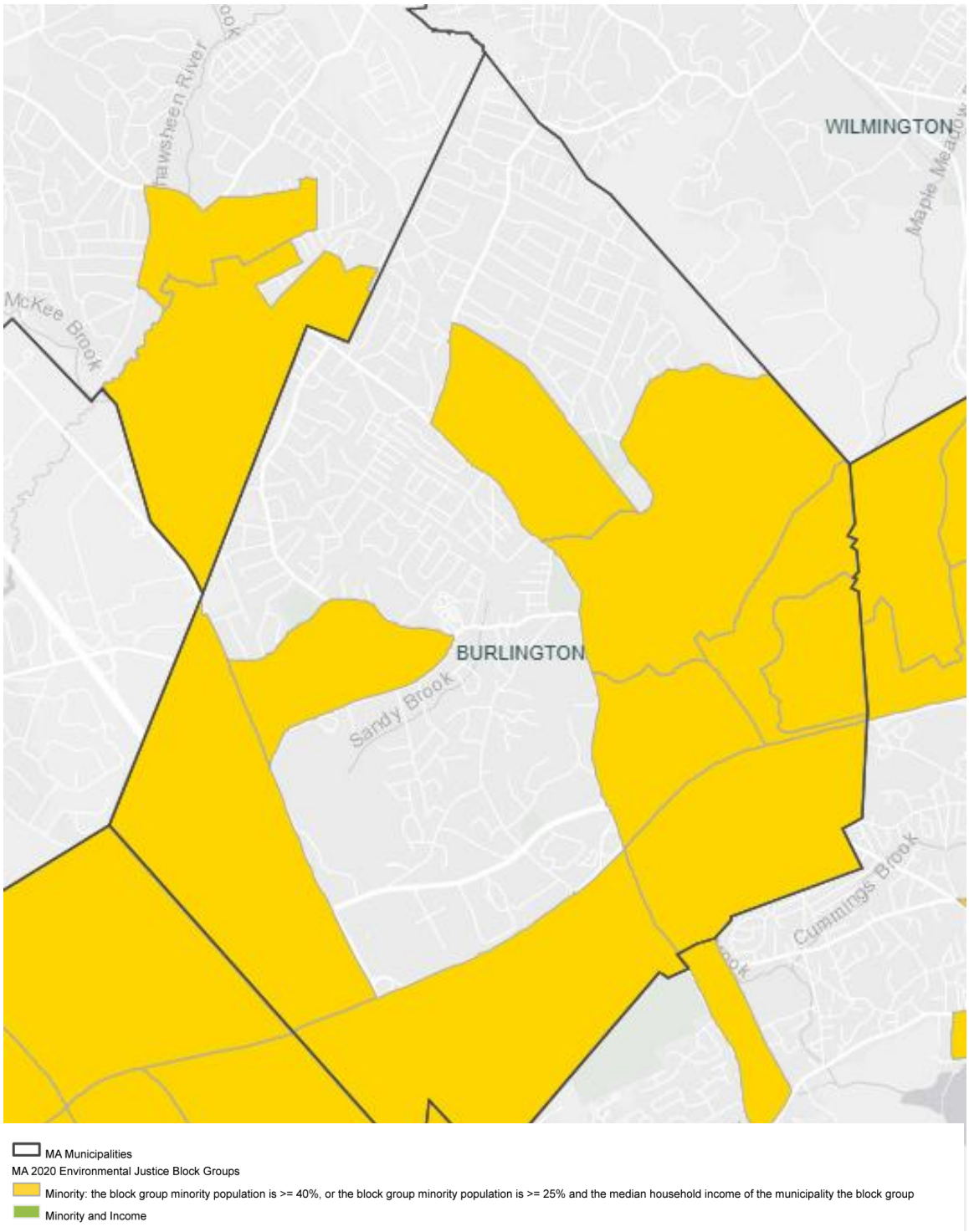


Figure 3.1: Environmental Justice populations in Burlington

Facilities that Serve these Populations

People Assets are defined as "assets that serve populations that are more vulnerable to disaster (e.g., elderly, children, visiting populations) and/or serve densely populated areas" (FEMA, 2022).

Table 3.1: People Assets in Burlington

Asset Type	Name	Location	Community Lifeline
Schools/Daycare	Fraser, Carol Day Care	75 Bedford Street	Food, Hydration, Shelter
	Johnson, Kathleen A. Day Care	117 Bedford Street	Food, Hydration, Shelter
	Kirchner, Victoria Day Care	15A Heritage Way	Food, Hydration, Shelter
	Linda's LuvNCare, Linda Norden	13 Manhattan Drive	Food, Hydration, Shelter
	Rocha De Albuquerque, Ana Day Care	5 Hillsdale Avenue	Food, Hydration, Shelter
	Fabrizio-Nota, Angela Day Care	86 Locust Street	Food, Hydration, Shelter
	Buccheri Pereira, MaryAnn Day Care	13 Dearborn Road	Food, Hydration, Shelter
	Kinder Care Learning Center	133 Cambridge Street	Food, Hydration, Shelter
	Knowledge Beginnings	30 Mall Road	Food, Hydration, Shelter
	Little Executive Center	15 District Avenue	Food, Hydration, Shelter
	KinderCare Child Care and Preschool	18 Ray Avenue	Food, Hydration, Shelter
	Presbyterian Nursery School	335 Cambridge Street	Food, Hydration, Shelter
	Temple Nursery School	14 Lexington Street	Food, Hydration, Shelter

Asset Type	Name	Location	Community Lifeline
	Tender Learning Centre	87 Second Avenue	Food, Hydration, Shelter
	The Children's Circle, Inc.	10 St. Marks Road	Food, Hydration, Shelter
	Rosebud Childcare	85 Wilmington Road	Food, Hydration, Shelter
	Abramo, Catherine J. Day Care	102 Mill Street	Food, Hydration, Shelter
	Dori's Daycare/School	20 Olean Road	Food, Hydration, Shelter
	Teachable Moments	11 Brookside Lane	Food, Hydration, Shelter
	Little Steps Childcare (Leanne Freda)	224 Fox Hill Road	Food, Hydration, Shelter
	Safari Kid	156 Cambridge Street	Food, Hydration, Shelter
	Learning Cottage	21 Douglas Street	Food, Hydration, Shelter
	Primrose School	10 Greenleaf Way	Food, Hydration, Shelter
	Sandra Johnson Farm Daycare	3 Elizabeth Ave	Food, Hydration, Shelter
	La Creche Daycare	5 Crawford Road	Food, Hydration, Shelter
	Growing by Leaps & Bounds	12 St. Marks Road	Food, Hydration, Shelter
	Siya Daycare	22 Townline Road	Food, Hydration, Shelter
	Small Wonder Family Daycare	36 Locust Street	Food, Hydration, Shelter

Asset Type	Name	Location	Community Lifeline
	School for Early Excellence	56 Middlesex Turnpike	Food, Hydration, Shelter
	Burlington Montessori	6 Lexington Street	Food, Hydration, Shelter
	Kiddie Academy of Burlington	209 Middlesex Turnpike	Food, Hydration, Shelter
	Burlington Creative Start	56 Middlesex Turnpike	Food, Hydration, Shelter
	Burlington High School	123 Cambridge Street	Food, Hydration, Shelter
	Marshall Simonds Middle School	114 Winn Street	Food, Hydration, Shelter
	Memorial Elementary School	4 Winn Street	Food, Hydration, Shelter
	Francis Wyman Elementary School	41 Terrace Hall Avenue	Food, Hydration, Shelter
	Fox Hill Elementary School	Fox Hill Road	Food, Hydration, Shelter
	Pine Glen Elementary School	4 Pine Glen Way	Food, Hydration, Shelter
	Mount Hope Christian School	3 McGinnis Drive	Food, Hydration, Shelter
	Open Bible Academy	3 Winn Street	Food, Hydration, Shelter
	Burlington Early Childcare Center at Burlington High School	123 Cambridge Street	Food, Hydration, Shelter
	YMCA After School Program at Francis Wyman Elementary School	41 Terrace Hall Avenue	Food, Hydration, Shelter

Asset Type	Name	Location	Community Lifeline
	YMCA After School Program at Memorial Elementary School	125 Winn Street	Food, Hydration, Shelter
Elderly Housing	Birchcrest Arms/Burlington Housing Authority	14 Birchcrest Street	Food, Hydration, Shelter
	Tower Hill Apartments/Burlington Housing Authority	15 Birchcrest Street	Food, Hydration, Shelter
	Heritage at Stoneridge (55+)	1 McNamara Way	Food, Hydration, Shelter
Assisted Living	Atria Longmeadow Place	42 Burlington Mall Road	Food, Hydration, Shelter
	Sunrise of Burlington	24 Burlington Mall Road	Food, Hydration, Shelter
	Stonebridge at Burlington	50 Greenleaf Way	Food, Hydration, Shelter
Library	Burlington Public Library	22 Sears Street	Hydration, Shelter
Religious Centers	Islamic Center of Burlington	130 Lexington Street	Hydration, Shelter
	Mount Hope Christian Center and Family Life Center	3 McGinnis Drive	Hydration, Shelter
	International Church of God Prayer Center	84 Cambridge Street	Hydration, Shelter
	Nazazim Church and Fellowship Bible Church	71 Center Street	Hydration, Shelter
	Presbyterian Church	335 Cambridge Street	Hydration, Shelter
	St Mark's Episcopal Church	10 St Marks Road	Hydration, Shelter

3.2.2. | Structures Assets

"Structure" assets are built facilities including residential, commercial, and industrial facilities that may be in harm's way during a hazard event. Many of these structures provide community lifeline services.

Development Since Previous Hazard Mitigation Plan

Over two-thirds of the town is zoned for single-family homes with the remaining third zoned for commercial and multi-family residential uses. Residential areas comprise much of the northern part of the town. Areas of business, commercial, and industry are generally clustered around I-95 in the southern portion of the town. Within the residential zones there are small commercial clusters that serve the local neighborhoods. Most notably is the town center which consists of the local central business district and the town's civic center. There are two distinct parcels of open space in the southeast and southwest parts of the town adjacent to Lexington and Woburn. The existing land use map for Burlington is shown below in Figure 3.2. Burlington's land use goals include (Burlington, 2023):

- Allow and encourage compact, well-organized development within commercial and retail areas of town.
- Promote a broader mix of uses in areas where it will enhance efficient use of the land, increase the quality of life, and keep Burlington in pace with other communities as a great place to live, work, and visit.
- Raise the design quality of buildings and site improvements so that they are more attractive and valuable from private and public perspectives.
- Enhance the Cambridge Street corridor as Burlington's own "Main Street" providing convenient and community-serving businesses and institutions in a mixed-use setting along an increasingly attractive corridor.
- Promote sustainable land use practices throughout the community.
- Provide mitigation for negative impacts associated with development and provide positive amenities that will protect and enhance all areas of Burlington.
- Preserve and enhance the land devoted to open space.
- Clearly define and strengthen the community core of Burlington including the civic-oriented Common area and the business-oriented Town Center.

Burlington regulates land use and development through zoning, which has the capacity to guide the development of vacant land. Zoning districts in Burlington include:

- General Business
- Business Limited
- Continuous Traffic Business
- General Industrial
- Innovation
- Retail Industrial
- Open Space
- Planned Development
- One-Family Dwelling

- Continuing Care
- Garden Apartment

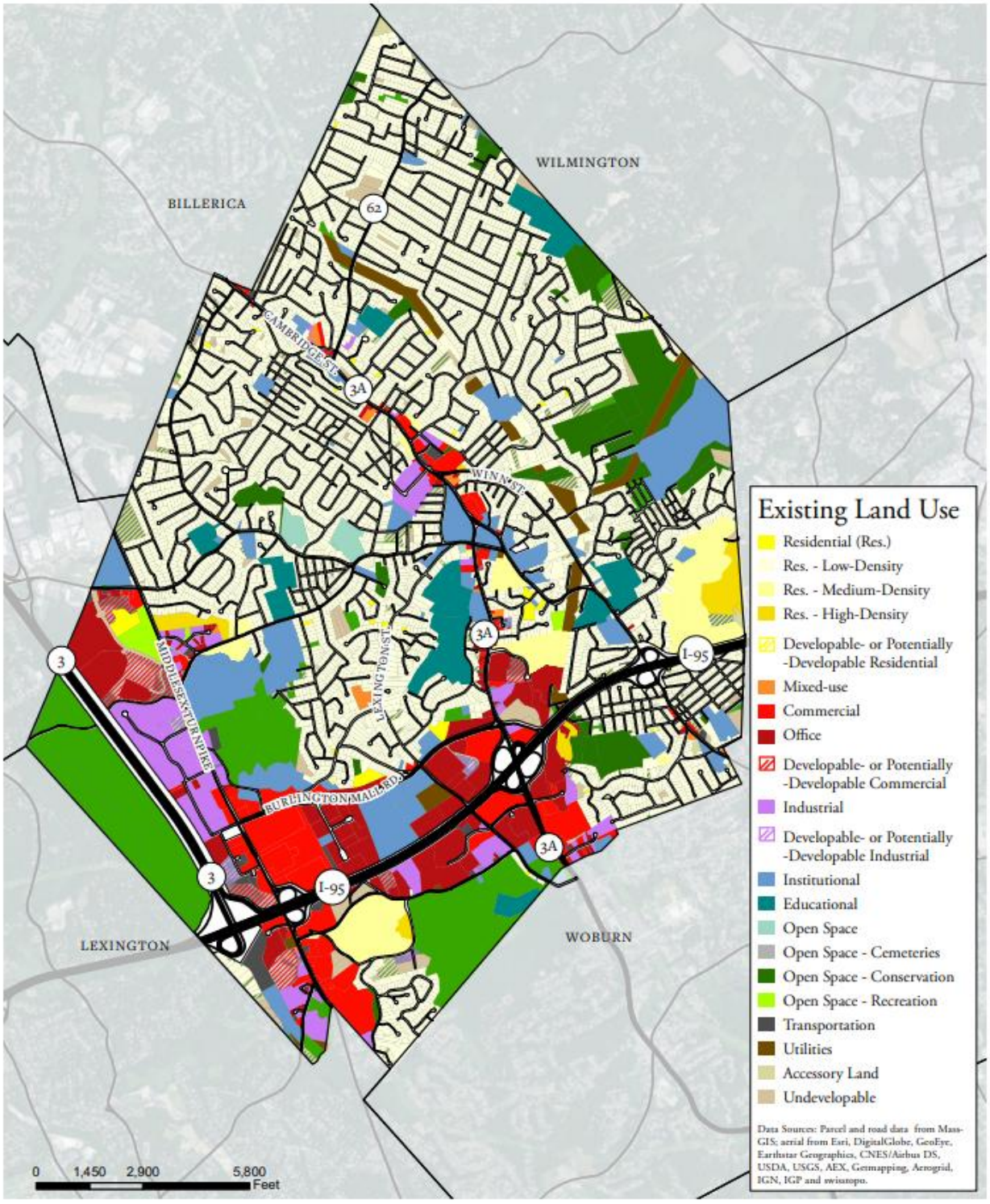


Figure 3.2: Existing Land Use in Burlington

Since the preparation of the last HMP in 2016, several new or redevelopment projects have occurred in the Town of Burlington. These projects are listed below in Table 3.2.

Table 3.2: Recent developments in the Town of Burlington

Year	Number of Building Permits	Major Development	Housing Units Permitted- Single Family	Housing Units Permitted 5+ unit Buildings
2016	1211	5	32	297
2017	1180	5	41	299
2018	1125	5	44	
2019	1217		28	
2020	1170		31	
2021	1338		NA	NA
2022	1485	5	NA	NA
2023	1463	2	NA	NA

Source: Town, MHP Datatown

Existing Structure Assets

Table 3.3 shows current structural assets in Burlington by type and number. In addition, the relevant community lifeline, previously described in Section 3.1.2, is noted.

Table 3.3: Structure Assets in Burlington

Asset Type	Name	Location	Community Lifeline
Fire Stations	Burlington Fire Department Headquarters	21 Center Street	Safety & Security
	Burlington Fire Station #2	114 Terrace Hall Avenue	Safety & Security
Police Stations	Burlington Police Department	45 Center Street	Safety & Security

Asset Type	Name	Location	Community Lifeline
Town Facilities	Burlington Town Hall Annex	25 Center Street	
	Department of Public Works Office	25 Center Street	
	Department of Public Works Highway Barn	1 Great Meadow Road	
	State Highway Department Salt Barn	2 Grant Avenue	
	Salt Shed	38 Grant Avenue	
	Department of Public Works/Recreation Department Maintenance Garage	10 Great Meadow Road	
	Dog Pound	2 Great Meadow Road	
	Burlington Town Hall	29 Center Street	
	Grand View Farm	55 Center Street	
	Center for Human Services	61 Center Street	
Dams	Main Dam	70 Winter Street	Water Systems
	North Dike	Mill Pond Reservoir	Water Systems
	South Dike	Mill Pond Reservoir	Water Systems
Bridges	Middlesex Turnpike Bridge	Route 128 at Middlesex Turnpike	
	Cambridge Street Bridge	Route 128 at Cambridge Street	
	Winn Street Bridge	Route 128 at Winn Street	

Asset Type	Name	Location	Community Lifeline
Hospital	Lahey Clinic	41 Burlington Mall Road	Health & Medical
	Mass General Brigham Community Physicians	47 Middlesex Turnpike	Health & Medical
	AFC Urgent Care	90 Middlesex Turnpike	Health & Medical
	ConvenientMD Urgent Care	181 Cambridge Street	Health & Medical
	Harvard Vanguard	20 Wall Street	Health & Medical
Emergency Operations Center	Emergency Operations Center / Town Hall Annex Basement	25 Center Street	Safety & Security
	Emergency Operations Center / Police Department	45 Center Street	Safety & Security
Hazardous Material Site	Town Irwin, Inc.	11 A Street	Hazardous Materials
	Herb Chambers	33 Cambridge Street	Hazardous Materials
	Verizon	1 Bedford Street	Hazardous Materials
	Verizon	51 South Bedford Street	Hazardous Materials
	Abramo Pool & Spa, Inc.	292 Cambridge Street	Hazardous Materials
	Burlington Fire Department	21 Center Street	Hazardous Materials
	Mill Pond Water Treatment Plant	82 Winter Street	Hazardous Materials
	Vine Brook Water Plant	171 Middlesex Turnpike	Hazardous Materials
	Sun Microsystems	1 Network Drive	Hazardous Materials

Asset Type	Name	Location	Community Lifeline
	QSA Global	40 North Avenue	Hazardous Materials
	M/A COM	33R Second Avenue	Hazardous Materials
	Keurig Dr. Pepper	43 South Avenue	Hazardous Materials
	Wayne's Drain	36 Grant Avenue	Hazardous Materials
	Lahey Clinic	41 Burlington Mall Road	Hazardous Materials
Grocery Stores	Market Basket	43 Middlesex Turnpike	Food, Hydration, Shelter
	H Mart	3 Old Concord Road	Food, Hydration, Shelter
	Trader Joe's	51 Middlesex Turnpike	Food, Hydration, Shelter
	Wegmans	53 3rd Avenue	Food, Hydration, Shelter
	Target Grocery	34 Cambridge Street	Food, Hydration, Shelter
	Shaw's	180A Cambridge Street	Food, Hydration, Shelter

Critical infrastructure like dams provide recreation, water supply, floodplain management, energy, and other essential functions. Dam owners and operators can be private, non-profit, or public. These structures and their owners are a vital component of local hazard mitigation.

The Hazard Potential Classification System for Dams provides an indication of the consequences of failure of a dam in the United States. This system contains three classes I – Low, II – Significant, and III – High, each representing the degree of potential damage to downstream life and property (FEMA, 2004).

The Town of Burlington owns and operates three dams, as shown in Table 3.3, above. Two of these dams are classified as high hazard.

Potential Future Development

According to the Metropolitan Area Planning Commission's population projections, under status quo trends Burlington's population will grow to 26,538 by 2030, with a slight decrease in the number of

children under 15 (-7%) and an increase of people over the age of 65 by 51% (Metropolitan Area Planning Commisssion, 2014). Burlington adopted zoning amendments in May 2024 that will locate a new zoning overlay on existing multifamily properties at Heritage at Stoneridge, Beacon Village, Lifetime Living, The Huntington and The Tremont, as well as the underutilizing existing commercial area around the Staples store on Middlesex Turnpike. This will bring Burlington in compliance with the MBTA Communities Zoning Act and may allow for potential future development at the Staples parcels, though the other parcels that have been rezoned are fully built out.

3.2.3. | Systems Assets

Systems are defined as "a collection of components that perform a critical service for the community. Systems are linear type assets. Systems may include horizontal assets associated with linear type assets" (FEMA, 2022).

Table 3.4: Systems Assets in Burlington

Asset Type	Name	Location	Community Lifeline
Cell Towers/Antennas	Fire Communication Antenna	69 Cambridge Street	Communications
	Police Communication Antenna	69 Cambridge Street	Communications
	Private cell tower	72 Center Street	Communications
Utilities and Power Generating Stations	Eversource Sub Station	64A Middlesex Turnpike	Energy
Sewer Pump Stations	Bedford Street Sewer Pump Station	152 Bedford Street	Water Systems
	29 Douglas Avenue Sewer Pump Station	29 Douglas Avenue	Water Systems
	Wilmington Road Sewer Pump Station	87 Wilmington Road	Water Systems
	Brookside Sewer Pump Station	9A Brookside Lane	Water Systems
	Westwood Street Sewer Pump Station	30A Westwood Street	Water Systems

Asset Type	Name	Location	Community Lifeline
	Lexington Street Sewer Pump Station	134 Lexington Street	Water Systems
	Lucya Road Sewer Pump Station	8 Lucaya Circle	Water Systems
	Town Line Road Sewer Pump Station	24 Town Line Road	Water Systems
	Keans Road Sewer Pump Station	44 Keans Road	Water Systems
	Belmont Road Sewer Pump Station	34 Belmont Road	Water Systems
	Grandview Avenue Sewer Pump Station	12 Grandview Avenue	Water Systems
	Partridge Lane Sewer Pump Station	12 Partridge Lane	Water Systems
	Francis Wyman Road Sewer Pump Station	26A Francis Wyman Road	Water Systems
	Main Sewer Pump Station	112 Terrace Hall Road	Water Systems
Water Storage Tank	Center Street Water Storage Tank	72 Center Street	Water Systems
	Greenleaf Mountain Water Storage Tank	69 Cambridge Street	Water Systems
	Blanchard Road Water Storage Tank	27 Blanchard Road	Water Systems
Wastewater Treatment	Mill Pond Water Treatment Plant	70 Winter Street	Water Systems
	Vine Brook Water Plant	171 Middlesex Turnpike	Water Systems
Water Pump Stations	Main Water Pump Station	2 Great Meadow Road	Water Systems

Asset Type	Name	Location	Community Lifeline
	Water Pump Station #3	171 Middlesex Turnpike	Water Systems
	Water Pump Station #5	171 Middlesex Turnpike	Water Systems
	Water Pump Station #4	171 Middlesex Turnpike	Water Systems
	Terrace Hall Ave Water Pump Station #1	46 Terrace Hall Avenue	Water Systems
	Terrace Hall Avenue Water Pump Station #2	46A Terrace Hall Avenue	Water Systems
	Water Pump Station #11	132 Lexington Street	Water Systems
	Water Pump Station #10	132 Lexington Street	Water Systems
	Water Pump Station #7	132 Lexington Street	Water Systems
	Wellesley Avenue Water Pump Station	2 Wellesley Avenue	Water Systems
	Robin Lea Water Pump Station	Off Main Dam	Water Systems

3.2.4. | Natural Resources Assets

Natural Resources are defined as "areas that provide protective function to reduce magnitude of hazard impact and increase resiliency, areas of sensitive habitat that are vulnerable to hazard events, and protection of areas that are important to community objectives, such as the protection of sensitive habitat, provide socio-economic benefits, etc." (FEMA, 2022).

Table 3.5: Natural Resource Assets in Burlington

Asset Type	Name	Location	Community Lifeline
	Mill Pond Reservoir	99 Wellesley Avenue	

Asset Type	Name	Location	Community Lifeline
Open Space	Mill Pond Conservation Area	5 Hansen Avenue	
	Mary Cummings Park	25 Blanchard Road	
	Landlocked Forest	7 Mountain Road	

3.2.5. | Cultural and Historic Resources Assets

Cultural and Historic Resources are defined as "assets that possess historical, cultural, archaeological or paleontological significance, including sites, contextual information, structures, districts, and objects significantly associated with or representative of earlier people, cultures, maritime heritage, and human activities and events" (FEMA, 2022).

Table 3.6: Cultural and Historic Resource Assets in Burlington

Asset Type	Name	Location	Community Lifeline
Cultural Resources	Town Common / Simonds Park	2 Bedford Street	
	Overlook Park	1 Edgemere Avenue	
	Center for Human Services	61 Center Street	
	Marvin Field	100 South Bedford Street	
	Rotary Field	100 South Bedford Street	
	Mitre Corp Fields	142 Bedford Street	
	TRW Playground	26 Burlington Mall Road	
	Pathwoods Tot Lot	20 Pathwoods Avenue	
	Rahanis Playground	84 Mill Street	
	Veteran's Playground	110 Wilmington Road	

Asset Type	Name	Location	Community Lifeline
	Wildmere Playground	19 Wildmere Avenue	
	Regan Playground	14 Sumpter Road	
	Wildwood Park	116 Bedford Street	
Historic Resources	Center School/Burlington Historical Museum	13 Bedford Street	
	Francis Wyman House	56 Francis Wyman Road	
	General John Walker House	9 Bedford Street	
	Isaiah Reed House	336 Cambridge Street	
	John Wynn House	13 Wyman Street	
	Marion Tavern/Grandview Farm	55 Center Street	
	Old Burying Ground	17 Bedford Street	
	West School	106 Bedford Street	
	Woburn Second Parish Meeting House	6 Lexington Street	

3.2.6. | Economic and Community Assets

Economic assets are defined as entities that produce a financial benefit for the owner or community, while community assets are defined as "Activities that benefit the community by increasing community morale and well-being. Activities may include education and knowledge transfer" (FEMA, 2022).

Table 3.7: Economic and Community Assets in Burlington

Asset Type	Name	Location	Community Lifeline
Community Events	4th of July Parade	Cambridge Street and Winn Street	
	Winter Carnival	2 Bedford Street	
	Celebrate Burlington	2 Bedford Street	
	Truck Day	2 Bedford Street	
	Christmas Tree Lighting	2 Bedford Street	
Top Employers	Lahey Hospital and Medical Center	41 Burlington Mall Road	
	Genesis HR Solutions	30 Corporate Drive	
	Keurig Dr. Pepper	53 South Ave	
	Oracle	8 Van de Graaff Drive	
	Endurance International	10 Corporate Drive	
	Aetna Student Health Agency	77 S Bedford Street	
	Avid Technology	75 Network Drive	
	Circor International	30 Corporate Drive	
	Cerence, Inc.	1 Burlington Woods Drive	
	EMD Millipore	400 Summit Drive	
	Peace Plus Maintenance Corp	New England Exe Park # 104	
	Progress Software Comp	15 Wayside Road	

Asset Type	Name	Location	Community Lifeline
	Raytheon Technical Svc Co LLC	3 Van de Graaff Drive	
	Wegman's	53 3rd Avenue	
	Everbridge	25 Corporate Drive	
Employment Hub	Burlington Mall	75 Middlesex Turnpike	

4

4. Risk Assessment: Natural Hazards, Asset Vulnerabilities, and Community Impacts

Natural hazards have the potential to induce damage or loss to physical assets, including the structures, infrastructure, and natural, historic, and cultural resources within the Town. Natural hazards also have the potential to affect people, including priority populations, municipal processes and operations, and activities that have value to the community.

As explained by FEMA, "in hazard mitigation planning, risk is the potential for damage or loss when natural hazards interact with people or assets. These assets may be buildings, infrastructure or natural and cultural resources. The way natural hazards interact with a community's people, property and assets can result in a disaster. A risk assessment is a robust, data-driven analysis. It explains what might happen. It also finds where the local jurisdiction is vulnerable to hazards."

4.1. Key Terms & Methods

As previously stated in Section 1.1, Natural Hazards are a source of harm or difficulty created by a meteorological, environmental, or geological event (such as extreme wind events, tornadoes, winter weather as well as earthquakes, flooding, and fires) (FEMA). The natural hazards presented herein are those from the 2023 ResilientMass Plan that apply to Burlington. Because Burlington is not a coastal community, no information is provided related to Coastal Erosion, Coastal Flooding, or Tsunami.

Average / Extreme Temperatures

Changes in Groundwater

Drought

Earthquakes

Flooding from Precipitation

Hurricanes / Tropical Cyclones

Invasive Species

Landslides/Mudflows

Tornadoes

Wildfire

Winter Storms / Nor'easters

For each natural hazard, the following is discussed in accordance with FEMA guidance:

- How is the hazard described (description)?
- Where might it happen in Burlington (location)?
- How severe or intense may it be (extent)?
- Where has it happened in the past (previous occurrences) and how likely it is to occur (frequency)?
- How may it change in the future (probability)?
- Which assets are at risk from it (vulnerability)?
- What effects will it have on community assets including populations (impacts)?

The following methods were used to complete each section of the risk assessment:

- **Description:** A description for each natural hazard from the Massachusetts 2023 State Hazard Mitigation and Climate Adaptation Plan (ResilientMass Plan) is provided.
- **Location:** Location is the geographic boundary in which a hazard occurs or the type of environment that is conducive to the hazard. This may include areas larger or smaller than the Town of Burlington's jurisdiction. It may also include a specific land cover or topographic environment.
- **Previous Occurrence(s) and Frequency:** A list or summary of historical occurrences of the natural hazard event within or near Burlington. Frequency refers to how often the hazard has occurred in the past within the geographical area, based on historic records publicly available.
- **Severity/Intensity:** The likely magnitude of the hazard, using industry standard scales where applicable. For example, the National Hurricane Center's categorizations of tropical storms and hurricanes was used to define the range of hurricanes that may affect areas of Massachusetts. When no standard scale is available, a qualitative description is provided.
- **Probability of Future Hazard Events, including due to Climate Change:** Probability is the likelihood of a hazard occurring or recurring. This includes the effects of future conditions, including long term weather patterns, temperatures, and sea levels, on the type, location, and range of anticipated intensities of the hazard. Climate projections indicate a change in long-term weather patterns. Each section identifies how climate change may affect the probability of the natural hazard occurring, and to what degree it may change. In 2018, MA EOEEA created ResilientMA, an online clearinghouse for local governments and the public to explore climate change science and data, information on community resilience, and decision support tools. The climate change planning efforts that ResilientMA has undertaken have focused on the 2030, 2050, 2070, and 2090 planning horizons, which are defined by the bounding years 2020-2039, 2040-2059, 2060-2079, and 2080-2090, respectively. Future climate data in each section was obtained from the ResilientMA clearinghouse and the ResilientMass Plan.
- **Vulnerability:** A description of which assets within locations identified to be hazard prone are at risk from the effects of the identified hazard(s). To determine which assets identified in Chapter 3 are located within an area identified to be hazard prone, presently or in the future, the natural hazard profiles presented in this chapter were utilized. For inland flooding, GIS mapping of assets and areas of flooding were utilized to describe vulnerability, as further

described in Section 4.7. For all other hazards, the identified hazard is not mapped or cannot be mapped and therefore a qualitative analysis that relies on local knowledge and rational decision making was used to identify vulnerability. Vulnerability discussions focus on specific assets that are most important and most susceptible to damage or loss from hazards.

- **Impacts:** Consequences or effects of each hazard on the town's assets identified in the vulnerability assessment. The categories below discus general impacts that can be the result of natural hazards affecting Burlington's assets. The impacts in Table 4.31 are discussed throughout this chapter.

Table 4.1: Potential impacts from hazards in Burlington

Impact	Examples
Loss of Life	Death
Physical Injuries	Cuts, bruises, broken bones, or amputations.
Public Health	Spread of disease, bacterial infections, and vector-borne illnesses Elevated rates of emergency room visits Respiratory problems arising from air pollution, allergens, and mold
Displacement	Forced abandonment of the home due to unsafe living conditions, either permanently or temporarily
Psychological Impacts	Trauma Anxiety Stress PTSD
Impacts to Daily Life	Cancellation or postponement of sporting or other events that are important to the community Damage to parks, community centers, or public pools inhibits recreation Destruction of historic or cultural landmarks
Property Damage	Damage to physical structures Damage to contents within homes and buildings Damage to vehicles
Building Damage	Structural damage to roofs, walls, or foundations

Impact	Examples
	Collapse or destruction
Utility Infrastructure Damage	Damage to power lines, communications towers, and water, wastewater, and gas mains resulting in power outages, loss of water, wastewater, or gas services, and loss of communication, radio signal, or internet
Transportation Infrastructure Damage	Damage to or debris build-up on roads, bridges, railways, or airports that render them impassable or unsafe to use
Disruption to Lifelines	Medical facilities, emergency services, or transportation networks are unable to provide essential services due to damage or debris
Water Resources	Disruption to agriculture practices Yield reduction or damage to drinking water wells
Business Impacts	Lost wages Closure of or interruption to businesses Increased insurance premiums Increased costs for repairs/rebuilding Decreased property values Disruption of industry and the transport of goods and services Decreased tourism revenues
Utilities	Increased cost of utilities Disruption of utilities creating travel delays or lack or services
Building Damage	Structural damage to roofs, walls, or foundations Collapse or destruction
Economic	Lost wages Closure of or interruption to businesses Increased insurance premiums Increased costs for repairs/rebuilding Decreased property values

Impact	Examples
	Disruption of industry and the transport of goods and services Decreased tourism revenues
Government Services	Increased demand for state and municipal government services Cost of repair services
Municipal Resources	Increased need for municipal resources Disruption of resources
Contamination	Air pollution from dust and debris Transport of toxic chemicals by floodwater Release of hazardous materials into soil and water Decreased water quality Sewage release into waterways
Ecological	Loss of wildlife Loss or destruction of habitat Disruption to migratory patterns Loss of biodiversity Loss of or damage to natural resources Changes in groundwater temperature
Geological	Landslides Erosion Removal of topsoil Debris deposit Altered nutrient balance

4.2. Previous Federal/State Disaster Declarations

To understand the importance of hazard mitigation, it is useful to know the types and frequencies of disasters that occur in Massachusetts. Since 1953, there have been 35 Federal Disaster Declarations in Middlesex County, which includes the Town of Burlington (FEMA, Disaster Declarations for States and Counties, 2024). There have also been 9 Massachusetts State of Emergency Declarations in Burlington since 2011, the earliest available data provided by the State (Commonwealth of Massachusetts, 2024). These disasters are described in Table 4.32.

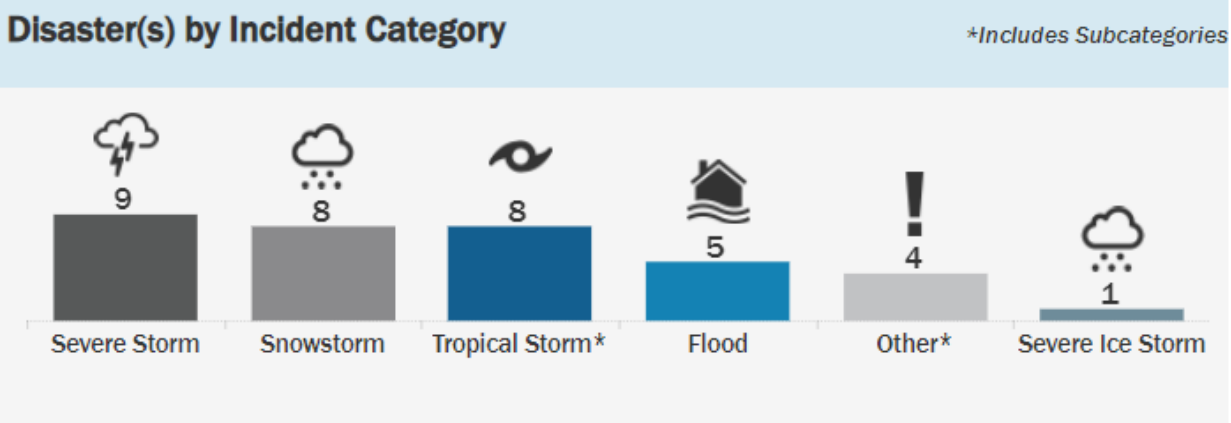


Table 4.2: Federal Disaster and MA State of Emergency Declarations in Burlington

Disaster Name	Date of Event	FEMA Disaster Number	Declaration Type
Hurricane Gloria	10/28/1985	751	Federal
Severe Storms & Flooding	04/18/1987	790	Federal
Hurricane Bob	08/26/1991	914	Federal
Winter Coastal Storm	12/21/1992	975	Federal
Snowstorm	03/16/1993	3103	Federal
Blizzard of '96	01/24/1996	1090	Federal

Disaster Name	Date of Event	FEMA Disaster Number	Declaration Type
Flood	10/23/1996	3119	Federal
Flood	10/25/1996	1142	Federal
Flood	06/23/1998	1224	Federal
Snowstorm	03/28/2001	3165	Federal
Severe Storm	04/10/2001	1364	Federal
Snowstorm	03/11/2003	3175	Federal
Snowstorm	01/15/2004	3191	Federal
Flood	04/21/2004	1512	Federal
Snowstorm	02/17/2005	3201	Federal
Hurricane Katrina Evacuation	09/13/2005	3252	Federal
Severe Storm	11/10/2005	1614	Federal
Severe Storm	05/25/2006	1642	Federal
Severe Storm	12/13/2008	3296	Federal
Severe Ice Storm	01/05/2009	1813	Federal
Severe Storm	03/29/2010	1895	Federal
Water Main Break	05/03/2010	3312	Federal

Disaster Name	Date of Event	FEMA Disaster Number	Declaration Type
Hurricane Earl	09/02/2010	3315	Federal
Snowstorm	03/07/2011	1959	Federal, MA State of Emergency
Hurricane Irene	08/26/2011	3330	Federal, MA State of Emergency
Severe Storm	11/01/2011	3343	Federal, MA State of Emergency
Severe Storm	01/06/2012	4051	Federal
Hurricane Sandy	10/28/2012	3350	Federal, MA State of Emergency
Severe Storm	02/08/2013	N/A	MA State of Emergency
Explosions- Human Cause	04/17/2013	3362	Federal
Severe Storm	04/19/2013	4110	Federal
Severe Storm	01/26/2015	N/A	MA State of Emergency
Severe Storm	02/09/2015	N/A	MA State of Emergency
Severe Storm	04/13/2015	4212	Federal
Severe Storm	03/03/2018	N/A	MA State of Emergency
Snowstorm	07/19/2018	4379	Federal
Biological	03/13/2020	3438	Federal

Disaster Name	Date of Event	FEMA Disaster Number	Declaration Type
Biological	03/27/2020	4496	Federal
Hurricane Lee	09/15/2023	3599	Federal, MA State of Emergency

4.3. Average/Extreme Temperatures

4.3.1. | Description

Average/Extreme temperatures include extreme cold, extreme heat, and the change over time of average temperatures experienced throughout the year in Massachusetts (EOEEA M. &., 2023). Although there is no universal definition, temperatures are considered extreme when they extend outside of the typical range of average conditions for acute or prolonged periods of time. Extremes can vary seasonally and occur in the form of either extreme cold or extreme heat. The 2023 ResilientMass Plan defines extreme temperatures as "those that are far outside the normal seasonal ranges for Massachusetts" (EOEEA M. &., 2023).

Extreme heat can be defined as a period of excessively hot weather – usually defined as a daily high temperature above 90 degrees Fahrenheit in Massachusetts – which may be accompanied by high humidity (EOEEA M. &., 2023).

Extreme cold is defined as a period of excessively low temperatures, especially with additional wind chill. In Boston, the National Weather Service issues a wind chill advisory when the Wind Chill Temperature index drops below -15 degrees Fahrenheit (EOEEA M. &., 2023).

4.3.2. | Location

Extreme Heat

Extreme heat is often more extreme in concentrated parts of Burlington that have less tree canopy, more pavement, and dark surfaces such as roofs and parking areas that absorb more heat.

Extreme Cold

Extreme cold can occur throughout Burlington. Extreme cold can disproportionately affect priority community members through the town, especially for people without shelter, those who are stranded, and those who live in homes that are poorly insulated or without heat.

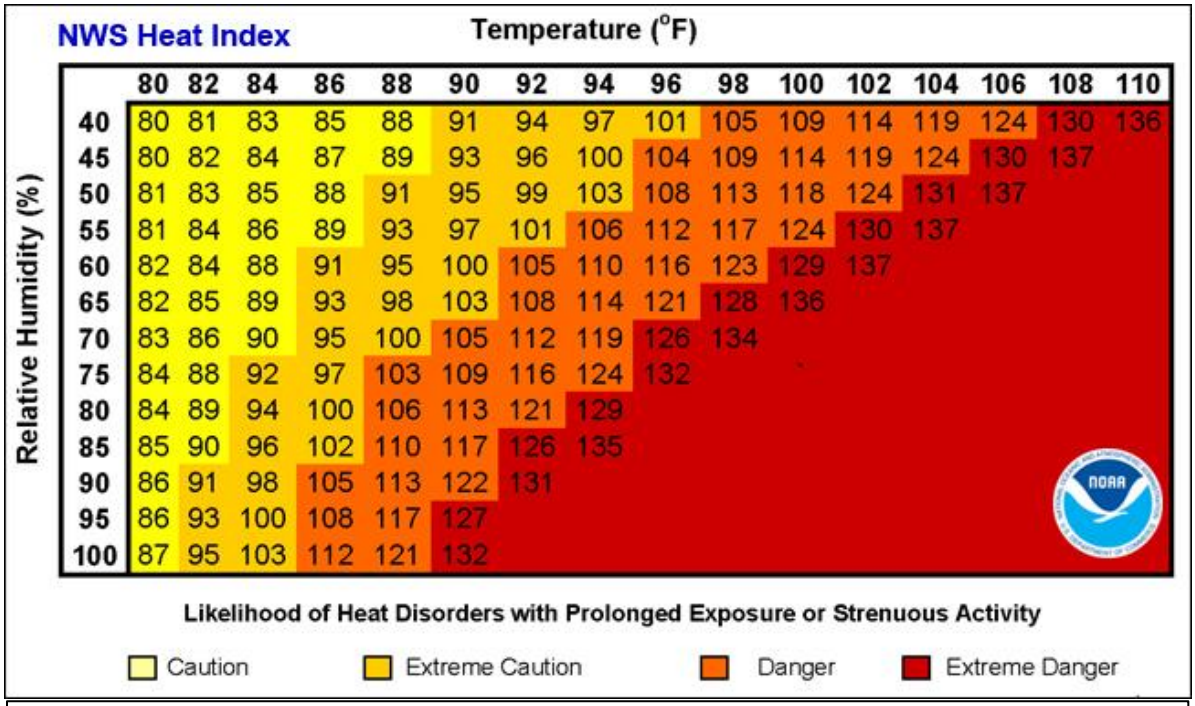
4.3.3. | Severity/Intensity

Extreme Heat

Heat waves are an extreme heat phenomenon that affects the town. Heat waves are identifiable as 3 or more consecutive days when maximum temperatures greater than 90°F occur. This implies that there is an extended period of unusually high temperatures, causing stress on everyday operations and physical health (EEA & EOPSS, 2018).

Another extreme heat phenomenon that is relevant for the Town of Burlington is the urban heat island (UHI) effect. The term "heat island" describes built-up areas that are hotter than nearby rural or shaded areas due to their larger percentage of impervious surfaces, such as concrete, asphalt, or other pavements. Large areas of impervious surfaces can exacerbate extreme heat. The area surrounding the Burlington Mall and the commercial region clustered around I-95 in the southern portion of Town may experience the UHI effect. Increased tree canopy and other engineered green infrastructure solutions, such as bioretention basins, rain gardens, green roofs, and highly reflective surfaces, as well as built shade structures have the potential to reduce the UHI effect in Burlington.

Relative humidity can worsen human health effects as temperatures increase. The extent of extreme heat temperatures is generally measured through the NWS Heat Index, which is based both on temperature and relative humidity, and describes a temperature equivalent to what a person would feel at a baseline humidity level. Figure 4.1 presents the heat index chart as published by the National Weather Service and NOAA.



Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Figure 4.1: National Weather Service Heat Index

Extreme Cold

Extreme cold temperatures can be exacerbated by factors such as wind and relative humidity. The extent of extreme cold temperatures is generally measured through the Wind Chill Temperature Index, and Figure 4.2 shows the Wind Chill Temperature Index. As evident from the figure, temperatures can feel colder and cause more damage to human health as wind speeds increase. 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 3 hours, based on sustained winds (not gusts). For example, frostbite can occur in 30 minutes at warmer than usual temperatures if wind speeds are greater.

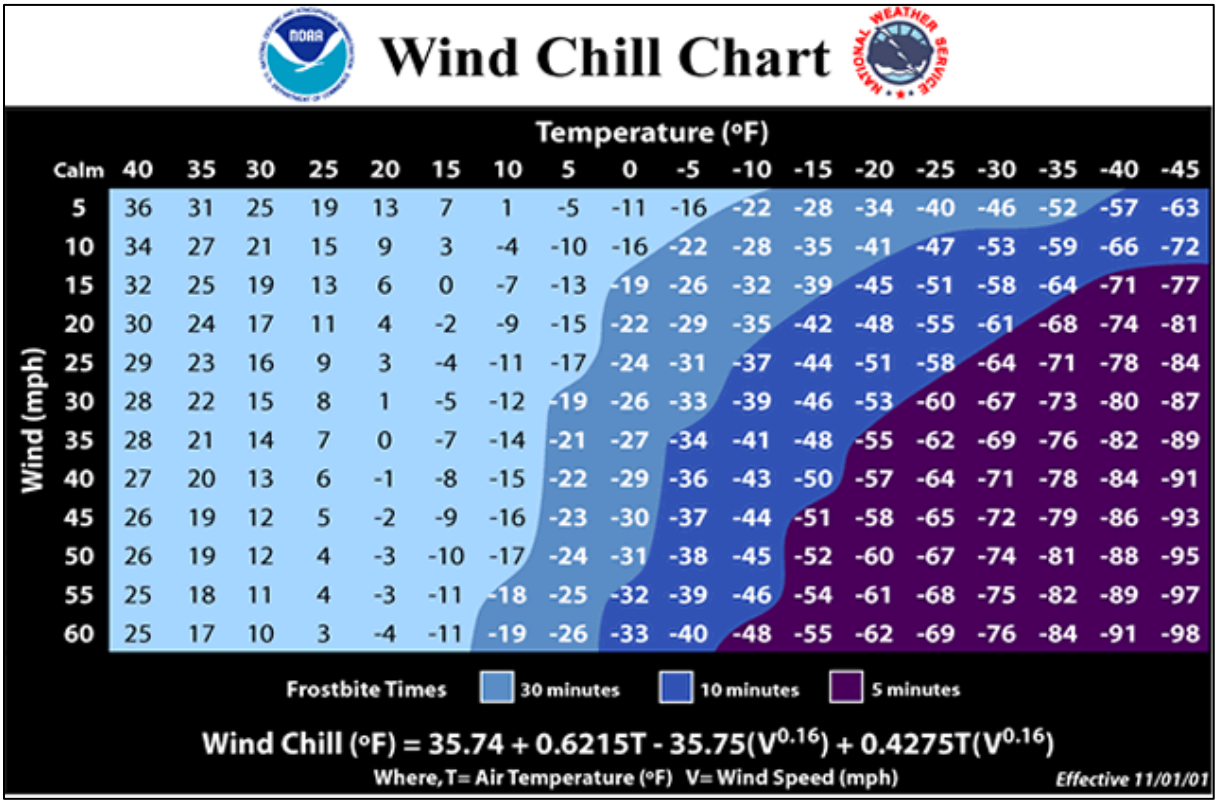


Figure 4.2: Wind Chill Temperature Index

4.3.4. | Previous Occurrences and Frequency

2022 was one of the hottest and driest summers on record in Massachusetts (EOEEA M. &., 2023). In response to temperatures over 95 degrees, the Town of Burlington opened a cooling center in Room 107 of the Human Services Building located at 61 Center Street. The cooling center was opened from July 19, 2022, through July 23, 2022 (Burlington Cable Access Television, 2022). The cooling center reopened later in 2022 due to temperatures of 100 degrees in August (Patch, 2022). As of 2024, the Council on Aging operates a cooling center in the summer. Residents also rely on the Burlington Mall, Wegmans, and public library for cooling.

Over the last century, annual air temperatures increased at an average rate of 0.5 degrees Fahrenheit per decade (EOEEA M. &., 2023). Massachusetts' hottest recorded temperature was 107 degrees

Fahrenheit in August 1975 (EOEEA M. &., 2023). Its coldest was -35 degrees Fahrenheit in February 1943 (EOEEA M. &., 2023).

4.3.5. | Probability of Future Hazard Events, including Due to Climate Change

Climate change has already changed the average and extreme temperatures in Massachusetts. Climate change is projected to reduce the number of extreme cold events, increase the number of extreme heat events, and shift the average temperature in the Commonwealth higher (EOEEA M. &., 2023). It is also expected to shift the warm seasons forward and lengthen their duration (EOEEA M. &., 2023). The effects of these changes will include changes in growing seasons and crops, shifts in habitat and vegetation, warming surface waters, degradation of air quality, impacts on public health, and increased demand for energy and water resources (EOEEA M. &., 2023).

The ResilientMass Climate Change Projections Dashboard allows users to view climate data projections by town or city based on different planning horizons. Projections for Burlington show that by 2090, the Town will have 65 fewer days below 32 degrees, and 52 more days above 90 degrees. Projections for the Town of Burlington can be found in Table 4.33.

Table 4.3. Resilient Massachusetts Extreme Temperature Projections for Burlington

Climate Projection	2030	2050	2070	2090
Days below 32 degrees F	-28	-41	-57	-65
Days above 90 degrees F	12	21	39	52

4.3.6. | Vulnerability and Impacts

Extreme temperatures can have severe impacts on the Town of Burlington. During instances of extreme heat, the frequency of heat stroke, heat stress, or heat related illness is higher. High temperatures can cause people to lose fluids more quickly than usual, leading to dehydration. Dehydration can cause headaches, dizziness, and fatigue. This is especially true for the elderly, many of whom cannot install air conditioners themselves and thus rely on the provision of cooling centers, and individuals who work physically demanding jobs outside, such as landscapers or construction workers. These individuals should be considered vulnerable during episodes of extreme heat.

Extreme heat can cause materials such as concrete, asphalt, and steel to expand and contract, leading to cracking, warping, and other forms of structural damage. High temperatures also increase the demand for the water supply, which can potentially lead to shortages. High temperatures also increase the risk of wildfires, which can cause significant damage to structures and infrastructure. There are certain areas of Burlington where the high level of impervious surface area drives the temperature up. Some notable areas that might experience the Urban Heat Island effect are the

commercial district around Cambridge Street near Shaw's, the area around Burlington Public School, and the area surrounding the Burlington Mall.

Extreme cold scenarios are equally impactful and more common in the state of Massachusetts. Extremely cold temperatures can impact public health, transportation, agriculture, energy, water resources, and infrastructure. The homeless, the elderly, and people with disabilities are especially vulnerable during instances of extreme cold. Burlington has multiple assisted living facilities and elderly housing complexes that should be considered especially vulnerable during episodes of extreme cold. Cold weather can cause frostbite or hypothermia. Power outages during cold weather events may cause pipes to freeze and burst. Even underground pipes are subject to freezing and bursting, potentially leading to water main breaks. Power outages may also result in the inappropriate use of space heaters or generators in poorly ventilated areas, potentially leading to carbon monoxide poisoning. If extreme cold is accompanied by snow or ice, travel conditions can become extremely dangerous, and public transportation may shut down. Burlington also has multiple bridges in town that could become icy and dangerous to traverse during inclement weather. Table 4.44 contains vulnerabilities due to extreme temperatures.

Table 4.4: Impacts from Extreme Temperatures

Asset Category	Likely Impacts
People	Impacts to people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Increased risk of cold-related or heat-related death or illness (hypothermia, frostbite, heat stroke, heat exhaustion, etc.) • Most at-risk populations include children, the elderly, the homeless, and those that work outside • Atria Longmeadow Place, Sunrise of Burlington, and Stonebridge at Burlington are assisted living facilities that may be especially vulnerable during extreme cold or extreme heat • There is one environmental justice population in the western portion of the Town that has a lower-than-average median household income. This group should be provided with access to warming and cooling shelters during instances of extreme temperatures in case they are unable to heat or cool their homes.
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Extreme heat can lead to structural damage such as cracking or warping • Extreme cold can freeze and damage pipes leading to water leaks and flooding when temperatures rise • Extreme cold can lead to icy conditions on local bridges such as the Cambridge Street Bridge, Middlesex Turnpike Bridge, and the Winn Street Bridge.

Systems	Impacts on transportation systems, electricity and water systems: • Power grid strain from increased heating or air conditioning use, potentially resulting in power outages • Extreme heat can cause pavement to soften and buckle leading to road closures and transportation disruptions • Extreme cold can result in icy road conditions and reduced visibility, making travel hazardous
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Potential increase of wildfires during extreme heat • Extreme temperatures may alter migrations, allow for invasive species, decrease crop yields, and adversely affect livestock
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Cancellation of community or sports events due to extreme temperatures

4.4. Changes in Groundwater

4.4.1. | Description

Groundwater is a renewable, long-term resource that depends on an adequate quantity and quality of water to replenish it (EOEEA M. &., 2023). The quantity and quality of groundwater reflects the cumulative effects of extraction, recharge, and contamination. Groundwater challenges are caused or amplified by other hazards such as sea level rise, extreme temperatures and rising temperatures, drought, extreme precipitation, and other meteorological events. There are three primary categories of risk associated with groundwater in Massachusetts (EOEEA M. &., 2023):

- Rise in groundwater levels
- Groundwater depletion
- Changes in groundwater quality and characteristics

Changes in groundwater can affect human and natural systems. The disruption can generate long-term risk to human life and property. Changes in groundwater can result in interruption, loss, and risk due to human demands and impacts on the resource. Furthermore, infrastructure is built using historical water conditions and parameters. When groundwater levels change outside historical ranges, this can affect critical infrastructure including drainage systems, septic systems, and building foundations (EOEEA M. &., 2023).

4.4.2. | Location

Figure 4.3 shows the aquifers in Burlington. There are multiple high yield aquifers in the Town of Burlington. Areas of frequent groundwater flooding have been reported in Fox Hill, in the Sandy Brook and Long Meadow Brook area, on Hilltop Road, on Thomas Street and Susan Avenue, on Donald Road, on Muller Road and Wheeler Road, on Harriett Avenue and Kenmere Avenue, in the

Garrity Road/Middlesex Turnpike Extension area, in Maud Graham Circle, and along the commercial strip on Cambridge Street.

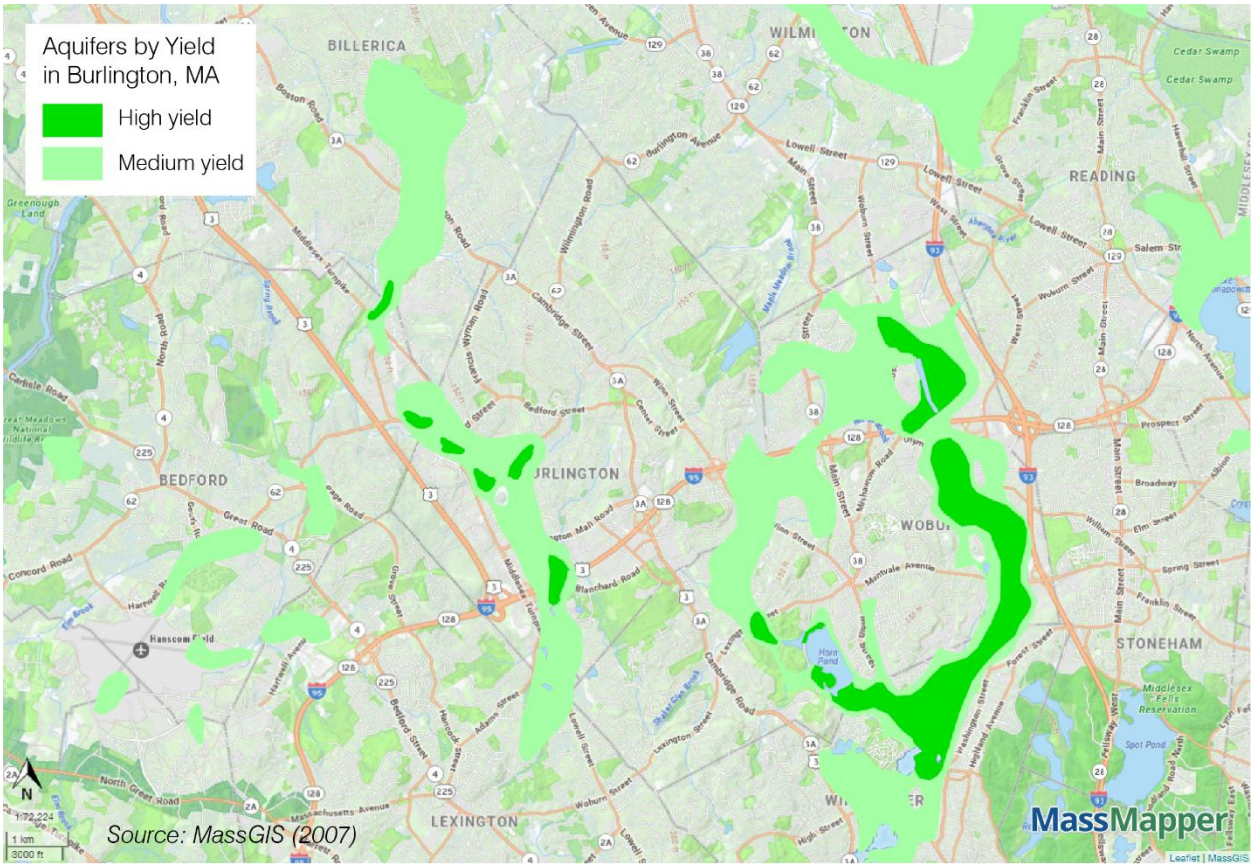


Figure 4.3. Aquifers by yield in Burlington (MassGIS, 2007)

4.4.3. | Severity/Intensity

The severity of changes in groundwater depends on the ability of the groundwater system to recharge, the timing of the recharge, and the quality of the water (EOEEA M. &., 2023). Recharge refers to the balance between extraction and replenishment. Extraction can occur via human activity or natural discharge, which can increase when surface water levels drop, particularly during droughts (EOEEA M. &., 2023). Water levels can increase during periods of high precipitation, snowmelt, and inland flooding events. Local characteristics such as topography, hydrology, vegetation, soil conditions, and human activity also have significant impacts on the severity and intensity of changes in groundwater.

Groundwater rise is driven by precipitation intensity, inland storms, and snowmelt. Groundwater rise can result in flooding, contamination and pollution of groundwater and aquifers, and increased inundation of ecosystems below ground, and at grade assets and infrastructure (EOEEA M. &., 2023). Constant sump pump usage, as reported at some residences in the Town, and the halt to wellfield pumping because of the transition to MWRA participation have been seen as potentially exacerbating to groundwater rise, though no issues have emerged since the wells were disconnected.

Groundwater depletion, which results in a lower water table and strained water resources, will be more intense when conditions for groundwater recharge are low. These conditions include increasing frequency of drought, a reduced snowpack, higher rates of evapotranspiration, reduced precipitation, diversion of precipitation away from groundwater recharge areas, and pressure from human consumption and natural discharge into surface water (EOEEA M. &., 2023). Development patterns and river and stream flood management infrastructure also reduce opportunities for groundwater recharge. Recharge rates can vary significantly by region.

4.4.4. | Previous Occurrences and Frequency

Changes in groundwater levels can be influenced by several factors associated with human actions, climate change, and natural variations. Groundwater levels fluctuate daily, weekly, and seasonally (EOEEA M. &., 2023). Recent analysis has detected long-term variation in groundwater levels over the last 50 years, but the direction of change depends on complex interactions (EOEEA M. &., 2023). While there are several studies that evaluate the changes in groundwater levels in specific locations and at the regional level, there is need for a statewide understanding of factors affecting groundwater.

During the drought of 2016-2017, many of the groundwater monitoring wells throughout Massachusetts had levels well below normal (Mass EEA, 2017). As a result, the Town of Burlington experienced water shortages and had to implement a ban on outdoor watering.

Since then, a rise in groundwater levels has become a major issue for many residents. Most respondents to a June 2024 public survey reported poor groundwater drainage in their yards and basements and near their businesses. Groundwater flooding was reported to be an issue even in years of drought, and heavy rain events have further contributed to the frequency of both stormwater flooding and groundwater flooding, the latter due to poor soil drainage. Residents have noted Burlington's location in lowlands and former wetlands, and at the junction of three major watersheds. One resident acknowledged that "Burlington is full of water, and with all the development, the foundations being dug are leaving nowhere for the groundwater to go. So, it floods lower lying areas and infiltrates into basements.

4.4.5. | Probability of Future Hazard Events, including Due to Climate Change

Climate change can affect the severity of groundwater rise, depletion, and quality due to the following factors: changes in precipitation, changes in temperature, intensity of precipitation, drought, and contamination.

Precipitation: Increased quantities of precipitation can elevate groundwater levels and increase recharge (EOEEA M. &., 2023). However, slow steady snowmelt and rain are more likely to lead to recharge than extreme precipitation events.

Temperature: Rising temperatures will also increase the number of days when evapotranspiration is higher. Evapotranspiration is associated with lower rates of groundwater recharge (EOEEA M. &., 2023). Increased temperatures are also likely to extend the growing season, placing more demands on aquifer reserves via additional water use and evapotranspiration.

Intensity of precipitation: Climate change is expected to change the intensity of precipitation events. High levels of precipitation over short periods affect the ability of the soil and groundwater system to absorb the water, which can lead to reduced recharge and increased runoff resulting in flooding.

Drought: Climate change is projected to affect the severity and duration of drought. Aquifers experience reduced recharge and increased demand for water reserves during drought periods (EOEEA M. &., 2023).

Contamination: Higher precipitation over shorter periods of time can mobilize surface contaminants that can seep into the groundwater. This is particularly a concern in shallow aquifers like those in Massachusetts (EOEEA M. &., 2023). Additionally, contamination may also occur from road salting, which may become more frequent in the future due to increased mixed precipitation events (EOEEA M. &., 2023).

4.4.6. | Vulnerability and Impacts

Groundwater rise can lead to the flooding of below-grade and at-grade utilities, infrastructure, natural environments, living spaces, and workspaces. Rising groundwater levels can also mobilize contaminants in soil and destabilize ground and soil. Groundwater rise can lead to saltwater intrusion to salt-sensitive habitats, vegetation, land uses, and infrastructure.

Decreases in the water table can also have an impact on ecosystems and human health by reducing the availability of freshwater sources. Currently, there are 18 private drinking water wells in town. Long-term changes in groundwater levels can also affect structure stability, especially for buildings built on wood pilings.

Groundwater changes in salinity and height driven by sea level rise can affect drinking water supplies and have significant impacts on the natural environment. Groundwater rise can interact with precipitation, drainage, and sea level rise in complex ways that can contribute to flooding. Table 4.5 includes potential vulnerabilities associated with changes in groundwater according to the 2023 ResilientMass Plan (EOEEA M. &., 2023).

Table 4.5: Impacts from Changes in Groundwater

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Flooding and damage to basements or below grade living areas creating risk of mold and contamination • Septic system failure leading to water quality degradation in nearby waterways and increased bacterial exposure
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Damage or loss to below-grade buildings and foundations of buildings due to flooding or unstable soils • Damage to building foundations from salinity intrusion

Asset Category	Likely Impacts
Systems	Impacts on transportation systems, electricity and water systems: • Damage or loss to below-grade or at-grade utilities, infrastructure, roads, and transit including power, heat, water, sewer, and stormwater services due to flooding or unstable soils
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Damage to habitats, natural areas, and wetlands due to reduced freshwater supplies • Changes to groundwater temperature in urban environments which can amplify heat island effects and stress vegetation and urban trees • Low water levels in reservoirs and aquifers • General water shortages
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Cost of damage from flooding, especially in areas of repetitive loss • Disruption of utility and infrastructure creating travel delays or lack of water, power, or sewer service • Outdoor watering bans

4.5. Drought

4.5.1. | Description

Drought is an extended duration of time characterized by below normal levels of precipitation. The duration of drought can vary widely and can occur in virtually all climatic zones, with different conditions based on the region-specific precipitation normal. Drought differs from aridity, in which a region experiences low precipitation as a typical or permanent characteristic of the climate (i.e., a desert).

The National Drought Mitigation Center references five common, conceptual definitions of drought (Types of Drought, 2024):

- Meteorological drought is when the amount and duration of rainfall in a region is less than normal. It is defined solely by the degree of dryness. Due to climatic differences, what might be considered a drought in one part of the country may not be a drought in another location.
- Hydrological drought results when the lack of precipitation affects streamflow, surface water bodies and groundwater such that they are below normal levels. The frequency and severity of hydrological drought is often defined on a watershed or river basin scale.

- Agricultural drought occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to the water demands of plant life, primarily crops. This type of drought can occur when there are precipitation shortages, soil water deficits, and reduced ground water reservoir levels.
- Socioeconomic drought occurs when the demand for an economic good such as water exceeds the supply because of precipitation-related shortfall. This differs from the other types of droughts because its occurrence depends on the processes of supply and demand.
- Ecological drought is a deficit in water availability that drives ecosystems beyond thresholds of vulnerability, impacts ecosystem services, and triggers feedback in natural and/or human systems.

4.5.2. | Location

The Massachusetts Drought Management Plan organizes the Commonwealth into seven Drought Regions (MEMA, 2023). Burlington is in the Northeast Drought Region in Middlesex County. A map of the drought regions can be found in Figure 4.4. Residents have reported Peach Orchard Road and the Mill Pond Reservoir area being vulnerable to drought, with Mill Pond drying up in 2023.

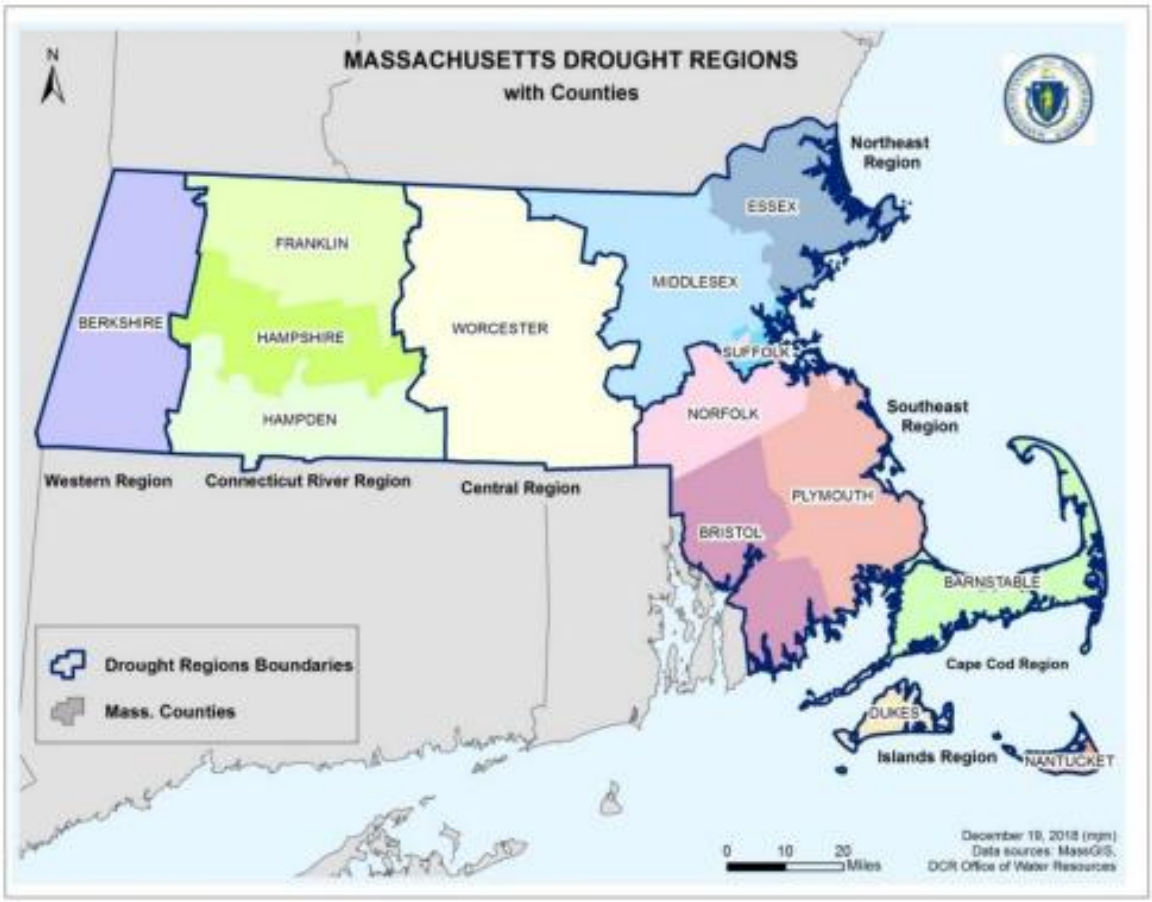


Figure 4.4: Drought Regions in Massachusetts

4.5.3. | Severity/Intensity

Droughts in Massachusetts are defined by several different indices, as detailed in the Drought Management Plan (MEMA, 2023).

1. Precipitation. The Standardized Precipitation Index is based on monthly precipitation totals compiled from DCR's Precipitation Program and the National Weather Service network. The Standardized Precipitation Index is widely used and can be calculated for a range of lookback periods.
2. Streamflow. This index provides an early indication of impacts to rivers, streams, wetlands, and other riparian habitats due to precipitation deficits.
3. Groundwater. Due to the length of time required for groundwater recharge, this index provides information on drought impacts over a longer period.
4. Lakes and impoundments. This index captures the effect of droughts on surface- water storage, including lakes, ponds, and water supply and flood control reservoirs.
5. Fire danger. The Keetch-Byram Drought Index indicates the fire potential and flammability of organic material in the ground by assessing the amount of precipitation required for the top eight inches of soil to be saturated.
6. Evapotranspiration. This index is based on the Crop Moisture Index, which assesses the short-term or current conditions of dryness or wetness relative to the water needs of specific crops and can be used to understand potential impacts to agricultural crops.

The state uses the indices described above to determine the onset, end, and severity of droughts. The North American Drought Monitor, shown in Figure 4.5, is also used to define droughts (What is the USDM?, 2024).

Category	None	D0	D1	D2	D3	D4
Description	Normal or wet conditions	Abnormally Dry	Moderate Drought	Severe Drought	Extreme Drought	Exceptional Drought

Figure 4.5: Drought conditions as defined by the North American Drought Monitor

4.5.4. | Previous Occurrences and Frequency

Middlesex County, which includes the Town of Burlington, most recently experienced a period of Severe Drought (D2) from July 2016 through April 2017 (NOAA Storm Events Database, 2024). The months where the drought declarations were the most severe were October, November, and December of 2016. According to NOAA, during this period precipitation levels, and soil moisture were abnormally low and groundwater conditions were found to be below normal. River and streamflow conditions were also well below normal. During this period, the Town was unable to draw water from the nearby Shawsheen River and had to rely on the Mill Pond Reservoir. Low levels in the reservoir required institution of an outdoor watering ban. Mill Pond was again reported by residents to have low levels in 2023.

4.5.5. | Probability of Future Hazard Events, including Due to Climate Change

Rising temperatures and changes in precipitation patterns are expected to increase the length, frequency, and intensity of droughts (EOEEA M. &., 2023). Reduced snowpack will affect the ability of groundwater supplies to recharge and the availability of water for the growing period. The likely range of consecutive dry days per year is projected to increase by up to 33 days per year in 2090,

compared to the annual statewide-average baseline of 31 days from 1986-2005 (EOEEA M. &., 2023). However, drought may persist with extremely low precipitation days; therefore, consecutive dry days and average dry days per year likely underestimate the potential increase in dry or drought conditions (EOEEA M. &., 2023).

4.5.6. | Vulnerability and Impacts

Droughts can lead to water scarcity, which can affect drinking water supplies, sanitation, and hygiene. Lack of access to safe drinking water can lead to dehydration, malnutrition, and waterborne illnesses, which can be especially harmful to children and vulnerable populations. Droughts can cause the soil to dry out, shrink, and crack, which can lead to settlement and subsidence of buildings. This can result in damage to foundations, walls, and other structural elements. Droughts can impact water infrastructure, including reservoirs, wells, and pipelines. Lower water levels can impact water quality and availability, leading to water rationing and potentially causing damage to infrastructure due to exposure. Finally, droughts can impact soil quality by reducing moisture levels, leading to soil erosion, degradation, and reduced fertility. This can impact agriculture, food production, and ecosystem health. Table 4.66 contains vulnerabilities that may occur in Burlington due to drought.

Table 4.6: Impacts from Droughts

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Increased risk of dehydration, death, heat-related illness, and heat stroke (if the drought coincides with warmer months) • Dry soil and wildfires can increase the number of airborne particles such as pollen and smoke with can worsen chronic respiratory illness • Individuals that rely on private water supply should be considered especially vulnerable during periods of drought • Increased economic risk to individuals in the agricultural community
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Drying or cracking sediments can cause foundation damage to structures or the settlement/ subsidence of buildings
Systems	Impacts on transportation systems, and electricity and water systems: • Reduced water availability can complicate firefighting efforts • Decrease in groundwater supplies may cause shortages or rationing of water • Waterways can recede which can limit the size of ship that can navigate shallower waters, potentially impacting the delivery of goods and services

Asset Category	Likely Impacts
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Damage to wildlife habitat, degradation of air and water quality, wildfires, degradation of landscape quality, loss of biodiversity, soil erosion • Loss of wetlands, lakes, and vegetation • Impact on crop production and supplies of animal feed • Increased potential for fires • Low water level in the Mill Pond Reservoir • Unable to draw water from Shawsheen River
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Waterways can recede, which can limit the size of ships that can navigate shallower waters, potentially impacting the delivery of goods and services • Potential to drain state and local resources, which can have a significant fiscal impact on local government • Economic impact on those in the agricultural community • Outdoor watering bans

4.6. Earthquakes

4.6.1. | Description

An earthquake is a vibration, sometimes violent, of the earth's surface that follows the release of energy in the earth's crust due to fault fracture and movement (EOEEA M. &., 2023). The magnitude or extent of an earthquake is a seismograph-measured value of the amplitude of the seismic waves (EOEEA M. &., 2023).

4.6.2. | Location

New England earthquake epicenters do not follow the major mapped geologic faults of the region, nor are they confined to any geologic structures of terrains, but they have been detected all over the region (EOEEA M. &., 2023). Therefore, seismologists suggest that an epicenter of a strong earthquake could be located anywhere in Massachusetts.

Ground shaking and the liquefaction resulting from it are the primary causes of earthquake damage. This damage can vary locally due to soil types that can either amplify the shaking or are susceptible to liquefaction (EOEEA M. &., 2023). Therefore, the strength of the earthquake may vary regionally based on soil type. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from and earthquake and E represents soft soils that amplify and magnify ground shaking and increases building, infrastructure, and utility damage and losses (EOEEA M. &., 2023). A map of these areas is shown in Figure 4.6.

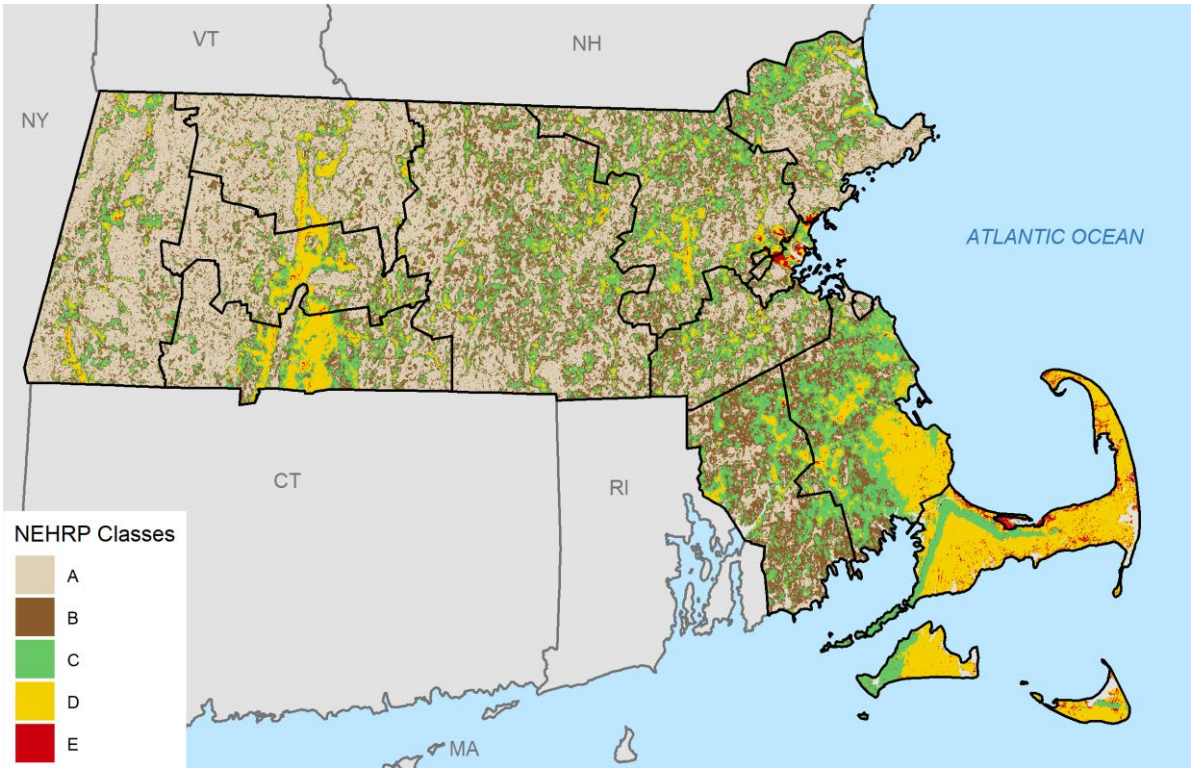


Figure 4.6: Soil classifications in Massachusetts

Burlington is a developed area. Earthquakes will have the greatest impact in developed areas where there are taller or larger structures. Areas with less built environments will experience a lesser impact.

4.6.3. | Severity/Intensity

Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude of an earthquake is a seismograph-measured value of the amplitude of the seismic waves. The most widely known scale for earthquake magnitude is the Richter scale, shown in Table 4.7, developed in 1935 as a mathematical device to compare earthquakes. The Richter scale has no upper limit.

Table 4.7: Richter Scale Magnitude and Typical Effects

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

Richter Magnitude	Earthquake Effects
8.0 or greater	Great earthquake. It can cause serious damage in areas several hundred meters across.

Importantly, it does not express damage: an earthquake in a densely populated area, which results in many deaths and considerable damage, can have the same magnitude as an earthquake in a remote area that causes no damage. It is the presence of vulnerable assets and populations near an earthquake epicenter, combined with the earthquake magnitude, which determines the amount of damage and where that damage takes place.

The severity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features. Intensity is expressed by the Modified Mercalli Intensity (MMI) scale, shown in Table 4.8, which describes how strongly an earthquake was felt at a particular location using values ranging from I to XII. Seismic hazards are also expressed in terms of PGA, which USGS defines as the greatest acceleration that "is experienced by a particle on the ground." Table 4.88 summarizes the MMI scale. Note that the typical comparisons between Mercalli intensity and Richter magnitudes are biased toward the type of earthquakes that happen in California. Smaller magnitude earthquakes can be felt over larger regions in New England, so the Mercalli descriptions for "equivalent"-magnitude earthquakes are not always accurate in this region. For example, a 4.2 magnitude is typically considered to be equivalent to MMI II ("felt only by a few persons"); this may be true on the West Coast, but an earthquake of that magnitude in New England can be felt my many more people over a wide area, sometimes so strongly that people get scared and run out of their buildings (as is typically described for an MMI IV or V earthquake) (EOEEA M. &., 2023).

Table 4.8: Modified Mercalli Intensity Scale

Mercalli Intensity	Equivalent Richter Scale Magnitude	Abbreviated MMI Scale Descriptions		Acceleration (Percent g) (PGA)
I		Detected only on seismographs.	Not felt except by a very few under especially favorable conditions.	< .17
II		Some people feel it.	Felt only by a few people at rest, especially on the upper floors of buildings.	.17–1.4
III		Felt by people resting; like a truck rumbling by.	Felt quite noticeably by people indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.	.17–1.4

Mercalli Intensity	Equivalent Richter Scale Magnitude	Abbreviated MMI Scale Descriptions		Acceleration (Percent g) (PGA)
IV		Felt by people walking.	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	1.4–3.9
V	< 4.8	Sleeping people awake; church bells ring.	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.	3.9–9.2
VI	< 5.4	Trees sway; suspended objects swing; objects fall off shelves.	Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	9.2–18
VII	< 6.1	Mild alarm; walls crack; plaster falls.	Damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, considerable in poorly built or badly designed structures; some chimneys broken.	18–34
VIII		Moving cars are uncontrollable; masonry fractures; poorly constructed buildings damaged.	Slight damage in specially designed structures; considerable damage in ordinary substantial buildings, with partial collapse. Great damage in poorly built structures. Chimneys, factory stacks, columns, monuments, and walls fall. Heavy furniture overturned.	34–65
IX	< 6.9	Some houses collapse; ground cracks; pipes break open.	Considerable damage in specially designed structures; well-designed frame structures thrown out of plumb. Great damage in substantial buildings, with partial collapse. Buildings shifted off foundations.	65–124

Mercalli Intensity	Equivalent Richter Scale Magnitude	Abbreviated MMI Scale Descriptions		Acceleration (Percent g) (PGA)
X	< 7.3	Ground cracks profusely; many buildings destroyed; liquefaction and landslides are widespread.	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.	>124
XI	< 8.1	Most buildings and bridges collapse; roads, railways, pipes, and cables are destroyed; general triggering of other hazards occurs.	Few, if any (masonry structures remain standing. Bridges destroyed. Rails bent greatly.	>124
XII	> 8.1	Total destruction; trees fall; ground rises and falls in waves.	Total damage. Lines of sight and level are distorted. Objects thrown into the air.	>124

4.6.4. | Previous Occurrences and Frequency

Earthquakes cannot be predicted and may occur at any time. Since 1963, there have been 151 earthquake events in Massachusetts (USGS 2023), the highest having a magnitude of 3.7 on the Richter scale. There have been no epicenters located in Burlington.

4.6.5. | Probability of Future Hazard Events, including Due to Climate Change

There is no consensus on the effects of climate change on the frequency and severity of earthquakes across the United States or within Massachusetts (EOEEA M. &., 2023).

4.6.6. | Vulnerability and Impacts

In addition to building collapse, earthquakes can cause structural damage to roadways, breakage of water and gas lines, and flooding and fires. Furthermore, landslides can be triggered by earthquakes. An area's vulnerability to an earthquake is based primarily on the density of the population in the region, and the age of the region's buildings and lack of earthquake proof design. Being a fairly populated and developed area, Burlington has the potential to experience devastating impacts from a severe earthquake.

A particularly strong earthquake could be potentially devastating for the town, causing disruptions to daily life and severe structural damage, with a full list of potential impacts listed in Table 4.99. Using FEMA's Hazus software, potential losses for various earthquake scenarios were estimated.

Table 4.9: Impacts from Earthquakes

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Loss of life or severe injury • Vehicle accidents • Injury from debris or falling objects • First responders are particularly at-risk
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Significant structural damage, especially if buildings are not constructed to withstand seismic forces or if there are insufficient evacuation plans • Critical facilities can be impacted or damaged from ground shaking and falling debris • Collapse of buildings, bridges or dams including high hazard dams
Systems	Impacts on transportation systems, and electricity and water systems: • Disruption of government operations • Seismic activity can damage communication infrastructure such as phone lines, cell networks, and data networks • Power outages from damaged electrical infrastructure • Disruption of gas lines, electric lines, or phone service
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Potential to trigger secondary hazards such as fires, flash flooding, hazardous materials release, slope failure, dam failure, and tsunamis • Contamination of the environment from hazardous materials • Significant injury to animals or livestock • Historic buildings may not be able to withstand ground shaking due to outdated construction standards
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Expensive response and recovery efforts can drain local resources • Closure of businesses due to damage • Disruption of delivery services due to dangerous transportation conditions

4.7. Flooding from Precipitation

4.7.1. | Description

Extreme precipitation events can result in flooding, often characterized and "inland flooding" to distinguish it from coastal flooding. This section addresses the risks associated with flooding from high precipitation events, which include convective storms (thunderstorms or other typically sudden and extreme precipitation events), nor'easters, and hurricanes. Also included are inland flood events caused by extreme rainfall events, riverine overtopping, overwhelmed stormwater systems, ice jams blocking drainage, and dam failure or overtopping, described in greater detail below.

Riverine Flooding

Riverine flooding occurs when excessive rainfall over an extended period collects across a watershed and causes a river to exceed its natural drainage capacity (EOEEA M. &., 2023).

Stormwater Drainage Flooding

Stormwater drainage flooding is caused by high-intensity rainfall in combination with high amounts of impervious surface area that prevents infiltration. This causes stormwater drainage systems to reach a state of over-capacity (EOEEA M. &., 2023).

Ice Jams

An ice jam is an accumulation of ice that acts as a natural dam and restricts the flow of a body of water. There are two types of ice jams: a freeze-up jam and a breakup jam. A freeze-up jam usually occurs in early to mid-winter during extremely cold weather when super-cooled water and ice formations extend to nearly the entire depth of the river channel. This type of jam can act like a dam and begin to back up the flowing water behind it. The second type, a breakup jam, forms because of the breakup of the ice cover at ice- out: large pieces of ice move downstream, potentially piling up at culverts, around bridge abutments, and at curves in river channels. Breakup ice jams occur when warm temperatures and heavy rain cause rapid snowmelt. The melting snow, combined with the heavy rain, causes frozen rivers to swell. The rising water breaks the ice layers into large chunks, which float downstream and pile up near narrow passages and obstructions (bridges and dams). Ice jams may build up to a thickness great enough to raise the water level and cause flooding upstream of the obstruction (EOEEA M. &., 2023).

Dam Failure

As dams are used to impound water by controlling water flow, changes in precipitation intensity and duration can affect dam performance and safety. When reservoir inflows exceed the capacity of a dam's spillway, rising reservoir water levels can result in increased rates of seepage outflow, destabilization of embankment slopes, and/or dam failure due to overtopping (EOEEA M. &., 2023).

4.7.2. | Location

Floods can impact a small portion of the Town or the entire Town of Burlington. Areas of lower elevation are more likely to experience impacts from flooding.

The Federal Emergency Management Agency (FEMA) characterizes the current hazard using floodplain boundaries. These data include the locations of FEMA flood zones:

- The 1 percent annual chance event (also sometimes referred to as 100-year flood) zones, including both A Zones and V Zones
- The 0.2 percent change event (or 500-year flood) zones, also called X zones

While A and V Zones are more likely to experience flooding than X zones, it is still possible to experience flooding in X zones. Figure 4.7 shows the flood zones in Burlington.

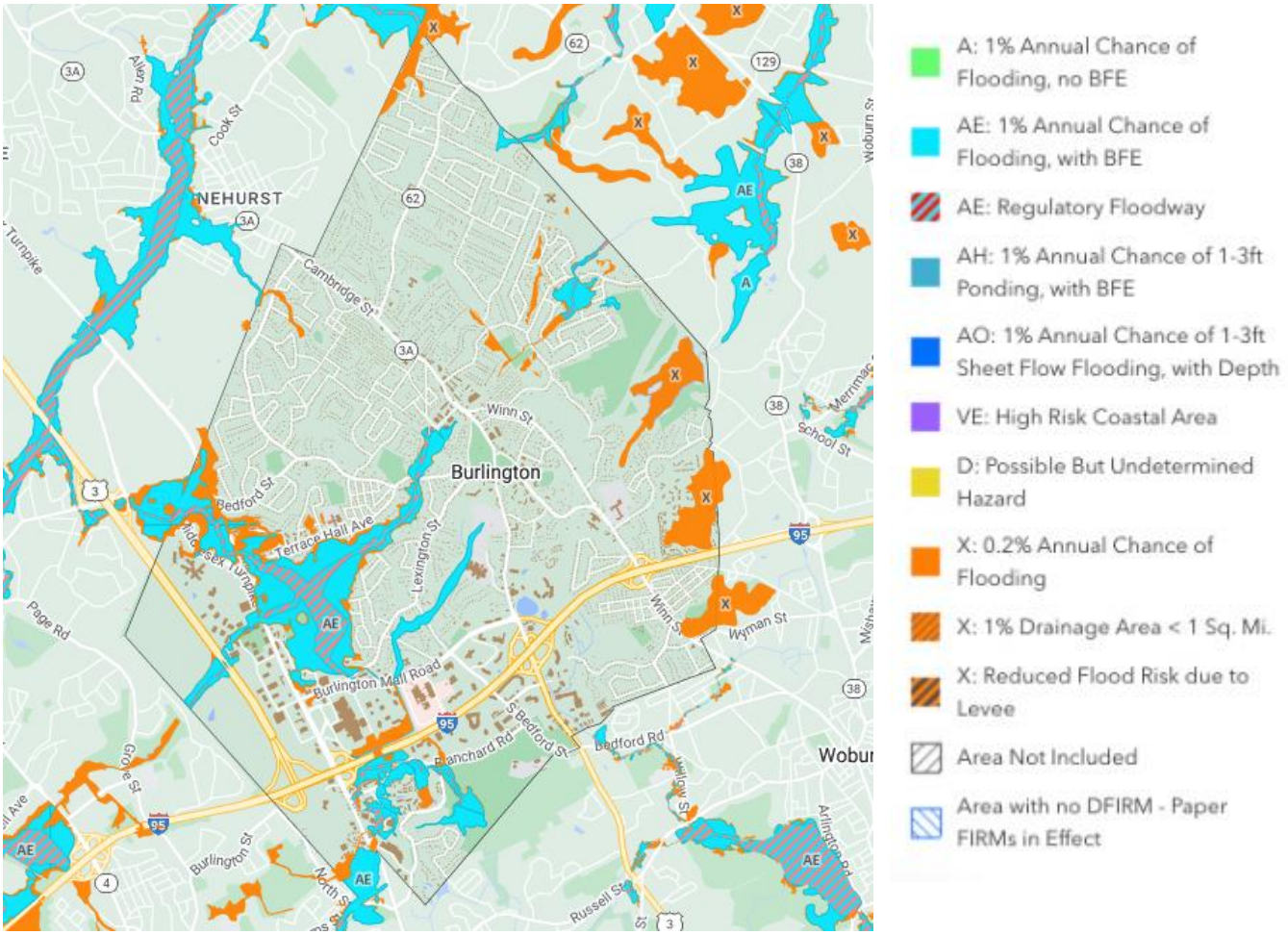


Figure 4.7: FEMA flood zones in Burlington (FEMA 2025,via MassMapper)

Specific areas that have the most flooding potential include areas adjacent to Sawmill Brook from the Wilmington town line to Lucaya Circle and most areas along the entirety of Longmeadow Brook, Sandy Brook, and Vine Brook. Other specific areas mentioned by local officials include:

- Sandy Brook: A small residential area where flooding continues to impact approximately four homes and sometimes forces the road to be closed to one land; Town staff did not consider Sandy Brook Road to be a major access road, rather more of a short cut road for the southwestern part of town. No mitigation has been conducted since it was noted in 2008. This is seen as a medium priority by the NHM team.

- Thomas, Carol and Susan Streets: Sawmill Brook. The stream causing flooding, has been cleaned twice between 2008 and 2016, and it has been flooding much less frequently due to the reduced use of sand for winter road traction. Since 2016, the Department of Public Works has conducted some drainage work. However, beaver activity still contributes to flooding from the stream.
- Wheeler Road: Beaver Deceivers were installed in 2010 by National Development and need to be maintained. Wheeler Road was rebuilt in 2015 with stream cleaning and drainage system upgrade. Flooding continues to be an issue.
- Middlesex Turnpike/Bedford Street: This area still experiences flooding, but the 2011 Middlesex Turnpike Extension did add flood storage capacity for the neighborhood.
- Wyman Street: The old town well culvert was replaced and the stream impacting this neighborhood has been cleaned twice in the last 5 years.
- Stewart Street at Wilmington Street: No mitigation action taken since 2008. This was a low priority area in 2008 with 1-2 houses impacted on a very infrequent basis. Stream cleaning under the Capital Improvement Program will address the problem going forward.
- 13 Old Concord Road: H Mart commercial site was built 15 years ago; the road floods only during very high precipitation events.

Figure 4.8: Burlington Square Plaza - 101 Middlesex Turnpike; Property owner currently (April 2024) working on flood mitigation plan

Figure 4.9: Intersection of Winn Street and Cambridge Street (Rt. 3A)

Additionally, areas in closer proximity to the three dams located in Burlington are at a greater risk of flooding due to dam overtopping. The three dams in Burlington are described below (USACE, 2024). All three dams are owned by the Town of Burlington, were most recently inspected in 2016 and assessed to be in fair condition. Mill Pond South Dike and Mill Pond Dam are high hazard dams, while Mill Pond North Dike is a significant hazard dam. The most recent inspection/evaluation of these dams was conducted in September 2024 (Haley Aldrich, 2024). Both high hazard dams have emergency action plans, but these need to be updated according to the most recent inspection report. In addition, the report recommends increased vegetation management and mowing, as well as cleaning the diversion pipe inlet trash racks and toe drains.

- The **Mill Pond Reservoir North Dike** is primarily used for water supply and has a hazard potential classification of "significant."
- The **Mill Pond South Dike** is primarily used for water supply and has a hazard potential classification of "high." The dam is owned by the Town of Burlington. The dam is owned by the Town of Burlington. Its most recent inspection was in 2024 and assessed its condition to be satisfactory.
- The **Mill Pond Dam** is primarily used for water supply and has a hazard potential classification of "high." The dam is owned by the Town of Burlington. Its most recent inspection was in 2024 and assessed its condition to be satisfactory.

4.7.3. | Severity/Intensity

Return periods are used to represent the average interval between occurrences of rainfall events. Rainfall events with greater return periods will have much more rain than a smaller return period and thus will cause more flooding and greater damage. Table 4.1010 below outlines the amount of precipitation that would fall during various return periods in Burlington.

Table 4.10: Return intervals in Burlington

Return Interval (duration 10m):	1 year	5 years	10 years	25 years	50 years	100 years	200 years	500 years	1000 years
Depth (inches)	0.5	0.8	0.9	1.1	1.3	1.4	1.6	1.9	2.1

Flooding from precipitation can vary in severity and intensity depending on several factors, including the amount and duration of rainfall, topography, soil conditions, land use patterns, and the capacity of drainage infrastructure. Increases in intensity and duration of precipitation on rainy days can lead to flooding, stress on built infrastructure and ecosystems, and impacts on human health.

4.7.4. | Previous Occurrences and Frequency

Since the previous Hazard Mitigation Plan in 2016, there have been 45 days with flooding or flash flooding in Middlesex County (NOAA, 2024). 14 of those days contained property damage (NOAA, 2024). Damages from these flooding events totaled 1.515 million dollars in Middlesex County. Most recently, storms in December of 2023 brought widespread flooding and power outages. Eversource reported more than 2,000 outages across Burlington during this event. Significant flooding occurred on Cambridge Street near Winn Street. See Section 4.7.2 for additional areas that typically experience flooding in Burlington.

4.7.5. | Probability of Future Hazard Events, including Due to Climate Change

Scientists expect that there will be more precipitation overall in Massachusetts, on an annual basis and in most years (EOEEA M. &., 2023). Higher temperatures will mean the moisture-holding capacity of the atmosphere increases, but also that evaporation rates are higher. Patterns to date suggest that annual precipitation is likely to be more variable and fall over fewer days, but that precipitation will be more intense on days when it rains or snow (EOEEA M. &., 2023).

Figure 4.10 below shows projected precipitation intensity and frequency over time in the central region of Massachusetts, where Burlington is located. The graph shows changes in the expected size of a 10-year return period rainstorm (i.e., a storm, defined in terms of equal or greater precipitation within 24 hours, that has 10 percent chance of occurring in a given year) and the expected frequency of rainstorms that would meet the current 10-year return period size (EOEEA M. &., 2023).

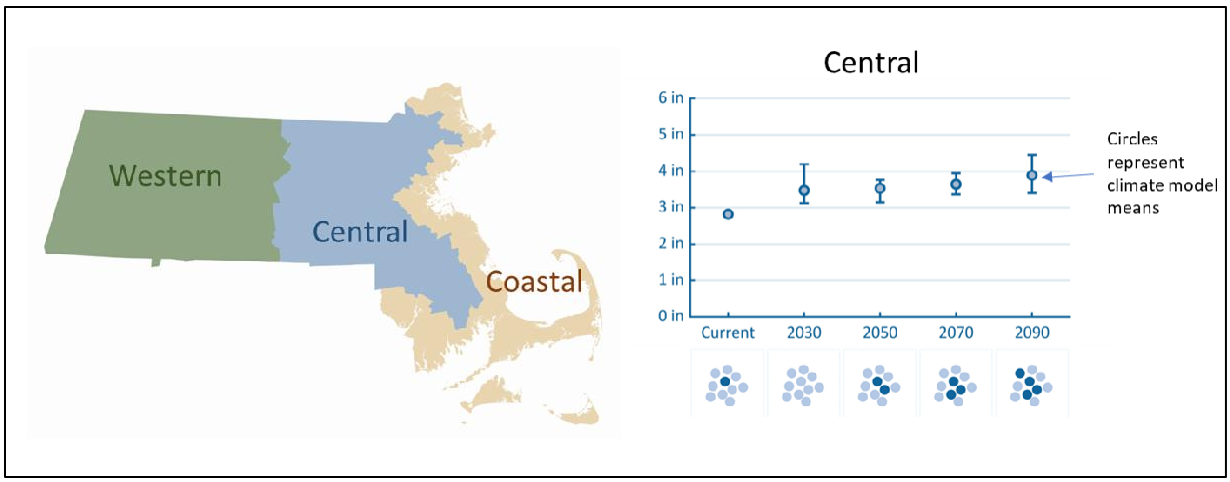


Figure 4.10: Projected precipitation intensity and frequency over time in the central region of Massachusetts

Under the current climate, the 10-year return period event is roughly 3 inches. By the end of the century, the intensity of the 10-year return period event is expected to increase by one third, to 4 inches in a day. The frequency of the current 10-year return period event is expected to increase by the end of the century by a factor of four in the Central region.

The ResilientMass Climate Change Projections Dashboard allows users to view climate projections data for specific cities or towns based on different planning horizons. Table 4.1111 shows the total precipitation percent change for Burlington from 2030 to 2090, as well as days above 1 inch of rain and days above 2 inches of rain.

Table 4.11: Precipitation Projections for Burlington

Climate Projection	2030	2050	2070	2090
Total Precipitation (Percent Change)	6.4	8.7	10.8	13.4
Days Above 1 inch	1	1	2	2
Days Above 2 inches	0	0	0	1

4.7.6. | Vulnerability and Impacts

Precipitation flooding includes stormwater flooding, riverine flooding, and flooding from dams overtopping. Riverine flooding is most likely to impact areas closest to bodies of water, while stormwater flooding can occur anywhere in the Town. Dam overtopping can impact areas adjacent to and downstream of the dam. Dams are categorized as “high hazard”, “significant hazard,” and “low hazard.” Higher hazard dams post a greater risk to downstream populations. Burlington has two high-hazard dams, Mill Pond Reservoir South Dike and Mill Pond Dam, and one significant hazard dam, Mill Pond Reservoir North Dike, all are part of the Mill Pond Reservoir (Haley Aldrich, 2024). The most recent inspection and evaluation of these dams was in September 2024. The overall

physical condition of all dams was found to be satisfactory. All have existing emergency action plans, which need to be updated.

The Mill Pond Reservoir Dam does not have a spillway, meaning there is no designated structure to release excess water when the reservoir fills up. Instead, all water from heavy rainfall or extreme storms must be stored within the reservoir itself. Engineers use a test flood to evaluate the dam's ability to handle extreme weather, and for this dam, they use the ½ PMF (Probable Maximum Flood), which is an estimate of the most severe flood that could reasonably occur. Under this scenario, the water level is expected to rise to elevation (El.) 145.9 feet, which is 1.6 feet below the top of the dam (El. 147.5 feet). This difference, called freeboard, is the remaining space available before water begins to flow over the dam. While current projections show the dam can handle this extreme event without overtopping, climate change could increase the frequency and intensity of storms, potentially pushing water levels higher in the future. Because of this, it is important to continuously monitor the reservoir's capacity and update emergency plans to prevent flooding (Haley Aldrich, 2024).

Much of the infrastructure in Burlington, including bridges, stormwater systems, and roadways, were designed based on historical rain events. With increased frequency and severity of storm events, inland flooding could become an increased vulnerability for the Town to manage. Recently, more frequent occurrences of flood events larger than the historic have occurred and put vital infrastructure at risk. Vulnerabilities related to inland flooding are listed in Tables 4.12 and 4.13.

Using FEMA's Hazus software, potential losses during the 100-year and 500-year flood events were estimated. Past flooding events are known to have displaced significant numbers of residents from their homes. Both the 100-year and 500-year events have the potential to generate debris, cause damage, and interrupt daily life.

Some areas of Burlington are environmental justice communities because of higher concentrations of minority residents and increased flood risk.

These include the residential neighborhoods in western Burlington near Drake Road, Chandler Road, and Mill Street, as well as the neighborhoods near Burlington Mall and off the Middlesex Turnpike as shown in Figure 4.111.

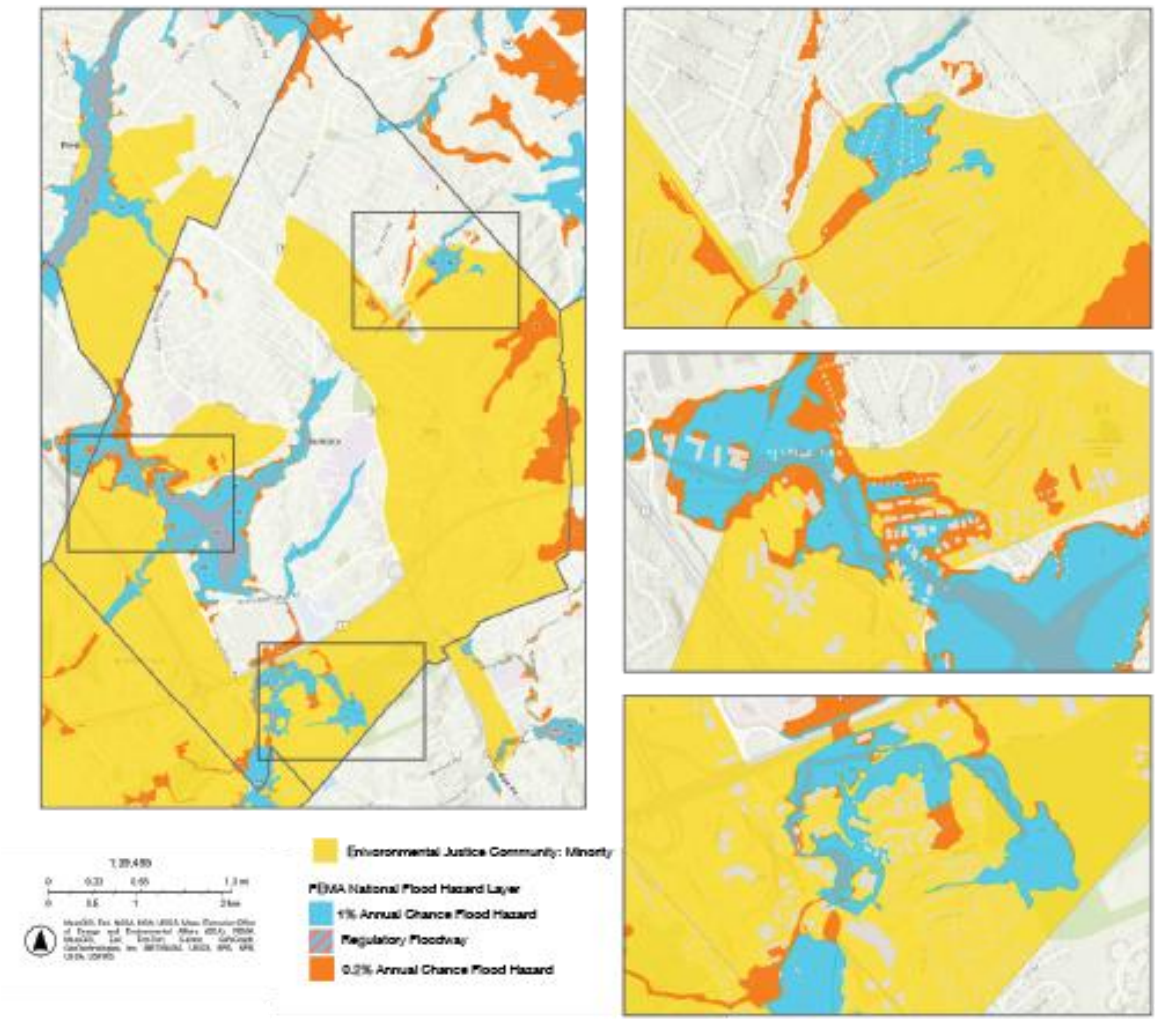


Figure 4.11: Environmental Justice Communities in Burlington Vulnerable to Flooding

Other community assets that are at risk of flooding due to their proximity to mapped flood zones are listed in Table 4.12. Located in the 1% Annual Chance Flood Zone are Tender Learning Centre Daycare, multiple water pump and sewer pump stations, and Burlington Fire Station #2. Additional daycares, water plants, and water pump stations are in the 0.2% Annual Chance Flood Zone.

Table 4.12: Vulnerable Community Lifelines to Flooding due to Precipitation

Community Lifeline Type	FEMA Flood Hazard	Name
Food, Hydration, Shelter	1% Annual Chance	Tender Learning Centre Daycare
	0.2% Annual Chance	Stonebridge at Burlington Assisted Living

Community Lifeline Type	FEMA Flood Hazard	Name
		Kiddie Academy of Burlington Daycare
		Teachable Moments Daycare
Hazardous Materials	0.2% Annual Chance	Vine Brook Water Plant
Safety & Security	1% Annual Chance	Burlington Fire Station #2
Water Systems	1% Annual Chance	Bedford Street Sewer Pump Station
		Main Sewer Pump Station
		Terrace Hall Ave Water Pump Station #2
		Lexington Street Sewer Pump Station
		Water Pump Station #11
		Water Pump Station #10
		Partridge Lane Sewer Pump Station
		Lucya Road Sewer Pump Station
	0.2% Annual Chance	Vine Brook Water Plant
		Water Pump Station #3

Vulnerabilities and likely impacts to community assets are described in Table 4.13.

Table 4.13: Vulnerabilities from Flooding due to Precipitation

Asset Category	Likely Impacts
People	Impacts to people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Physical injury or death • Increase in physiological stressors • Displacement due to building damage • Isolation due to road closures

Asset Category	Likely Impacts

	• Mold and allergens from water damage create an increased risk to people with existing respiratory damage
	• Increase in vector-borne diseases and bacterial infections
	• Increased rate of emergency room visits
	• Environmental justice populations with higher concentrations of minority residents in the following neighborhoods:
	  ○ Eastern Burlington near Drake Road, Chandler Road and Mill Street
	  ○ Adjacent to the Burlington Mall
	  ○ Western Burlington

Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Water damage to interior and exterior of buildings, including houses, governmental buildings, community lifelines, and critical infrastructure • Damage to facilities • Potential flooding at Burlington Mall, Burlington Public School, Burlington Fire Station 2, Lahey Hospital and Medical Center
Systems	Impacts on transportation systems, and electricity and water systems: • Disruption to roadways because of water and debris blocking routes and road washouts, making transportation networks impassible or unsafe, specifically Cambridge Street and Middlesex Turnpike • Damage to utility infrastructure • Bridge support scour possible at Middlesex Turnpike Bridge, Cambridge Street Bridge, and Winn Street Bridge • Dams (Main Dam, North Dike, and South Dike) are at higher risk of overtopping or experiencing damage from flooding
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Damage or destruction of the natural environment preserved at Mill Pond Reservoir, Mill Pond Conservation Area, Mary Cummings Park, and Landlocked Forest • Ecosystem degradation and reduced water quality due to increased sedimentation, nutrients, and contaminants from agriculture practices, stormwater runoff, and septic overflow. • Loss of habitat • Erosion • Changes in river and stream ecology • Forest health degradation

Asset Category	Likely Impacts
	• Damage to cultural resources and sites (Town Common/Simonds Park, Wildwood Park, playgrounds, fields) • Damage to historic buildings and sites, including the Burlington Historical Museum, Francis Wyman House, General John Walker House, and others • Parks and public spaces (Town Common/Simonds Park, Wildwood Park, playgrounds, fields) could experience damage or disruptions
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Business interruption • Limited patrons resulting in reduced revenue • Increased costs of maintenance • Increase in demand for municipal services • Increased cost for response and repairs • Temporary loss of community activities

4.8. Hurricanes / Tropical Cyclones

4.8.1. | Description

Hurricanes originate from tropical storms, which form rotating cloud systems, developing over tropical or subtropical waters.

- Tropical Depression: A tropical cyclone with maximum sustained winds of 38 mph (33 knots) or less.
- Tropical Storm: A tropical cyclone with maximum sustained winds of 39 to 73 mph (34 to 63 knots).
- Hurricane: A tropical cyclone with maximum sustained winds of 74 mph (64 knots) or higher. In the western North Pacific, hurricanes are called typhoons; similar storms in the Indian Ocean and South Pacific Ocean are called cyclones.
- Major Hurricane: A tropical cyclone with maximum sustained winds of 111 mph (96 knots) or higher, corresponding to a Category 3, 4 or 5 on the Saffir-Simpson Hurricane Wind Scale.

The term "tropical" refers both to the origin of these systems, which usually form in tropical regions of the globe, and their formation in maritime tropical air masses. The term "cyclone" refers to such storms' cyclonic nature, with counterclockwise wind flow in the Northern Hemisphere and clockwise wind flow in the Southern Hemisphere (EOEEA M. &., 2023).

A tropical storm system is characterized by a low-pressure center and numerous thunderstorms that produce strong winds and heavy rain. Tropical storms strengthen when water evaporates from the ocean and are released as the saturated air rises, resulting in condensation of the water vapor contained in the moist air. These storms are fueled by a different heat mechanism than other cyclonic windstorms, such as nor'easters and polar lows. The characteristic that separates tropical cyclones from other cyclonic systems is that at any height in the atmosphere, the center of a tropical cyclone

will be warmer than its surroundings—a phenomenon called “warm core” storm systems (EOEEA M. &., 2023).

4.8.2. | Location

Despite being located inland, Burlington is still vulnerable to the impacts of hurricanes and tropical cyclones. While coastal areas are typically more directly affected by hurricanes, Burlington's vulnerability lies in the potential for severe weather conditions and flooding that can accompany tropical storms as they move inland. Heavy rainfall associated with hurricanes can lead to flash flooding, especially in low-lying areas or regions with poor drainage systems. Strong winds from hurricane remnants can also cause town-wide damage to structures, uproot trees, and disrupt power lines, impacting the local community.

4.8.3. | Severity/Intensity

Hurricanes are measured according to the Saffir-Simpson scale, described in Table 4.14 below. This scale categorizes hurricanes from 1 (minimal) to 5 (catastrophic) based on their intensity. This is used to estimate the property damage and flooding expected from a hurricane landfall. The determining factor of the scale is wind speed. All wind speeds are assessed using the U.S. one-minute average, meaning the highest wind that is sustained for one minute (EOEEA M. &., 2023).

Table 4.14: Saffir-Simpson Hurricane Scale

Scale No. (Category)	Winds (mph)	Potential Damage
1	74–95	Minimal: Damage is primarily to shrubbery and trees, mobile homes, and some signs. No real damage is done to structures.
2	96–110	Moderate: Some trees topple, some roof coverings are damaged, and major damage is done to mobile homes.
3	111–129	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	130–156	Extreme: Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; and some curtain walls fail.
5	>157	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.

Tropical storms and depressions, while generally less dangerous than hurricanes, can still cause widespread damage, disruption, injury, and loss of life. They produce powerful wind gusts and torrential rains and can possibly result in tornadoes. These storms often lose their strength as they

move inland due to increased surface friction and loss of the warm ocean as an energy source (EOEEA M. &., 2023).

4.8.4. | Previous Occurrences and Frequency

Burlington has been impacted by two tropical storms since the previous hazard mitigation plan update. Tropical storms occurred on September 20, 2017, and August 4, 2020, (NOAA, 2024). Together these storms caused $20,500 worth of damage in Middlesex County (NOAA, 2024). Tropical storms and hurricanes have occurred in the proximity of the Commonwealth about once every two years on average. NOAA's National Hurricane Center estimates that a Category 3 hurricane could occur once every 50–60 years (EOEEA M. &., 2023).

4.8.5. | Probability of Future Hazard Events, including Due to Climate Change

Historic events and models of future conditions suggest that climate change will cause the intensity of tropical storms and hurricanes to increase (EOEEA M. &., 2023). However, uncertainty over the relationship between the frequency of tropical cyclones and climate change remains (EOEEA M. &., 2023). The Massachusetts Climate Assessment identifies a possible increase in tropical cyclone frequency of nearly 50 percent by the end of the century (Massachusetts, 2022).

4.8.6. | Vulnerability and Impacts

Hurricane force winds can destroy buildings and mobile homes. Items that are not secured can quickly become airborne debris that can cause severe injury. Hurricanes can also spawn tornadoes. Heavy rain associated with hurricanes can cause extreme flooding. Hurricane rain and winds can result in downed trees and tree limbs, blocked roads, and downed telephone and power lines. This can severely disrupt transportation routes and communication channels. The elderly and those with mobility issues are of particular concern during hurricane or tropical storm events.

Using FEMA's Hazus software, potential losses for a Category 2 and Category 4 storm were estimated. Both storms have the potential to greatly impact the Town of Burlington by causing property damage, debris generation, and business interruptions. Vulnerabilities from hurricanes are shown in Table 4.15

Table 4.15: Vulnerabilities from Hurricanes

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Death and Injury • Mental health impacts such as anxiety or PTSD • Displacement • Loss of property
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Damage to buildings from high winds, flying debris, or flooding

Asset Category	Likely Impacts
	• Power outages • Damage to critical facilities is possible
Systems	Impacts to transportation systems, electricity and water systems: • Damage to transportation infrastructure such as roads or bridges can impact on emergency responses and daily travel • Damage to telecommunications infrastructure can disrupt communications • Widespread power outages can disrupt critical facilities, emergency response centers, water treatment plants, and hospitals • Water supply interruptions from flooding or damage to water treatment plants and pipelines • Flooding can overwhelm wastewater systems causing contamination and health risks • Utility services such as gas may be disrupted
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Historic buildings may not be able to withstand high winds • Increased coastal erosion • Potential for flash flooding and storm surge
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Decreased economic activity • Expensive response and recovery costs • Damage to businesses or business closures • School closures

4.9. Invasive Species

4.9.1. | Description

The term invasive species can apply to both flora (plants) and fauna (animals). This section will focus on plants and insects (referred to as pests) specifically. The Massachusetts Invasive Plant Advisory Group (MIPAG) was founded in 1995 by the Executive Office of Energy and Environmental Affairs to inform the Commonwealth about the presence and management of invasive species. MIPAG defines invasive species as meeting the following four base criteria (MIPAG, 2022):

- non-indigenous to Massachusetts,
- demonstrates the potential for rapid and widespread dispersion and establishment,
- has the potential to disperse over spatial gaps,
- exists in high numbers in natural habitats.

Invasive species have biological traits that give them competitive advantages over native species, particularly because they are not restricted by the biological controls of their native habitat. As a result, invasive species can outcompete natural communities, displace many natives and cause widespread economic and environmental damage (EOEEA M. &., 2023).

Pests exacerbate the problems that invasive plant species pose. Pests often prey on native plant species, causing pre-mature death and creating gaps in the eco-system for invasive species to fill. Certain pests, while not necessarily detrimental to the environment, can pose a threat to public health.

4.9.2. | Location

Invasive species are a widespread problem that have that potential to impact the entirety of Burlington, although the impacts of these species vary by location, elevation, ecosystem, and habitat type, as well as land and water uses. Locations with the greatest susceptibility include natural areas, waterways and wetlands, roadsides and disturbed areas, agriculture areas, and areas that are landscaped with non-native species.

The ability of invasive species to travel far distances (via either natural mechanisms once established or accidental human transport) allows them to propagate rapidly over a large area. Similarly, in open freshwater ecosystems, invasive species can spread quickly, as there are generally no physical barriers (other than physiological tolerances) to prevent establishment, and commercial and recreational water activities provide ample opportunities for transport to new locations.

4.9.3. | Severity/Intensity

The geographic extent, severity, and intensity of invasive species varies greatly depending on the species in question and other factors, such as the availability of hospitable natural or artificial habitats, availability of disturbed habitats and ecosystems, and the range that the invasive species can inhabit (EOEEA M. &., 2023). Quantifying the extent of and resultant damage from invasive species can be challenging. Accurately mapping their distribution and population is difficult due to their uneven distribution, dispersal mechanisms and speed, and impact from human activities. (EOEEA M. &., 2023). Invasive species may establish and spread in areas where they have not been previously documented and may not be noticed until they reach high population densities.

4.9.4. | Previous Occurrences and Frequency

Because the presence of invasive species is ongoing rather than a series of discrete events, it is difficult to quantify the frequency of these occurrences. However, increased rates of global trade and travel have created many new pathways for the dispersion of species outside their natural ranges. As a result, the frequency with which these threats have been introduced has increased significantly with globalization. Increased international trade in ornamental plants is particularly concerning because many of the invasive plant species in the U.S. were originally imported as ornamentals or for medicinal purposes. Notable invasive species in Burlington include Japanese knotweed, buckthorn, garlic mustard, bittersweet, and jumping worms (Amynthas agrestis) (MassAudubon, 2024).

4.9.5. | Probability of Future Hazard Events, including Due to Climate Change

There are a multitude of factors that can determine the ability of invasive species to survive and propagate, and climate change is impacting many of them. Factors include temperature, carbon dioxide concentration, habitat disturbances, changes in seasonal patterns, and available nutrients (EOEEA M. &., 2023). Climate change is already altering these variables.

Additionally, increased risks to ecosystems from flooding, fires, drought, and heat are already creating stress for native flora and fauna, making it easier for invasive species to outcompete them (EOEEA M. &., 2023). Extreme weather events, which are increasing due to climate change, may lead to increased establishment of invasive species.

4.9.6. | Vulnerability and Impacts

Invasive species can have far reaching impacts on the town of Burlington and its surrounding areas. Invasive species can sometimes outcompete native species, resulting in the extinction of local flora or fauna. Invasive species can be direct predators for local flora and fauna. This can disrupt or upset ecosystems. Additionally, invasive species have the potential to spread disease. Vulnerabilities associated with invasive species can be found in Table 4.1616.

Table 4.16: Vulnerabilities associated with invasive species

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Increased potential for vector-borne diseases • Invasive species can bring new diseases or aggravate existing health problems
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Japanese knotweed is known to decrease streambank stability and contribute to topsoil erosion which can contribute to flood damage
Systems	Impacts on transportation systems, and electricity and water systems: • Facilities that rely on biodiversity or the health of the surrounding ecosystems such as outdoor recreation areas or agricultural/forestry operations could be vulnerable • Japanese knotweed is known to decrease streambank stability and contribute to topsoil erosion which can contribute to flood damage
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources:

Asset Category	Likely Impacts
	• Die-off of native species that are unable to complete with invasive species • Loss of biodiversity • Loss of ecosystem function • Potential loss of species that were culturally important • Japanese knotweed can contribute to streambank destabilization and erosion
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • . Increased cost of ongoing control efforts • Economic impact from loss of crops, aquaculture, and public goods such as water quality

4.10. Landslides / Mudflows

4.10.1. | Description

A landslide or mudflow is the movement of rocks, earth, or debris down a slope. The most common types of landslides in Massachusetts included translational debris slides, rotational slides, and debris flows (EOEEA M. &., 2023). Most of these events are caused by a combination of unfavorable geologic conditions, steep slopes, and/or excessive water or saturated soils leading to excess pore pressures in the subsurface (EOEEA M. &., 2023).

In Massachusetts, landslides tend to be more isolated in size and pose threats to linear systems and networks such as highways, roadways, rail, and utilities (EOEEA M. &., 2023). Landslides typically occur in more remote and less populated areas.

4.10.2. | Location

Landslides and mudflows are most likely to occur in areas of elevation changes or higher slopes. The 2013 slope stability map in Figure 4.11 categorizes areas of Massachusetts into stability zones, and the categorization is correlated to the probability of instability in each zone.

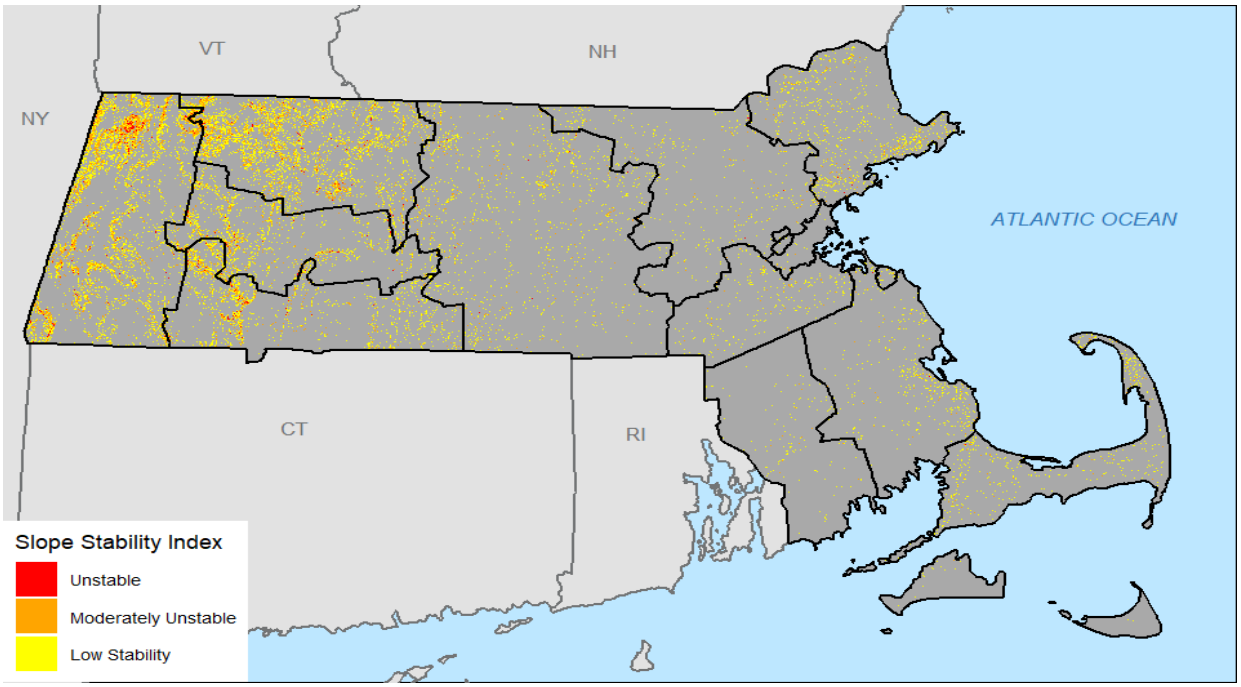


Figure 4.12: Slope Stability Map

While Burlington is in an area not typically associated with high landslide or mudflow risk compared to regions with steeper terrain or more frequent heavy rainfall, there are still factors that could contribute to localized risks. These include areas of town with slopes that are prone to instability, especially those that have been altered by human activities such as construction or landscaping. Soil characteristics such as loose or poorly compacted soils, particularly if they are situated on slopes, can increase vulnerability. Saturated soils have lower stability, and limited vegetation cover can cause erosion and reduce water absorption from the soil.

4.10.3. | Severity/Intensity

Variables that contribute to the potential occurrence of landslide activity include soil properties, topographic position and slope, and historical incidence (EOEEA M. &., 2023). Predicting a landslide is difficult and data are limited and hard to collect due to limited monitoring instruments and lack of eyewitness accounts. As a result, estimations of the severity of landslides are informed by previous occurrences as well as an examination of landslide susceptibility. Information about previous landslides can provide insight on where landslides may occur and what types of damage may result. It is important to note, however, that susceptibility only identifies areas potentially affected and does not imply a timeframe when a landslide might occur (EOEEA M. &., 2023).

4.10.4. | Previous Occurrences and Frequency

Landslides commonly occur shortly after other major natural disasters, such as extreme precipitation events, wildfire, earthquakes, and floods, which can slow response and recovery efforts, including emergency response, evacuations, debris removal, restoration of services, and stabilization efforts. Many landslide events occur in remote areas and are unobserved or reported, making it difficult to account for the frequency of landslides, the scale of such events, and the geographic range. In

general, landslides are most likely during periods of higher-than-average rainfall, with the intensity of the rainfall being an important factor, as well as the health of the soil. Areas that have experienced disturbance due to wildfire, drought, invasive species, recent development, or vegetation or tree removal are more likely to experience landslides.

There are no records of significant landslides or mudflows in Burlington.

4.10.5. | Probability of Future Hazard Events, including Due to Climate Change

It is difficult to determine the probability of future occurrences due to a lack of available data. However, it is thought that impacts of climate change on the duration and intensity of rainfall events, wildfire, drought, and invasive species will result in an increase in the frequency of landslides and may result in an increase in the areas at risk from landslides (EOEEA M. &., 2023). Another factor is the changes in the intensity and type of land uses in areas with high risk for landslides (EOEEA M. &., 2023).

4.10.6. | Vulnerability and Impacts

Landslides or mudflows can cause significant damage to trees, structures, roadways, cars, and other built infrastructure. This damage can result in blocked transportation routes, road closures, general disruption to daily life, and costly repairs. Vulnerabilities associated with landslides in Burlington are located in Table 4.1717.

Table 4.17: Vulnerabilities from landslides or mudflows

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Death or Injury • Loss of property
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Collapse of buildings or other damage • Damage to critical infrastructure
Systems	Impacts on transportation systems, and electricity and water systems: • Blocked or damaged roadways or bridges • Potential to impact utility services such as power, water, or gas lines • Road closures
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Increased erosion

Asset Category	Likely Impacts
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Cancellation of community events • Possible business or school closures

4.11. Other Severe Weather

4.11.1. | Description

Other severe weather refers to conditions such as high winds, thunderstorms, lightning, thunder, hail, and extreme precipitation events.

4.11.2. | Location

Severe weather can impact all of Burlington, but there are factors that create increased vulnerability. Areas of Burlington that are more exposed or have fewer natural windbreaks, such as hills, ridges, or open fields, may experience stronger winds. Additionally, areas with sparse vegetation or where trees have been removed posed an increased risk of impacts from high winds.

Areas with steeper slopes or valleys may experience more localized heavy rainfall. Low lying areas and locations with inadequate drainage are at higher risk of flooding from extreme precipitation.

The types of severe weather outlined in this section oftentimes occur simultaneously, with one bringing on the other. Certain weather conditions, such as thunderstorms, nor'easters, or tropical cyclones, can bring strong winds and precipitation to the region.

4.11.3. | Severity/Intensity

The severity of thunderstorms, high winds, and extreme precipitation events vary in Burlington. Storms can be quick and moderate or long and intense. Oftentimes, severity increases when these types of severe weather occur simultaneously. For example, impacts from thunderstorms can be exacerbated by high winds and extreme precipitation.

4.11.4. | Previous Occurrences and Frequency

Severe weather occurs fairly frequently in Burlington. Since the previous Hazard Mitigation Plan in 2016, there have been 132 days in Middlesex County with heavy rain, lightning, strong wind, or thunderstorm wind (NOAA, 2024). There have been 10 injuries from severe weather and one fatality from severe weather since the previous Hazard Mitigation Plan in 2016 (NOAA, 2024). A child was killed in northwest Middlesex County due to wind gusts knocking down a rotted tree (NOAA, 2024). In total, severe weather has caused 2.1 million dollars' worth of property damage since the previous plan update in 2016 (NOAA, 2024).

4.11.5. | Probability of Future Hazard Events, including Due to Climate Change

Massachusetts is highly likely to continue experiencing high wind events based on previous occurrences. Though the effect of climate change on high winds is not certain, based on recent data, it appears likely that high wind events will increase because of more frequent severe weather events in the future (EOEEA M. &., 2023).

Massachusetts experiences between nine and 27 thunderstorm days each year (EOEEA M. &., 2023), and is likely to continue experiencing thunderstorms. Data supports the trend of slightly increased frequency (EOEEA M. &., 2023).

Extreme precipitation projections by the U.S. Geological Survey indicate that the coast will experience the greatest number of high-intensity rainfall days, but increased precipitation will occur in every region of the Commonwealth (EOEEA M. &., 2023). Higher temperatures due to climate change are anticipated to increase the moisture-holding capacity of the atmosphere.

4.11.6. | Vulnerability and Impacts

Severe storms, high winds, and heavy precipitation can have a wide range of effects on people, structures, systems, and resources. First and foremost, in the absence of proper shelter, people are subject to serious injury or even death from hail, lightning, and high winds. Thunderstorms can cause power outages, which can disrupt daily life and impact essential services. They can also cause damage to electrical infrastructure, such as power lines, transformers, and substations. Severe thunderstorms can also strain public safety resources, including emergency services, law enforcement, and medical facilities. They can also cause wildfires from lightning strikes. High winds have the capability of blowing down tree limbs and creating flying debris that can injure people or block roads. Vulnerabilities associated with severe weather are in Table 4.1818.

Table 4.18: Vulnerabilities associated with other severe weather

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Death and injury • Mental health impacts such as anxiety and PTSD • Displacement
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Falling objects, trees, or debris can damage buildings or critical infrastructure • Fallen power lines • High winds and hail can damage buildings or infrastructure

Asset Category	Likely Impacts
Systems	Impacts on transportation systems, and electricity and water systems: • Airport closures • Electrical infrastructure damage • Communications disruptions from damage to telecommunications infrastructure • Power outages • Transportation disruptions from heavy rain, strong winds, or flooding • Severe storms can overwhelm water treatment plants and wastewater facilities leading to contamination and water supply disruptions
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Flash floods or riverine flooding • Potential for wildfire due to lightning strikes • Potential for tornadoes to form
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Severe storms may cause business closures • Cancellations of community or sporting events

4.12. Severe Winter Storms

4.12.1. | Description

Winter storms are a common occurrence in Burlington. These events can include nor'easters, blizzards, and ice storms. Severe winter storms are a type of extratropical cyclone, which are formed when a cold mass of air meets with a warm mass of air and creates a front. Extratropical cyclones have cold air at their core and can be accompanied by either weak or strong winds (EOEEA M. &., 2023). Blizzards and ice storms in Massachusetts can range from an inconvenience to extreme events that cause significant impacts and require a large scale, coordinated response.

The National Weather Service defines a blizzard as a winter snowstorm with sustained or frequent wind gusts of up to 35 miles per hour or more, accompanied by falling or blowing snow that reduces visibility to or below a quarter of a mile over at least a three-hour period (Service, Winter Storms and Blizzards, 2024). Blizzards are also often associated with extreme temperatures.

Freezing rain is defined by liquid rain falling and freezing on contact with old objects, creating ice buildups (EOEEA M. &., 2023). Even a small amount of ice can cause significant impacts, but an ice

storm by the National Weather Service's definition is a half inch of ice accumulation across any location (Service, Winter Watch, Warning, and Advisory Definitions, 2024).

A nor'easter is a storm that occurs along the East Coast of North America with winds from the northeast. A nor'easter is characterized by a large counterclockwise wind circulation around al ow-pressure center that often results in heavy snow or rain and high winds. Nor'easters can occur any time of year but occur most frequently between September and April. The storm radius of a nor'easter is often as much as 100 miles across, and nor'easters can last between 12 hours and 3 days, affecting multiple tide cycles and causing extended heavy precipitation in an area (EOEEA M. &., 2023). Sustained wind speeds of 20 to 40 miles per hour are common during a nor'easter, with short-term wind speeds gusting up to 50 to 60 miles per hour (EOEEA M. &., 2023).

4.12.2. | Location

The entire Town of Burlington is at risk from the hazard of severe winter storms. These storms can bring heavy snow which can paralyze inland cities or regions, limiting access to some areas.

4.12.3. | Severity/Intensity

Snowfall is a component of multiple hazards, including nor'easters and other severe winter storms. Since 2005, the Regional Snowfall Index (RSI) has become the descriptor of choice for measuring winter events that affect the eastern two-thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, as shown in Table 4.1919. It also includes population as a variable.

The RSI is a regional index. Each of the six climate regions in the eastern two-thirds of the nation (as identified by the NOAA National Centers for Environmental Information) has a separate index, calculated according to region-specific parameters and thresholds. The RSI is important because, with it, a storm event and its societal impacts can be assessed in the context of a region's historical events (EOEEA M. &., 2023).

Table 4.19: Regional Snowfall Index for Massachusetts

Category	RSI Value	Northeast Threshold	Description	Number of Events in New England (1973–2022)
1	1–3	Less than 4 inches	Notable	75
2	3–6	4–10 inches	Significant	23
3	6–10	10–20 inches	Major	7
4	10–18	20–30 inches	Crippling	4
5	18.0+	30+ inches	Extreme	3

Source: National Centers for Environmental Information (n.d.).

4.12.4. | Previous Occurrences and Frequency

Middlesex County, which includes Burlington, experienced 49 days of severe winter weather since the previous hazard mitigation plan update. A complete list of winter weather events is presented in Table 4.2020 below. The combined property damage from these winter events totaled $562,900.

Table 4.20: Winter weather events in Burlington

Date of Occurrence	Type of Hazard
1/23/16	Winter Weather
2/05/2016	Heavy Snow
2/08/2016	Winter Weather
3/21/2016	Winter Weather/ Heavy Snow
4/03/2016	Winter Weather
4/04/2016	Winter Weather/ Heavy Snow
12/17/2016	Winter Storm/ Winter Weather
12/29/2016	Heavy Snow
1/07/2017	Winter Storm
2/08/2017	Winter Weather
2/09/2017	Winter Storm
2/12/2017	Winter Storm
3/14/2017	Heavy Snow
12/09/2017	Winter Storm
12/22/2017	Winter Weather
12/23/2017	Winter Weather
12/25/2017	Winter Weather

Date of Occurrence	Type of Hazard
1/04/2018	Winter Storm
1/23/2018	Winter Weather
2/07/2018	Winter Weather
2/17/2017	Winter Storm
3/07/2018	Winter Storm
3/13/2018	Winter Storm
11/15/2018	Heavy Snow
12/28/2018	Winter Weather
1/19/2019	Winter Storm
2/13/2019	Winter Weather
3/03/2019	Winter Storm
12/01/2019	Heavy Snow
12/30/2019	Winter Weather
1/18/2020	Heavy Snow
3/23/2020	Heavy Snow
4/18/2020	Winter Weather
10/30/2020	Heavy Snow/Winter Weather
12/05/2020	Heavy Snow
12/16/2020	Heavy Snow
2/01/2021	Winter Storm/Heavy Snow
2/07/2021	Heavy Snow
4/16/2021	Heavy Snow

Date of Occurrence	Type of Hazard
1/07/2022	Heavy Snow
1/16/2022	Heavy Snow
1/28/2022	Heavy Snow/Winter Storm/Blizzard
2/25/2022	Heavy Snow
12/16/2022	Winter Weather
1/20/2023	Heavy Snow
1/23/2023	Heavy Snow
3/03/2023	Heavy Snow
3/13/2023	Heavy Snow
3/14/2023	Heavy Snow

4.12.5. | Probability of Future Hazard Events, including Due to Climate Change

Burlington already experiences notable winter weather events and nor'easters every year. Therefore, it is virtually certain that Burlington will continue to experience severe winter storms at least annually. However, it is unclear how much the frequency of these storms will change in Massachusetts over the next few decades due to climate change. Extreme weather events- including extreme precipitation events- are anticipated to occur more often as climate change occurs. Rising temperatures mean that more of this precipitation is likely to fall as rain rather than snow (EOEEA M. &., 2023). However, there has been little information on the climate trends of nor'easters (EOEEA M. &., 2023).

While evidence for frequency is not clear, climate change is likely to increase the intensity of winter storms. Increased sea surface temperature in the Atlantic Ocean due to climate change will cause air moving north over the ocean to hold more moisture. As a result, when these fronts meet cold air systems moving from the north, an even greater amount of precipitation than normal can be anticipated to fall on Massachusetts (EOEEA M. &., 2023).

4.12.6. | Vulnerability and Impacts

Severe winter weather has the potential to paralyze the entire town. Heavy snow and ice can yield dangerous travel conditions and result in public transportation closures. Prolonged closures of roads and public transportation systems can inhibit the delivery of critical services or the ability to obtain vital resources. Heavy snow has the capacity to cause power outages or frozen pipes. Extended

power outages, the cost of snow removal, and repairing damages can have severe economic impacts on smaller communities. The elderly and the sick are populations of particular concern during these events. Table 4.21 contains vulnerabilities associated with severe winter weather.

Table 4.21: Vulnerabilities associated with severe winter weather

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Death and injury • Increased instances of frostbite and hypothermia • Stranded or isolated communities • Environmental justice population in the western portion of the Town should be considered high risk due to a lower median household income; warming shelters should be offered.
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Heavy snow loads may cause roof collapse • Increased heating demands • Frozen pipes
Systems	Impacts on transportation systems, and electricity and water systems: • Power outages • Transportation disruptions due to low visibility, icy road conditions, or heavy snow • Communications disruptions from damaged infrastructure due to ice and freezing rain • Water supply interruptions caused by frozen pipes that burst • Bridges may become icy and freeze over; Winn Street Bridge, Cambridge Street Bridge, Middlesex Turnpike Bridge
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Historic buildings may not be capable of handling snow loads and may be more susceptible to roof collapse • Flooding may occur after the rapid melting of snow • Chemicals used to treat roadways may contaminate natural environments and water bodies if used in large quantities

Asset Category	Likely Impacts
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Increased heating costs • Disruption of essential services • Reduced economic activity • Expensive response and recovery costs • School closures

4.13. Tornadoes

4.13.1. | Description

A tornado is a narrow, violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The observable aspect of a tornado is the rotating column of water droplets, which captures dust and debris in the column (EOEEA M. &., 2023). Tornadoes are the most violent of atmospheric storms. Tornadoes tend to form when cold, dry air clashes with warm, humid air (EOEEA M. &., 2023).

The following are common factors in tornado formation (EOEEA M. &., 2023):

- Very strong winds in the middle and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed at the lowest 10,000 feet of the atmosphere (i.e., 20 miles per hour at the surface and 50 miles per hour at 7,000 feet)
- Very warm, moist air near the ground, with unusually cool air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity

Tornadoes can form along severe thunderstorm squall lines, from individual supercell thunderstorms, or from tropical cyclones. Most tornadoes occur in the late afternoon and evening hours when the temperatures are the highest. The most common months for tornadoes to occur in Massachusetts are June, July, and August (EOEEA M. &., 2023).

4.13.2. | Location

Burlington, like much of the Commonwealth, is not located in a region known for frequent tornado activity. However, there is still the possibility of a tornado occurring in Burlington. In general, tornadoes can develop anywhere, but they are most likely to occur in areas with certain characteristics. Areas with flat terrain are more conducive to tornadoes. Tornadoes often form along or near weather fronts. Burlington experiences a variety of weather conditions; therefore, it is possible that the town may be affected by weather systems that produce tornadoes, particularly during the spring and summer months. Additionally, low-lying areas have a higher risk of tornado formation than areas with higher elevations or steep slopes.

4.13.3. | Severity/Intensity

Massachusetts ranks 35th among the states for frequency of tornadoes, 14th for frequency of tornadoes per square mile, 21st for injuries, and 12th for cost of damage (EOEEA M. &., 2023).

The National Weather Service rates tornadoes using the Enhanced Fujita scale (EF scale), shown in Figure 4.12, which does not directly measure wind speed but rather the amount of damage created. This scale derives three-second gusts estimated at the point of damage based on the assignment of one out of eight degrees of damage to a range of different structure types. These estimates vary with the height of a damaged structure (damage above the ground) and exposure of the event. This method is considerably more sophisticated than the original Fujita scale, and it allows surveyors to create more precise assessments of tornado severity after an event (EOEEA M. &., 2023).

EF-Scale	Class	Wind speed		Description
		mph	km/h	
EF-0	weak	65-85	105-137	Gale
EF-1	weak	86-110	138-177	Moderate
EF-2	strong	111-135	178-217	Significant
EF-3	strong	136-165	218-266	Severe
EF-4	violent	166-200	267-322	Devastating
EF-5	violent	>200	>322	Incredible

(NWS, 2023)

Figure 4.13: Enhanced Fujita Scale

4.13.4. | Previous Occurrences and Frequency

Massachusetts experiences far fewer tornadoes than other parts of the country. However, an occurrence is still possible. There have been no tornadoes reported in Burlington since the last Hazard Mitigation Plan update in 2016.

While the number of tornadoes is small in Massachusetts compared to other areas of the country, the Commonwealth experiences between two to five tornadoes per year and past tornadoes have caused significant damage (EOEEA M. &., 2023). Given these factors, the likelihood that a tornado event will occur within the Commonwealth is high. However, given the challenge of identifying specific parts of Massachusetts that are more at risk from tornadoes, mitigation measures to reduce the risk of high winds that tornadoes and other extreme weather events generate should focus on

the assets and populations most at risk, such as mobile homes and other manufactured buildings; people with characteristics that make them most at risk from tornadoes; and lifeline infrastructure, including utilities, infrastructure, and critical assets such as hospitals and schools (EOEEA M. &., 2023). Removing debris, storing hazardous waste and materials, and removing or enclosing critical equipment and assets located on roofs or outside of structures can make a significant difference in reducing the damage from tornadoes and other high-wind events (EOEEA M. &., 2023).

While there have been no tornadoes recorded in Burlington, there have been two tornadoes that passed through Middlesex County since the previous hazard mitigation plan update. The first tornado was an EF-1 that occurred on August 22, 2016, in Concord (NOAA, 2024). The second tornado was an EF-0 that occurred on August 23, 2021, In Marlborough and Stow (NOAA, 2024). The combined damage from these two tornadoes totaled 1.01 million dollars (NOAA, 2024).

4.13.5. | Probability of Future Hazard Events, including Due to Climate Change

Current climate models predict an increase in severe thunderstorms, which have the potential to produce tornadoes. However, it is unclear if tornado frequency will increase with climate change. Some studies suggest there will be a decrease in the number of tornado days, but an increase in the number of tornadoes per day. Given that less than 10 percent of severe thunderstorms produce tornadoes, it is difficult to draw firm conclusions about the processes leading up to a tornado and how these processes might be influenced by climate change (EOEEA M. &., 2023). Additionally, given that the tornado records only dates to 1950 in the United States and varies significantly from year to year, it is difficult to identify long-term trends (EOEEA M. &., 2023).

4.13.6. | Vulnerability and Impacts

Tornadoes can cause severe injury or even death. Tornadoes can destroy homes, businesses, and other structures, leaving people without shelter and their possessions destroyed or lost. Tornadoes can also cause economic impacts, such as lost wages, business interruption, and increased insurance premiums. Infrastructure such as power lines, communication towers, water mains, and gas mains are vulnerable to tornadoes. Damage to such infrastructure can cause power outages, disruptions to communication, and water contamination. Tornadoes can also disrupt transportation systems, including roads, railways, and airports, by blocking them with debris, making them impassable or unsafe to use. Vulnerabilities associated with tornadoes can be found in Table 4.2222.

Table 4.22: Vulnerabilities associated with tornadoes

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Death or injury • Flying debris can cause death or injury • Mental health impacts such as anxiety or PTSD • Displacement

Asset Category	Likely Impacts
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Damage to buildings and infrastructure from high winds and flying debris • Critical facility damage • Power outages
Systems	Impacts to transportation systems, electricity and water systems: • Damage to roadways, bridges, and other transportation infrastructure can disrupt daily travel • Damage to telecommunications infrastructure can disrupt communications • Downed power lines can cause power outages • Damage to water treatment plants, pump stations, or water distribution systems can lead to a loss of clean drinking water and sanitation services
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Uprooting or damaging trees • Destroyed vegetation or altered landscapes • Downed utility lines can cause wildfires
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Decreased economic activity • Business closures • School closures

4.14. Wildfires

4.14.1. | Description

A wildfire is an uncontrolled, unplanned fire that spreads through natural or unnatural vegetation (EOEEA M. &., 2023). Wildfires in Massachusetts are caused by natural events (such as lightning) and human activity. Wildfires often begin unnoticed but spread quickly, igniting brush, trees, and potentially homes. Fast-moving fires typically occur from March to June. Deep-burning duff fires can occur in the drier months of June through November. April is historically the month in which wildfire danger is the highest. However, drought, snowpack level, and local weather conditions can impact the timing and length of the fire season (EOEEA M. &., 2023).

4.14.2. | Location

The risk of wildfire in Burlington is fairly low as shown in Figure 4.13 below. The figure shows wildfire hazard potential on a scale from 1 (low) to 8 (high).

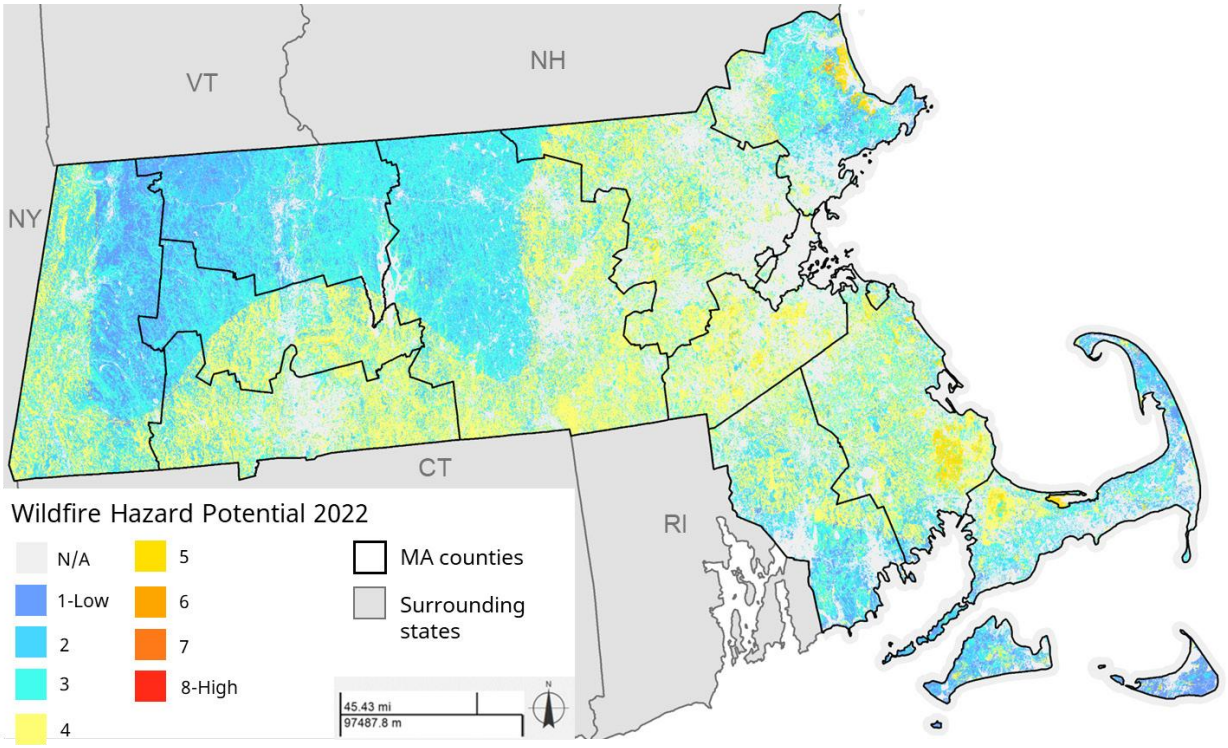


Figure 4.14: Wildfire Hazard Potential in Massachusetts

Source: Map created by ERG using data from Northeast-Midwest Wildfire Risk Explorer (2022)

Due to Burlington being fairly developed, there is a lower concentration of flammable vegetation that is most susceptible to wildfires. However, weather conditions such as dry and windy weather allow wildfires to spread rapidly. Wildfire risk also increases near roadways as they can be started by human activities such as discarded cigarettes and sparks from vehicles.

4.14.3. | Severity/Intensity

The National Wildfire Coordinating Group classifies wildfires based on how many acres are burned (EOEEA M. &., 2023). There are seven classes of wildfire:

- Class A: 0.25 acre or less
- Class B: more than 0.25 acres, but less than 10 acres
- Class C: 10 acres or more, but less than 100 acres
- Class D: 100 acres or more, but less than 300 acres
- Class E: 300 acres or more, but less than 1,000 acres
- Class F: 1,000 acres or more, but less than 5,000
- Class G: 5,000 acres or more

4.14.4. | Previous Occurrences and Frequency

Several notable wildfires have occurred in Massachusetts history, although none has ever resulted in a disaster declaration by the U.S. Federal Emergency Management Agency. Wildfires in the Commonwealth tend to be around five acres (EOEEA M. &., 2023). Due to the relatively small size

of the incidents compared to larger fires in California and other parts of the West, it can be difficult to consistently track and record these fires since they are not federally declared events. As such, it is difficult to compile a consistent historical record of wildfires for the Commonwealth. In 2017, DCR began working to improve fire reporting data.

Since 2016, the Burlington Fire Department has reported some small brush fires in Mill Pond and Landlocked Forest. Residents noted individual occurrences, one where a neighbor caused a brush fire and one where brushfires hit a gas line near Francis Wyman Elementary School, burning down a house.

4.14.5. | Probability of Future Hazard Events, including Due to Climate Change

Precipitation changes, prolonged drought, rising temperatures, and increased frequency of lightning are expected to contribute to increased frequency and severity of wildfire. As droughts become more frequent and severe, forest types that do not usually burn and are not fire adapted will be more likely to burn. Wildfires are projected to increase worldwide by 14% by 2030, 30% by 2050, and 50% by 2100 (EOEEA M. &., 2023).

4.14.6. | Vulnerability and Impacts

Wildfires can have extensive and far-reaching impacts. First and foremost, wildfire smoke can contain harmful pollutants that can cause respiratory problems, especially for people with pre-existing conditions like asthma or COPD. Exposure to smoke can also lead to eye irritation, headaches, and other health effects. Wildfires can also cause physical injuries such as burns and can even potentially be fatal. During wildfire events, people may be displaced from their homes due to the need to evacuate. Wildfires can cause severe structural damage to homes and businesses alike, as well as other property. The loss of personal possessions and cherished belongings can have emotional and financial impacts on individuals and families. Wildfires can destroy or damage critical lifelines such as power lines, water treatment facilities, and transportation infrastructure. This can lead to disruptions in basic services such as electricity, clean water, and transportation. Wildfires can cause soil erosion and other changes to the landscape that impact water quality. This can lead to contamination of drinking water supplies. Wildfires can also impact air quality, which can have implications for the health of individuals and for the operation of critical infrastructure such as airports. Lastly, wildfires can decimate natural landscapes as well as local populations of flora and fauna. Table 4.2323 contains vulnerabilities associated with wildfires.

Table 4.23: Vulnerabilities associated with wildfires

Asset Category	Likely Impacts
People	Impacts on people's health, welfare, and safety, including underserved communities and socially vulnerable populations: • Death or injury • Displacement or evacuation • Loss of property • Mental health impacts such as anxiety or PTSD

Asset Category	Likely Impacts
	• Worsening of chronic respiratory illnesses due to smoke and increased particles in the air
Structures	Impacts on buildings, facilities, lifelines, and critical infrastructure: • Burning structures • Charring of exterior surfaces • Damage to roofs, walls, or windows • Heat generated by wildfires can weaken or melt building materials
Systems	Impacts on transportation systems, and electricity and water systems: • Wildfire can damage utility infrastructure, including power lines, gas pipelines, and water lines, leading to disruptions in services • Damage to infrastructure such as roads or bridges can disrupt travel and emergency responses
Natural/Cultural/Historic Resources	Impacts on ecosystems, natural habitats, community areas, historical facilities and locations, and cultural resources: • Wildfires can decimate habitats and harm or displace wildlife • Displacement of wildlife can lead to conflicts with human populations • Post-fire landscapes are vulnerable to colonization by invasive plant species which can outcompete native vegetation and disrupt ecosystem function
Economic and Community Assets	Impacts to people's ability to work and make a living, and impacts to activities that benefit the community by increasing community morale and well-being: • Increased insurance claims • Reduced economic activity in areas affected by wildfire • Need for emergency shelters • Expensive response and recovery costs

4.15. Summary

The following table summarizes changes in population patterns and land use and development and how those impact hazards in Burlington.

4.15.1. | Changes in Population Patterns

Vulnerable Populations

The statistics discussed in Table 4.24 are relevant to the evaluation of the impact of how population patterns influence the impact of the hazards evaluated for this plan:

Table 4.24: Vulnerable Population Trends and Natural Hazards

Population Trend	Influence on Natural Hazard Impact(s)
Burlington's population of people of color increased from 21% of the population in 2010 to 30% of the population in 2020.	This increase highlights the need for culturally inclusive emergency communication and resources during natural hazards to ensure equitable access to support.
Burlington's elderly population increased by 2.7 points as a percent of population between 2010 and 2020.	The increase in the number of elderly residents could strain emergency services, as older adults may have greater vulnerabilities and specific needs during natural disasters such as hurricanes, severe winter weather and extreme temperatures.
Burlington's median income increased more than inflation between 2019 and 2020, increasing from $90,341 to $133,936, but its poverty rate increased from 4.0% to 5.2% of the population.	Overall, the increase in incomes in Burlington may indicate the overall population has more resources to respond to and prepare for natural hazards, but those living below poverty may have greater vulnerabilities.
Burlington's population of adults with a limited ability to speak English declined as a percent of population from 7.4% to 4.4%.	A higher proportion of residents may better understand emergency communications and services.

4.15.2. | Changes in Land Use and Development

Burlington has seen many changes in land use and development since the last HMP in 2016. The Zoning Bylaws include a 100-Year Flood Plain District, which limits development in areas prone to flooding to protect public safety, reduce emergency risks, and preserve the natural flood storage capacity. The Wetlands District protects water bodies and wetlands, preventing flooding and contamination while preserving the groundwater table. The town updated its Wetlands Bylaw in 2023 to prioritize climate resilience. Additionally, the Aquifer and Water Resource Districts restrict land use to safeguard groundwater supplies and protect public health by conserving recharge areas and preventing pollution. These districts collectively mitigate natural hazard risks and ensure long-term community safety and resilience.

While these regulatory changes have helped the Town to improve its resilience by guiding development into places that are less vulnerable to natural hazards, there are other development impacts that increase local vulnerability. These are listed below, in Table 4.25. They include more on-site employees as offices phase out remote work, and additional residential development.

Table 4.25: Land Use and Development Trends and Natural Hazards

Land Use and Development Trend	Influence on Natural Hazard Impact(s)
Burlington continues to see development in office parks, retail spaces, and technology sectors, continuing its status as a major employment hub.	The increased daytime populations create traffic congestion, potentially complicating evacuation efforts during natural disasters and increasing vulnerability to infrastructure strain. This daytime population is less post-Covid as workers continue to work from home via hybrid schedule.
Greater residential growth also places a burden on infrastructure systems — the water supply, sewer system, and emergency services.	The water supply is fully connected with MWRA as of 2021. Backup water supply is available through the Mill Pond water treatment plant, which is equipped with PFAS filters. The sewer system is connected with MWRA. The system is fifty years old, so it is relatively new compared to that of other municipalities. The Department of Public Works maintains sewer pumping stations with diesel backup generators.

Table 4.26 provides definitions of hazard location, extent, frequency, and probability. The definitions support the basis of determination in Table 4.27.

Table 4.26: Description of Natural Hazard Risks for the Town of Burlington

Points	Description
Hazard Extent (Severity/Intensity)	
Minor	Limited damages to property, no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e., one or two neighborhoods); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.
Serious	Scattered major property damage (more than 10% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services briefly interrupted up to 1 day; some minor injuries.
Extensive	Consistent major property damage (more than 25%); major damage public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and possible fatalities.

Points	Description
Catastrophic	Property and public infrastructure destroyed (more than 50%); essential services stopped for 30 days or more, multiple injuries and fatalities.
Present Frequency of Hazard	
Very Low	Events that occur less frequently than once in 100 years (less than 1% chance per year).
Low	Events that occur from once in 50 years to once in 100 years (1% to 2% chance per year).
Medium	Events that occur from once in 5 years to once in 50 years (2% to 20% chance per year).
High	Events that occur more frequently than once in 5 years (greater than 20% chance per year).
Future Probability of Hazard	
Very Low	Events that are projected to occur less frequently than once in 100 years (less than 1% chance per year).
Low	Events that are projected to occur from once in 50 years to once in 100 years (1% to 2% chance per year).
Medium	Events that are projected to occur from once in 5 years to once in 50 years (2% to 20% chance per year).
High	Events that are projected occur more frequently than once in 5 years (greater than 20% chance per year).
Location of Hazard	
N/A	Hazard has not yet affected the town area
Small	Less than 10% of the town is or could be affected by the hazard
Medium	Between 10-50% of the town is or could be affected by the hazard
Large	More than 50% of the town is or could be affected by the hazard

Table 4.27 below provides a summary of the natural hazards affecting Burlington. This evaluation considers historical records, the extent, frequency, location, and anticipated future probability. Information regarding future projections for specific scenarios is not available for every natural hazard, each hazard section contains the best available science and discusses projections in the context of specific future scenarios when available and appropriate.

Table 4.27: Summary of Natural Hazard Risks for the Town of Burlington

Natural Hazard	Previous Occurrence of Hazard Event in Burlington	Present			Future Probability of Occurrence
		Extent	Frequency	Location	
Hurricanes / Tropical Cyclones	Yes	Catastrophic	Low	Town wide	Medium
Tornadoes	No	Serious	Very Low	N/A	Medium
High Wind / Thunderstorms	Yes	Minor	High	Town wide	High
Severe Winter Weather	Yes	Serious	High	Town wide	High
Inland Flooding	Yes	Serious	High	Town wide	High
Dam Breach	No	Serious	Low	Variable	Cannot be predicted
Earthquakes	No	Minor	Very Low	N/A	Cannot be predicted
Wildfires	Yes	Minor	High	Variable	Medium
Drought / Extreme Heat	Yes	Minor	Medium	Town wide	High

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5. Community Capabilities

The Town of Burlington has a unique set of capabilities, in the form of laws, polices, programs, staff, funding, and other resources to carry out the HMP and to increase local climate resilience. This chapter reviews the Town's capabilities and describes the resources Burlington has available to accomplish hazard mitigation and reduce disaster losses now and in the future. There are five types of mitigation capabilities in accordance with FEMA's Local Mitigation Planning Handbook:

1. **Compliance with the National Flood Insurance Program**.
2. **Planning and regulatory capabilities** are the codes, ordinances, policies, laws, plans, and programs that guide growth and development.
3. **Administrative and technical capabilities** are the town's staff, skills, and tools.
4. **Financial capabilities** are the resources to fund mitigation actions.
5. **Education and outreach capabilities** are programs and methods that can communicate about and encourage risk reduction.

In each section, the Town's existing capabilities and gaps in capabilities are discussed.

5.1. National Flood Insurance Program Compliance

Communities across the country build their floodplain management capabilities by participating in the National Flood Insurance Program (NFIP). The NFIP supports flood risk reduction before and after disasters. It helps reduce the socioeconomic impact of floods. The NFIP allows property owners and renters in participating communities to purchase federal flood insurance policies to

recover financial losses after a flood. To participate in the NFIP, communities adopt and enforce floodplain management policies to reduce the effects of flooding.

5.1.1. | Existing Capabilities

Staff Resources

The responsibilities for administering the requirements of the NFIP in Burlington are handled by the Building Commissioner and lead Inspector of Buildings, who also enforces the Town's Building Code and Zone Enforcement. Additional Building Department staff have received some training on the NFIP and FEMA damage assessment regulations. Building Department inspectors manage tracking changes to the Town's Flood Insurance Rate Map.

Regulation

To participate in the NFIP, communities must either adopt a special purpose floodplain management ordinance that addresses minimum NFIP criteria, or do so through zoning codes, subdivision ordinances, and building codes. NFIP criteria specifically apply to Special Flood Hazard Zones (SFHAs) designated by FEMA, areas that have a 1% annual chance of flooding each year. The Town's Zoning Bylaw includes Section 8.1.0, the 100-Year Floodplain District which addresses the NFIP requirements.

In SFHAs, the minimum requirements are: "(1) Requiring permits for all proposed construction or other development in the community to determine whether such construction or development will be placed in flood-prone areas; (2) reviewing proposed development to assure that all necessary permits have been received; (3) elevation of new and substantially improved residential structures above the base flood level; (4) elevation or dry floodproofing (made watertight) of new or substantially improved non-residential structures in Zones A; (5) with limited exception, the prohibition of encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway, the central portion of a riverine floodplain needed to carry deeper and faster moving water; and (6) additional requirements to protect buildings in coastal areas from the impacts of waves, high velocity, and storm surge" (Federal Emergency Management Agency, 2021).

These requirements also extend beyond new construction to include "substantial improvement" and "substantial damage" projects, such that when older buildings are repaired, they are also brought into compliance with the floodplain ordinance.

Community Rating System

The Community Rating System (CRS) program is an incentive program that promotes floodplain management regulations that go beyond the minimum requirements set by the NFIP. The CRS program has 19 creditable activities, broadly organized in the categories Public Information, Mapping and Regulations, Flood Damage Reduction, and Warning and Response. When communities implement these activities, they receive points. The more points a community scores, the greater the discount on flood insurance premiums will be for citizens of that community.

The Town of Burlington does not currently participate in FEMA's CRS program. To join the CRS program, Burlington must remain in good standing with the NFIP and have enough credit points (500) to achieve a Class 9 rating, the first tier of participation that entails a 5% flood insurance discount. Discounts range from 5% to 45% and are awarded at increments of 5%.

Insurance Summary

The Town of Burlington currently has 59 active policies in effect with total premiums paid of $67,840. According to data provided by FEMA as of August 20, 2024, there are 8 repetitive loss properties in Burlington, which are all single-family residences.

NFIP Compliance History

There are no known NFIP compliance issues for the Town of Burlington.

5.1.2. | Capability Gaps

The following capability gaps can be addressed to further enhance Burlington's benefits from participating in the NFIP:

- Burlington has the opportunity to reduce NFIP flood insurance premiums for residents by participating in the Community Rating System. The first step to joining the program is completing an application and providing a letter of interest to FEMA.

5.2. Planning and Regulatory Capabilities

Planning and regulatory capabilities encompass a wide range of tools such as codes, bylaws, policies, laws, plans, and programs that guide growth and development. These capabilities play a crucial role in either supporting risk reduction or creating areas that are more vulnerable to disasters. These strategies are aimed at breaking the cycle of disaster damage and reconstruction. Additionally, effective law and regulation for disaster risk reduction are critical in shaping choices for sustainable development and building resilience to disasters.

5.2.1. | Existing Capabilities

Building Code

The Building Department at the Town of Burlington ensures that all new and re-development complies with the Zoning Code and the Massachusetts State Building Code 780 CMR. This is accomplished through a stringent permitting process and inspections of new and existing residential and commercial properties. The Building Department consists of an Inspector of Buildings, a Senior Building Inspector, an Inspector of Plumbing and Gas, and an Inspector of Wires. For construction projects, both the Building Department and Conservation Commission monitor compliance throughout construction to ensure structures are adhering to the Burlington Building Code, the State Building Code, and zoning regulations.

The Massachusetts building code addresses natural hazards through elevation requirements aligning with guidance from FEMA, hazard-resistant standards from ASCE 24 and ASCE 7, recognition of floodplain overlay districts, and enforcement.

Land Use / Development Bylaws and Regulations

Burlington Zoning Bylaws

The Burlington Zoning Bylaws have multiple aspects that contribute to hazard mitigation in the community. The Town recently updated zoning bylaw to require native species in landscape design. In addition, the zoning bylaw includes the following:

The 100-Year Flood Plain District is an overlay district that includes all special flood hazard areas within Burlington designated as A or AE on the Middlesex County Flood Insurance Rate Maps. The purpose of the Floodplain Overlay District is to:

- Ensure public safety through reducing the threats to life and personal injury

- Eliminate new hazards to emergency response officials
- Prevent the occurrence of public emergencies resulting from water quality, contamination, and pollution due to flooding
- Avoid the loss of utility services which if damaged by flooding would disrupt or shut down the utility network and impact regions of the community beyond the site of flooding
- Eliminate costs associated with the response and cleanup of flooding conditions
- Reduce damage to public and private property resulting from flooding waters
- Preserve the natural flood control characteristics and the flood storage capacity of the floodplain.

The Wetlands District includes all lands shown with the boundaries designated as wetlands on the Topographic Sheets, Town of Burlington entitled Wetlands 1977. The purpose of this district is:

- To preserve and protect the water bodies, water courses and wetlands in the Town of Burlington and their adjoining lands.
- To protect the health and safety of people and property against the hazards of flooding and contamination.
- To preserve and maintain the groundwater table for water supply purposes.
- To protect the natural environment.
- To conserve the watershed areas of the Town of Burlington for the health, safety, and welfare of the public.

The Wetlands Bylaw, first established in 2013, was updated in 2023 to include climate resilience as a key purpose of wetlands protection.

The Aquifer District encompasses all properties whose ground and surface waters directly recharge the Vine Brook wellfield, including all lands designated as Zone I and Zone II by the Massachusetts Department of Environmental Protection. The Water Resource District encompasses all properties whose ground and surface waters drain into the watershed contributing to the Vine Brook aquifer, including all areas designated as Zone III by the DEP. These are depicted in Figure 5.1. The purpose of these districts is:

- To promote the health, safety, and general welfare of the community.
- To protect, preserve, and maintain the existing and potential groundwater supply and groundwater recharge areas within the known aquifers of the Town.
- To preserve and protect present and potential sources of water supply for public health and safety.
- To conserve the natural resources of the town.
- To protect the groundwater and groundwater recharge areas of the town from adverse development or land use practices.
- To prevent blight and the pollution of the environment.

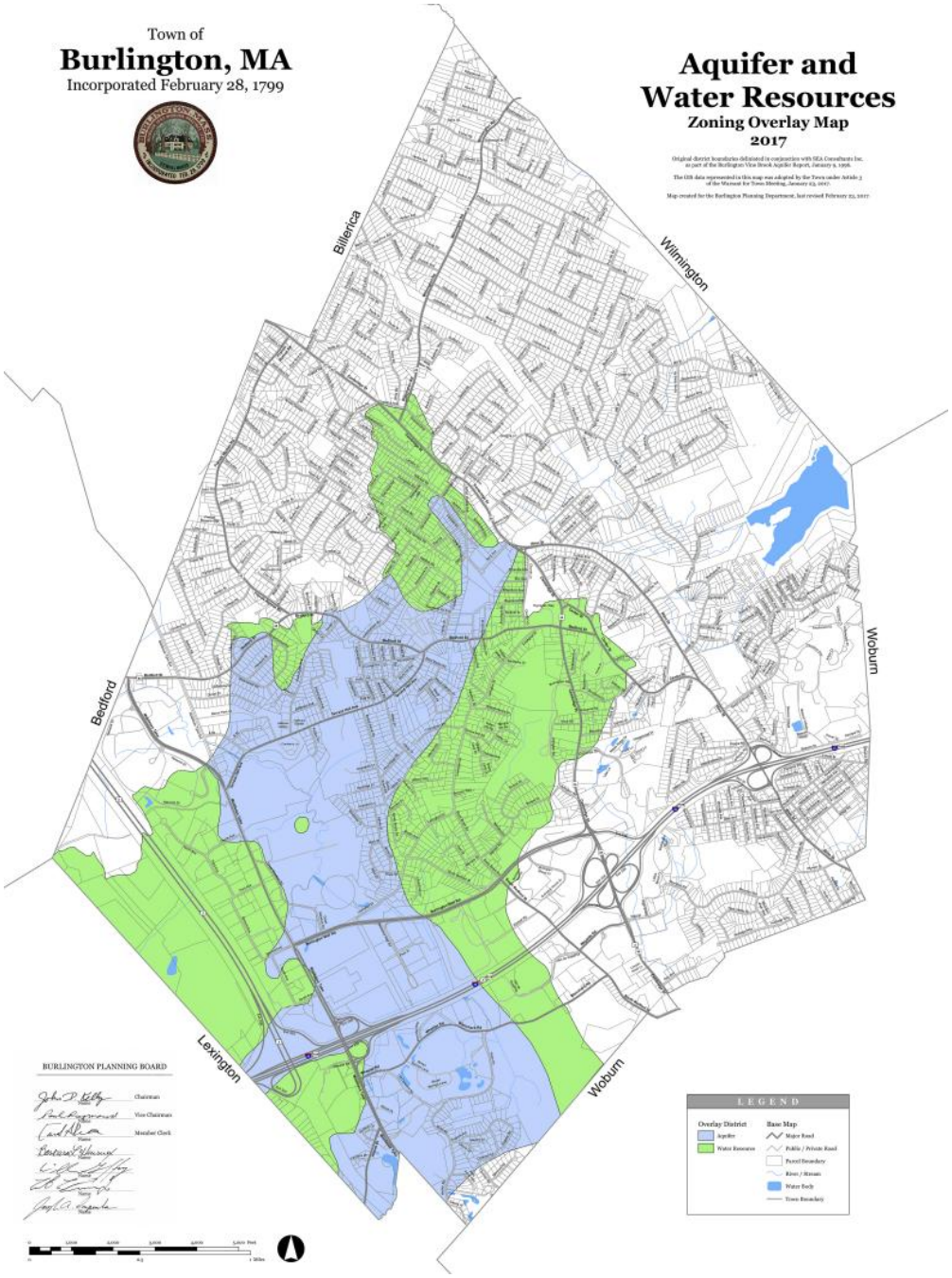


Figure 5.1: Aquifer and Water Resources Zoning Overlay Map

Source: Town of Burlington

Building on Floodplains Permitting Process

Permitting for construction on filled floodplains, which are under the jurisdiction of both the 100 Year Flood Plain District and the Wetlands District, and counts as Bordering Land Subject to Flooding, is carried out by the Building Department and the Conservation Commission. Under the Wetlands

Protection Act and Town Bylaw, filled floodplains must be filled by amounts "incrementally equal to the volume of flood water at each elevation up to and including the 100-year flood," and the fill must have an unrestricted hydraulic connection, not counting flood vents. Enforcement of these zoning specifications and the State Building Code's language on floodplains is carried out by the Town's Building Department.

Rules and Regulations Governing the Subdivision of Land

The Rules and Regulations Governing the Subdivision of Land aim to mitigate flood hazards by requiring additional protection measures for proposed subdivisions in the 100-year floodplain. The regulations require the applicant to identify any portion of the land that is within the 100-year floodplain as well as the base flood elevations associated with the land. The base flood elevation indicates the height the water is expected to rise during the 100-year flood. The applicant must show a proposed building site and demonstrate how that building will be protected from flooding. Additionally, the applicant must provide drainage calculations certified by a registered Professional Engineers that show how the subdivision drainage will accommodate the 100-year flood. These regulations also require that erosion and sediment controls be implemented to prevent detrimental impacts to drainage structures during construction or land disturbance activities.

Role of the Conservation Commission

The Burlington Conservation Commission enforces the Massachusetts Wetlands Protection Act and the Burlington Wetlands Bylaw, which regulates activities in and around wetlands, rivers, streams, floodplains, and other environmentally sensitive areas. The Commission ensures that developments and land-use changes do not negatively impact these resources, preserving water quality, preventing flooding, and protecting wildlife habitats. Additionally, they review and approve permits for activities like construction or land alterations that may affect protected areas, ensuring compliance with local, state, and federal environmental regulations. The Burlington Conservation Commission requires the use of native plant species in proximity to wetlands to ensure the protection of local ecosystems, enhance biodiversity, and support the natural functions of these sensitive areas.

Local Plans

Town of Burlington Master Plan (2023): The Burlington Master Plan is the community's comprehensive planning document that lays out the vision for Burlington in the future. The plan consists of multiple chapters including land use, transportation, housing, economic development, natural and cultural resources, open space and recreation, Town Center, services and facilities, and implementation. Hazard mitigation actions can be further integrated into this plan during its next revision.

Town of Burlington Complete Streets Policy (2018): The Complete Streets Policy aims to make the street network better and safer for drivers, transit users, pedestrians, and bicyclists. Burlington will incorporate Complete Streets principles into new or upgraded transportation projects. Burlington will design, construct, maintain, and operate all streets to provide for a comprehensive and integrated transportation network for people of all ages and abilities. Hazard mitigation activities regarding roadways or rights-of-way should be considered when implementing complete streets projects.

Town of Burlington Open Space and Recreation Plan (2019): This plan aims to properly manage open space in the Town of Burlington in order to achieve a sustainable and healthy community. It provides goals and guidance for land use management and acquisition over the next

seven years. The two largest undeveloped properties in Town, Landlocked Forest and Mary P.C. Cummings Estate (aka Mary Cummings Park), are of particular importance in the Plan. The Plan aims to communicate their incomparable value as open space and ensure their continued protection. The Plan also aims to increase public awareness and use of Conservation and Recreation resources, provide more passive recreation areas, and protect Burlington's water resources. The Plan sets goals to include drought-tolerant and native plantings in recreation facilities, as also set in Burlington's Zoning Bylaw, and to add spray parks and shade to address extreme heat.

Sustainable Burlington Landscape Handbook (not dated): This handbook aims to mitigate climate change and its impacts via sustainable landscaping. Sustainable landscaping can help to mitigate impacts from drought, flooding, winter storms, and extreme heat. These methods can also impact the water supply, water quality, biodiversity, energy consumption, and soil health of an area. This handbook is designed to help citizens create, install, and care for their landscaping in a way that conserves water, takes the changing climate into account, and promotes the health of native species. This handbook allows citizens of Burlington to mitigate hazards at the parcel level.

Vine Brook Watershed Inland Flood and Urban Heat Island Assessment (2022): This Municipal Vulnerability Preparedness Program-funded vulnerability assessment was conducted to identify nature-based solutions to urban flooding and extreme heat faced by vulnerable populations in the Vine Brook Watershed, including the elderly, children, and outdoors maintenance and construction workers. The assessment produced an opportunities matrix, identified nature-based solutions and resilience actions for the Town to move forward with, and provided educational materials for the surrounding community and Town staff.

5.2.2. | Capability Gaps

Based on evaluation with the planning and regulatory capabilities, the following gaps in capabilities are identified and can be incorporated into the mitigation strategy:

- A review of local bylaws & regulations for climate resilience provisions could be completed to enhance the ability to regulate approaches to mitigation the impact of natural hazards on community assets.
- When local plans are updated or developed, HMP Mitigation Actions discussed in Section 1.1 should be integrated and incorporated, for more effective implementation of Mitigation Actions.

5.3. Administrative and Technical Capabilities

Administrative and technical capabilities are the Town's staff, skills and tools, as well as capacity. They also include the ability to access, coordinate and implement natural hazard mitigation resources effectively. Administrative and technical capabilities are "people-powered" capabilities. This category includes other public and private sector resources, such as county, regional, quasi-governmental or nongovernmental agencies, community-based organizations, and grassroots groups.

5.3.1. | Existing Capabilities

Staff Resources

The departments responsible for responding to natural hazards are the Building Department, Department of Public Works, Fire Department, and Police Department, with the Planning Department and the Council on Aging in supportive roles. Following a natural disaster incident, Building Department inspectors are responsible for damage assessment of structures.

Throughout the year, the Planning Department works to implement local plans and enforce zoning bylaws. The Council on Aging operates a cooling center in the summer.

Internal and External Communications

Responsible departments within the Town coordinate with each other to ensure adequate services for natural hazard mitigation. Many of the department heads are new since the last Hazard Mitigation Plan in 2016, meriting a knowledge-sharing session and review of the 2016 and 2025 Hazard Mitigation Plans.

For external communications, the Town currently operates a Reverse 911 notification system for emergency events. When asked about their preferences for how to receive information on hazard mitigation, residents responded with the most interest in email updates from the Town, online fact sheets, and social media posts.

Regional Coordination and Collaboration

The Town pools resources with other municipalities to form an emergency management staff group. Regional agencies who partner with Burlington when responding to natural disasters are Metro Fire, Mystic Regional Emergency Planning Council, Board of Health (Led by Tom Green), Burlington Volunteer Medical Reserve Corporation, and the Massachusetts Emergency Management Agency (MEMA). The Fire Department manages mutual aid agreements to coordinate agencies in addressing natural hazards.

Local Committees and Task Forces

Conservation Commission: The Burlington Conservation Commission is responsible for the administration and enforcement of the Massachusetts Wetlands Protection Act and the associated Burlington Bylaws. The Commission is also responsible for the care and management of over 250 acres of permanently protected open space called Conservation Areas.

Planning Board: The Burlington Planning Board is responsible for making decisions on site plans, site plan waivers, and special permits. They also conduct public hearings and make recommendations to the Town Council regarding applications for changes in zoning districts and for amendments to the text of the Zoning Bylaw. The Board also initiates planning studies to identify existing and future land use issues and problems and proposes courses of action to address such issues and problems.

Recreation Commission: This Commission is responsible for decisions regarding parks and recreation in the Town of Burlington. This includes guiding decisions for open space acquisitions.

Assistance from Non-Governmental Organizations

Burlington does not currently partner with NGOs following natural hazard events.

5.3.2. | Capability Gaps

Based on evaluation of the administrative and technical capabilities, the following gaps in capabilities are identified and can be incorporated into the mitigation strategy:

- The Town could fund the Council of Aging to make their cooling center a permanent fixture.
- Elderly residents could sign up to receive air conditioner installation assistance, either through a volunteer program, Fire, or Police.
- Home checks on vulnerable residents, including the elderly and those who rely on oxygen, should be formalized under the Fire Department. The Council of Aging has a Meals on Wheels list and the Department of Public Works also maintains a list of vulnerable residents.
- The Department of Public Works should investigate the feasibility of culvert projects or constructed wetlands and/or floodable parks on Town property, to mitigate floodwater volumes.
- A local Community Emergency Response Team (CERT) should be developed, as there is interest from residents.

5.4. Financial Capabilities

Financial capabilities comprise the general and capital budgeting for natural hazard mitigation activities the Town has, as well as the methods for acquiring additional funding from state or federal grants.

5.4.1. | Existing Capabilities

Financial resources for natural disasters, including financial oversight and recordkeeping, are handled by the Town Accountant.

The Planning Committee identified the following financial methods as being used in the recent past to fund mitigation activities:

- MassWorks Infrastructure Grant Program
- Massachusetts Municipal Vulnerability Preparedness (MVP) Program
- American Rescue Plan Act (ARPA)
- Housing Choice Grant Program
- Funding through Town Meeting

5.4.2. | Capability Gaps

Based on evaluation of the financial capabilities, the following gaps in capabilities are identified and can be incorporated into the mitigation strategy:

- The Town does not have a dedicated fund for mitigation projects, which limits its ability to finance smaller-scale mitigation efforts without external funding.

- The Town relies heavily on state and federal grants, such as those from FEMA, for funding mitigation. This dependency makes long-term financial planning for mitigation uncertain, especially if these funding sources are reduced or eliminated.
- The Town has not yet joined FEMA's CRS program, which could provide flood insurance discounts for residents and encourage better floodplain management.

5.5. Education and Outreach

Education and outreach to the community are vital components of both preparedness and response. These capabilities are programs and methods that can communicate about and encourage risk reduction. These capabilities may be run by the Town or a community-based partner.

5.5.1. | Existing Capabilities

The Town runs a Reverse 911 public notification system for emergency events. As reported under the Administrative and Technical Capabilities section, residents in a public survey who were asked about their preferred outreach method on natural hazards responded with the most interest in email updates from the Town, online fact sheets, and social media posts.

The outcome of the Vine Brook Watershed Inland Flood and Urban Heat Island Assessment also included infographics for the public on inland flooding and extreme heat impacts, a StoryMap explaining nature-based solutions, an online mapping tool of the watershed, and two feature stories on the project with Burlington Cable Access TV.

The Burlington Conservation Commission provides valuable educational resources, including a dedicated section on its website offering tips on resilient and native plant species, recommendations for where to purchase them, and actively engages the community through its social media platforms to promote environmental stewardship.

5.5.2. | Capability Gaps

Based on evaluation of the financial capabilities, the following gaps in capabilities are identified and can be incorporated into the mitigation strategy:

- The Town offers a phone check program, but no residents have signed up, meaning more advertisement is necessary.
- Residents have asked for more educational materials on homeowner flood protection measures they can use to protect their homes.
- When considering property damage assistance, renters should be considered more significantly, not just homeowners.
- Unhoused residents of Burlington need shelter and support during natural hazards and should be made aware that cooling centers are available to them.
- The Town should increase awareness of what resources are available to residents before natural hazards occur.

6

6. Mitigation Actions

Mitigation actions are one of the most important components of the Hazard Mitigation Plan. They serve as the blueprint for reducing the potential losses identified in the risk and vulnerability assessments. They can be a measure, project, plan, or activity proposed to achieve the Town's mission and goals and reduce current and future vulnerabilities described in the risk assessment (Chapter 4).

Many different types of hazard mitigation actions generally fall into the following four categories (FEMA, Local Mitigation Planning Handbook, 2023):

Local Plans and Regulations: These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.

Structure and Infrastructure Projects: These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazardous area. This could apply to public or private structures as well as critical facilities and infrastructure.

Natural Systems Protection and Nature-based Solutions: This type of action can include green infrastructure and low-impact development, nature-based solutions, Engineering with Nature, and bioengineering to incorporate natural features or processes into the built environment.

Education and Awareness Programs: These types of actions keep residents informed about potential natural disasters. Many of these types of actions are eligible for funding through the FEMA HMA program.

Through the stakeholder and community engagement process discussed in Chapter 2, mitigation actions and an action plan for implementation were developed to help achieve the mitigation goals. This provides a framework to prioritize and implement actions to reduce risks from hazards. Chapter 6 reviews the mitigation actions created in 2016 and outlines mitigation actions for Burlington for the next five years.

6.1. Status of 2016 HMP Mitigation Actions

Town staff reviewed the mitigation measures identified in the 2016 HMP and determined whether measures identified in that plan had been implemented or deferred. For implemented projects, they were categorized as either complete or in progress, with the latter referring to projects that were still under development or had begun but had not yet been completed. If measures had been deferred, the Core Team evaluated whether the measure should be deleted or carried forward into this 2025 HMP Update. The decision on whether to delete or retain a particular measure was based on the Planning Committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the town to take action on the measure. Table 6.1 lists all mitigation actions from the 2016 HMP and their current status.

Table 6.1 2016 HMP Mitigation Actions and 2025 Status

Action #	Description	Priority	Status	Retain?	Rationale
1	Install stormwater management devices at Sandy Brook Road	High	Completed	Revise	Revise to address cleaning and high-water table
2	Acquire land along Sandy Brook	Medium	Not complete	Retain	
3	Implement Stream Cleaning and Drainage Repair under CIP	High	Ongoing	Retain	
4	Public Education on Wind mitigation, residents/businesses	Medium	Ongoing	Retain	
5	Increase brush fire risk awareness by offering GIS hazard mapping online for Burlington residents and interested parties.	Medium	Not completed	Retain	May want to use 2017's plan's GIS need to confirm accuracy and explore other MEMA data
6	Organize fire department tours to show town officials and residents the most vulnerable areas for brushfires and increase their knowledge of the risks.	Medium	Not completed	Revise	Reframe action to be more general/social media
7	Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.	Low	Not completed	Retain	

Action #	Description	Priority	Status	Retain?	Rationale
8	Assist vulnerable populations by identifying specific at-risk populations that may be exceptionally vulnerable during long term power outages.	Medium	In progress	Retain	
9	Determine which buildings may be most vulnerable to earthquake damage and conduct a structural assessment if needed.	Low	Not completed	Retain	
10	Assess the vulnerability of roadways and utilities in high liquefaction susceptibility areas	Low	Not completed	Retain	
11	Update the Emergency Action Plan for the Mill Pond Reservoir Dam spillway area every two years	High	Complete	Retain	
12	Site Design to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways.	Medium	In progress	Retain	
13	Promote Green Building and Cool Roof designs	Medium	In progress	Retain	
14	Assess placement of cooling centers at schools, senior center and emergency shelters.	High	In progress	Revise	Shift to regulatory updates needed
15	Promote drought tolerant landscaping and site design measures	Medium	Partially complete	Retain	Conservation Commission requires native species
16	Incorporate climate resilience/adaptation components into the next Comprehensive Plan	High	Not completed	Retain	When next amendment to comp plan happens, work to integrate

6.2. Mitigation Action and Adaptation Strategy for 2025-2029

The Steering Committee developed an updated mitigation action and adaptation strategy for this HMP Update. The actions were developed from a multi-faceted approach, including the following:

- The goals and objectives endorsed by the Steering Committee; more detail about this is available in Chapter 1.
- Input from stakeholders and the community through public meetings and survey input; more detail about this is available in Chapter 2.
- Identified community assets, described in Chapter 3.
- A hazard and climate change risk and vulnerability assessment; more detail about this is available in Chapter 4.
- The Town's capacity to mitigate and respond to hazard events as described in Chapter 5.
- The progress of actions from the 2016 HMP; more detail about this is available in Chapter 6.
- Actions included in related town plans and reports.

6.2.1. | Prioritization of Potential Actions

The LHMC used the STAPLEE system to assist in prioritizing certain actions over others. Each of the STAPLEE criteria (as shown in Table 6.2) were assigned a score from 1-3 (as shown in Table 6.3). This process and the scoring rubric are presented below.

Table 6.2: STAPLEE Criteria

Letter	Criteria	Details
S	Social	Does the measure treat people fairly? Does it adversely affect one segment of the population? Will it cause Social Disruption?
T	Technical	Will it work? Does it create more problems than it solves? Is it the most useful action in light of the goals?
A	Administrative	Is there capacity to implement and manage the project? (staff, technical experts, funding) Is there an ongoing administrative requirement that will be required (who will maintain)?
P	Political	Is there political support to implement and maintain the action? Who are the stakeholders? Did they get to participate? Is there public support to implement and maintain the action?
L	Legal	Does your organization have the authority to implement? Is there a clear and legal basis or precedent for the activity? Are there liability implications and/or legal consequences?

Letter	Criteria	Details
E	Economic	Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?
E	Environmental	Does it comply with environmental regulations or have adverse environmental impacts?

Table 6.3 STAPLEE Scoring Rubric

Scoring Rubric	Score
Very Favorable / High Priority	3
Neutral	2
Not Favorable	1

After each action item was scored for each criterion, the score of all criteria was summed, to give a total STAPLEE score. These were then divided into low (7-16), medium (17-18) and high (19-21) priorities by score. The prioritized list of Burlington's 2025 - 2029 Mitigation Actions, with STAPLEE scoring is available in Appendix C.

For each mitigation action considered to be part of the 5-year plan, the following characteristics were defined such that the Town is able to tie the actions to the risk assessment and mitigation goals, define who is responsible for implementing/ administering the identified mitigation action, understand general cost and benefit of an action, understand available funding source(s), determine the expected timeframe for the action, and confirm consistency with and integration into other local plans.

Generally, each action item is provided with the following information:

2025 Action #: Action number for 2025 HMP for quick reference.

2017 Action #: Action number from 2017 HMP for quick reference.

Action Description: Brief narrative describing the action.

Goals Addressed: This column lists which goals the mitigation action aims to accomplish. Some actions contribute toward more than one goal. The goals are listed in Section 1.5

Hazards/Risks Addressed: Actions may mitigate a single or multiple hazards, which will be indicated for each action. All the hazards discussed in Chapter 4 were addressed when developing the priority list, and there is at least one action associated with each hazard. Some actions address all hazards and are listed as such.

Overall Priority: This column shows the ranking based on the process described in Section 6.2.1.

Responsible Party: Many hazard mitigation actions and climate adaptation measures will require a multi-department strategy where several departments share responsibility. The designation of implementation responsibility is assigned to the Town staff based on the responsibility of each department.

Partner Agencies: Some mitigation actions may require cooperation with outside entities, such as Rhode Island state departments, neighboring communities, regional organizations, or private entities. In those cases, the relevant entities are included in additional to the town department.

Potential Funding Source: The Town's general funds are considered a default potential funding source unless the Town pursues additional funding. The identification of potential funding sources is preliminary and may vary depending on numerous factors. These factors include, but are not limited to, changes in grant eligibility criteria, program objectives, and funding availability. The funding sources identified do not guarantee that a specific project will be eligible for, or receive, funding. Upon adoption of this plan, the local representatives responsible for implementation should begin to explore potential funding sources in more detail. Potential grants were assigned based on eligibility and competitiveness, but the recommendations may not be comprehensive. Please note that grant eligibility and scoring criteria should also be reviewed prior to applying. Grants may also only be a source of funding for a single stage of a project. In many cases, the actions will require a combination of funding sources.

Timeframe: This column indicates the estimated timeline for completing the mitigation action.

Integration Opportunity into Local Plans: For successful implementation of mitigation actions, they must be incorporated into local plans. This column indicates where mitigation actions may be integrated into another local plan or planning mechanism.

The mitigation strategy, or action plan, is the heart of the plan and the primary tool to get funding, assign priorities, guide decisions, and track progress in future updates. Actions are listed in Table 6.4. Acronyms used in Table 6.4 are listed below:

HMGP – Hazard Mitigation Grant Program

DCR – Department of Conservation and Recreation

DPW – Department of Public Works

MVP – Municipal Vulnerability Program

CIP – Capital Improvement Program

DLTA RPA - District Local Technical Assistance through the Regional Planning Agency

Table 6.4 Burlington's 2025 – 2029 Detailed Mitigation Actions

2025 ACTION #	2016 ACTION #	Description of Strategy	Hazards	Goals Addressed	Overall Priority	Partner Agency	Responsible Town Staff	Potential Funding Source	Timeframe to Complete	Local Plan
1		Investigate the locations reported in the public survey (Cambridge St, Harriett Ave, Fox Hill, Sandy Brook, Long Meadow Brook)	Changes in Groundwater	1, 6, 7, 10	Medium	None Anticipated	DPW	MVP	5 years	N/A
2	11	Update the Emergency Action Plan for the Mill Pond Reservoir Dam spillway area every two years. Investigate the risk of overtopping with climate change.	Dam Mitigation	1, 4, 6, 7	High	DCR	DPW	FEMA HMGP	5 years	Emergency Action Plan (EAP)
3		Determine where drought has created the highest likelihoods of brushfires starting, using public feedback including the public survey from this Update, to target drought-tolerant landscaping especially in private residential lots	Drought; Wildfires	1, 4, 6, 10	Medium	MA DCR	Fire Department	MA DCR, MVP	1 year	N/A
4	9	Determine which buildings may be most vulnerable to earthquake damage and conduct a structural assessment if needed.	Earthquake	1, 3	Low	MEMA	DPW	FEMA HMGO	1 year	Emergency Action Plan (EAP)
5	10	Assess the vulnerability of roadways and utilities in high liquefaction susceptibility areas	Earthquake	1, 6	Medium	None Anticipated	DPW	CIP funds,	5 years	Emergency Action Plan (EAP)

2025 ACTION #	2016 ACTION #	Description of Strategy	Hazards	Goals Addressed	Overall Priority	Partner Agency	Responsible Town Staff	Potential Funding Source	Timeframe to Complete	Local Plan
6	12	Site Design to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways. Increase tree plantings or shade structures in the Burlington Mall complex and Market Basket shopping complex. Increase tree plantings in urban heat islands with socially vulnerable residents.	Extreme Temperature	1, 4, 6, 10	Medium	DCR	Conservation, Planning Department	MA Urban and Community Forestry Challenge Grants	1 year	Open Space and Recreation Plan (OSRP)
7	13	Promote Green Buildings and Cool Roof designs	Extreme Temperature	1, 6, 10	Low	None Anticipated	Planning Department	Local operating funds	1 year	N/A
8	14	Make regulatory updates to allow for new petroleum generators (which will enable additional shelters) at public buildings	Extreme Temperature	1, 3, 6	High	None Anticipated	Planning Department	Department operating funds	Less than a year	Emergency Operations Plan (EOP)
9		Analyze urban heat islands with social vulnerability in Burlington to prioritize location of future cooling centers and location of greener site design projects/retrofits	Extreme Temperature	1, 4, 6, 10	Medium	None Anticipated	Planning Department	DLTA RPA	5 years	MVP Plan

2025 ACTION #	2016 ACTION #	Description of Strategy	Hazards	Goals Addressed	Overall Priority	Partner Agency	Responsible Town Staff	Potential Funding Source	Timeframe to Complete	Local Plan
10	16	Incorporate climate resilience/adaptation components into the next amendment to Comprehensive Plan	Extreme Temperatures, Drought, Changes in Groundwater, Hurricanes, Invasive Species, Tornadoes, Wildfires, Winter Storms	1, 4, 6, 10	High	None Anticipated	Planning Department	MVP program, DLTA RPA grants, MVP, PAG	1 year	Comprehensive Plan
11		Seek funding for Climate Action / Sustainability plan	Extreme Temperatures, Drought, Changes in Groundwater, Hurricanes, Invasive Species, Tornadoes, Wildfires, Winter Storms	1, 6, 10	High	None Anticipated	Planning Department, Conservation	MVP program, DLTA RPA grants, MVP, PAG	2 years	Comprehensive Plan
12	1	Continue to monitor flooding around Sandy Brook Road	Flooding from Precipitation	1, 6	High	MassDEP	Conservation Commission Staff, Fire Department	Town operating funds	2 years	MVP Plan

2025 ACTION #	2016 ACTION #	Description of Strategy	Hazards	Goals Addressed	Overall Priority	Partner Agency	Responsible Town Staff	Potential Funding Source	Timeframe to Complete	Local Plan
13	2	Acquire land along Sandy Brook	Flooding from Precipitation	1, 4, 6, 7	Low	None Anticipated	Conservation Commission Staff	MA LAND Grant Program, MVP, HMGP	2 years	Open Space and Recreation Plan (OSRP)
14	3	Implement Stream Cleaning and Drainage Repair under CIP	Flooding from Precipitation	1, 6, 10	High	None Anticipated		CIP, MVP, MA Clean Water State Revolving Fund (CWSRF)	2 years	
15		Provide homeowner and renter flood protection educational resources via Town-wide emails and online factsheets	Flooding from Precipitation	2, 4	High	None Anticipated		Town funds via staff time	2 years	
16		Determine where invasive species plant growth is occurring and deploy the Department of Public Works to cut them down and replace with native species	Invasive Species	1, 6, 10	Medium	None Anticipated	Conservation Dept, DPW	MVP, Town Funds	2 years	OSRP
17		Determine where mudflows have been reported and are projected to occur due to heavy storms and precipitation; reinforce areas and communicate to nearby residents on how to protect their homes	Landslides/ Mudflows	1, 4, 6	Medium	None Anticipated	Fire Department	Local funds	5 years	
18	5	Increase brush fire risk awareness by adding links to wildfire resources like the MassGIS wildfire dashboard of USDA Risk to Communities Dashboard to the Town website.	Wildfires	1, 2, 4	Medium	DCR	Fire Department	FEMA's Fire Prevention & Safety Grants, MVP	1 year	

2025 ACTION #	2016 ACTION #	Description of Strategy	Hazards	Goals Addressed	Overall Priority	Partner Agency	Responsible Town Staff	Potential Funding Source	Timeframe to Complete	Local Plan
19	6	Utilize social media and in-person events to educate residents about the most vulnerable areas for brushfires and increase their knowledge of the risks.	Wildfires	1, 2, 4	High	None Anticipated	Fire Department	FEMA's Fire Prevention & Safety Grants, MVP	1 year	
20		Increase community education about creation of defensible spaces around properties by clearing vegetation and using fire-resistant materials.	Wildfires	1, 2, 4	Medium	None Anticipated	Fire Department	Town Funds	1 year	N/A
21	7	Evaluate public buildings for the ability to withstand snow loads; retrofit if needed to the greatest degree feasible.	Winter Storm	1, 3	Low	None Anticipated	DPW	Town funds	1 year	Capital Improvement Plan (CIP)
22	8	Assist vulnerable populations by identifying specific at-risk populations that may be exceptionally vulnerable during long-term power outages.	Winter Storm	1, 4, 6, 10	High	Local Council on Aging	Police Department, Planning Department	Town Funds, MVP Program	5 years	Emergency Operations Plan (EOP)

7

7. Plan Maintenance

Hazard Mitigation Plans are intended to serve as living documents. In order to be impactful, they must be regularly updated to reflect the current state of hazards, vulnerabilities, goals, strategies, and public sentiment. The three main components of plan maintenance are: *monitoring*, *evaluating*, and *updating* the plan.

Included in this chapter is a multi-pronged strategy to always keep the HMP as effective as possible. Monitoring, evaluating, and updating the plan will be intertwined with public engagement, integration with other local, regional, and state planning mechanisms, and plan implementation. These processes will run on an ongoing basis with the expectation there is coordination and collaboration between monitoring, evaluating, and updating the plan.

The Fire Chief will:

- Track the progress of the HMP Mitigation Actions (see Section 7.1);
- Reconvene the Planning Committee annually to monitor, evaluate, update, and integrate the plan (see Section 7.1, 7.2, 7.3, and 7.4);
- Share HMP progress with the public, at least once a year (see Section 7.5);
- Make all monitoring information publicly available (see Section 7.1);
- Notify the public when new information has been posted or updated (see Section 7.5; and
- Provide the public with opportunities to give input on this information (see Section 7.5).

7.1. Monitoring the Plan

According to FEMA, monitoring means tracking the implementation of the HMP over time.

Who: The Fire Chief will take ownership of monitoring the plan.
How: The Fire Chief will monitor the status of mitigation actions (Chapter 6) through an internal tracking system using Excel. This should be made publicly available.

When: Monitoring will take place on an ongoing basis with an annual discussion at a Development Coordination Meeting (DCM) to formally update the status of Mitigation Actions. In advance of this meeting, the Fire Chief will send out notices to the Planning Committee that will include a shared document where all Planning Committee members can collaborate to review the status of mitigation actions and identify any new mitigation actions that may be under consideration or in progress as part of ongoing Town efforts.

7.2. Evaluating the Plan

According to FEMA, evaluating means assessing the effectiveness of the plan at achieving its stated purpose and goals.

Who and When: The Planning Committee will meet annually at a Development Coordination Meeting (DCM) to evaluate the effectiveness of the plan. The Planning Committee may also be called to meet after a major event or storm to evaluate the effectiveness of the plan.

How: The Planning Committee will:

- Review the 2025 HMP Goals; and
- Discuss how mitigation actions are or are not meeting 2025 HMP Goals and where improvements or adjustments may be needed (e.g., re-prioritization of projects, integrating with other planning processes more effectively, adding new data to climate projections, etc.)

7.3. Updating the Plan

The following discusses plan updates under three circumstances:

- Maintaining eligibility with FEMA
- Major disasters

7.3.1. | Plan Updates to Maintain FEMA Funding Eligibility

According to FEMA, updating means reviewing and revising the HMP at least once every five years.

Hazard Mitigation Plans expire five years from the date approved by FEMA. To maintain eligibility for certain types of non-emergency disaster assistance from FEMA, an entity such as the Town of Burlington must have an approved active Hazard Mitigation Plan.

Hazard Mitigation Plans must be reviewed and updated at least every five years. The Fire Chief will initiate the process to complete a comprehensive update to the HMP. As a best practice, the comprehensive update should be initiated approximately 18 months prior to this HMP's expiration. This process generally includes:

- Re-engaging the Planning Committee;
- Considering expansion of the Planning Committee;
- Confirming FEMA's and MEMA's most recent requirements and guidance;

- Gathering updated information and relevant documents;
- Defining a list of stakeholders (such as the Stakeholders discussed in Chapter 2);
- Initiating an outreach and engagement process;
- Undertaking the planning steps to prepare required Hazard Mitigation Plan sections; and
- Completing and reviewing the draft Plan and submitting for approval.

The Town may elect to complete this process in-house or with guidance from an outside contractor.

7.3.2. | Plan Updates Due to Major Disaster Events or New Conditions

FEMA recommends that HMPs also be revisited and updated after a major disaster event (a State or federally declared disaster) or if new conditions significantly change risk (such as new climate projections or local risk and vulnerability assessment efforts). The Fire Chief will initiate the process to complete any updates needed in these circumstances. The decision to update the plan will be based on the annual monitoring and evaluation process.

7.4. Integrating the HMP

To be impactful, the HMP must be effectively integrated into other Town planning mechanisms. This will increase co-benefits of hazard mitigation projects, streamline planning and implementation activities, and help secure funding for mitigation projects.

Integrating the ideas, information, and strategy of a mitigation plan into other planning mechanisms can be achieved through plan integration. Plan integration involves a two-way exchange of information and the incorporation of ideas and concepts between hazard mitigation plans and other planning mechanisms. Some ways Burlington can integrate the ideas, information, and strategy of a mitigation plan into other planning mechanisms are:

Building and Zoning Regulations: The local hazard mitigation plan can integrate with building and zoning regulations to ensure that new construction and development are designed to withstand potential hazards.

Community Plans: Community planning mechanisms can be integrated into hazard mitigation plans to ensure that community needs and concerns are considered when developing hazard mitigation strategies.

Emergency Management Plan: The local hazard mitigation plan can integrate with the emergency management plan to ensure that hazard mitigation strategies are coordinated with emergency response efforts.

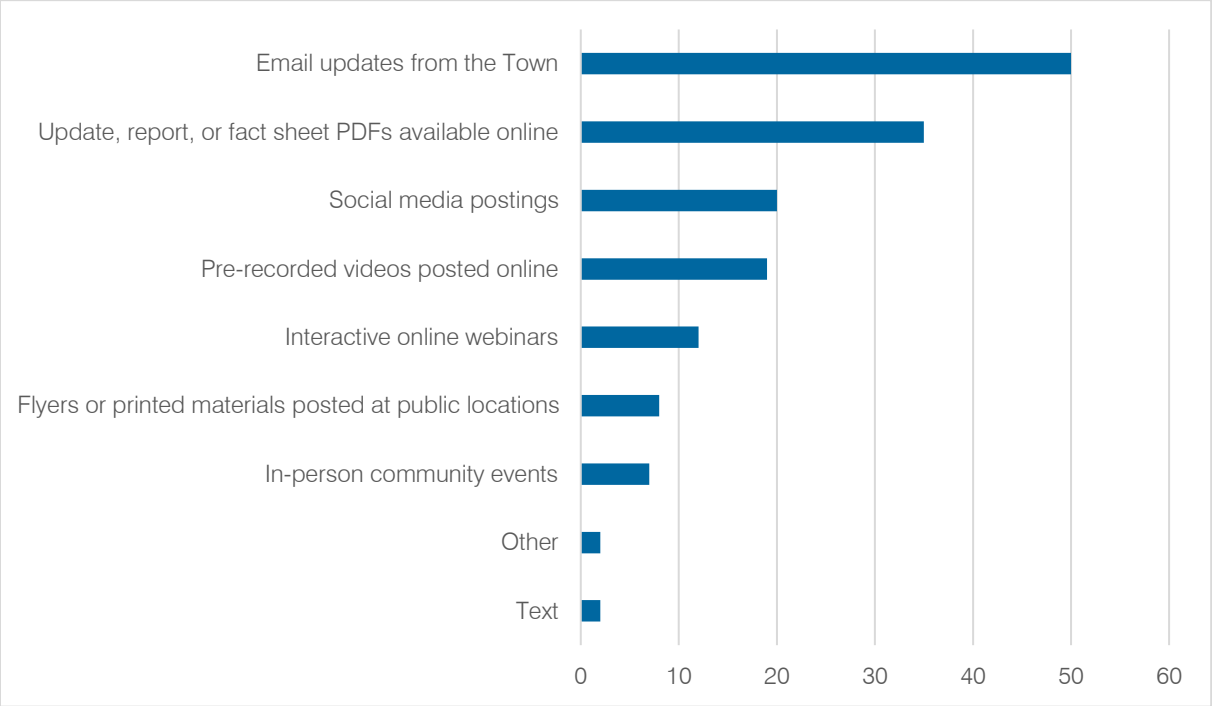
Partnerships: Developing strong partnerships between planners and emergency managers can help to integrate land use and hazard planning efforts

Integration will be a topic of discussion at each annual update meeting. HMP goals and mitigation actions will be integrated into other Town planning mechanisms. At each annual Planning

Committee meeting, there will be an update on the progress of the integration of mitigation actions into relevant planning mechanisms and a discussion of other planning mechanisms that should be integrated into the next five-year HMP update.

7.5. Public Participation throughout Plan Maintenance

Public engagement is a critical part of the plan maintenance process. Public input, education, and support are crucial to ensuring that the plan is effective, equitable, and impactful. These efforts will be coordinated by the Fire Chief and the Town's Conservation Administrator, working with the Local Hazard Mitigation Committee. The public survey indicated that residents would like to be informed about hazard mitigation in Burlington via emails from the Town, fact sheets on the Town website, or social media.



The Town is committed to developing equitable and impactful public participation. This means that greater attention will be paid to those who are most vulnerable to hazards and who do not have as many pathways for making their needs and opinions heard. The following steps will be taken to ensure that the HMP and its maintenance will be equitable:

Population: Priority populations will be considered as a priority for outreach and engagement. For this process, the Town identified its seniors as a priority for outreach.

Actions: Findings will be incorporated into the implementation, monitoring, evaluation, updating of the plan, and integration with other planning processes. The Fire Chief will be

responsible for incorporating this information with support from the Local Hazard Mitigation Committee.

Public engagement activities will align with the annual evaluation, monitoring, and plan update meetings as well as with large storms or events.

8


(Rycroft)

8. Adoption

Once the draft of the Burlington Hazard Mitigation Plan is reviewed by the Planning Committee, Stakeholders, and the public, the Plan is reviewed by MEMA and FEMA. When the Plan is finally approved by FEMA, it enters the five-year "maintenance" phase.

This Section describes the timeline for plan adoption and includes documentation of the Plan adoption by the Town Council.

8.1. Plan Adoption

The Certificate of Adoption is provided on the following page:

TOWN OF BURLINGTON, MASSACHUSETTS
RESOLUTION NO. _____

A RESOLUTION OF THE TOWN OF BURLINGTON ADOPTING THE 2025 HAZARD MITIGATION PLAN UPDATE

WHEREAS the Select Board recognizes the threat that natural hazards pose to people and property within the Town of Burlington; and

WHEREAS the Town of Burlington has prepared a multi-hazard mitigation plan, hereby known as the Town of Burlington 2025 Hazard Mitigation Plan Update, in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS the Town of Burlington 2025 Hazard Mitigation Plan Update identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Town of Burlington from the impacts of future hazards and disasters; and

WHEREAS the Select Board authorizes Departments to execute their responsibilities demonstrated in the 2025 Hazard Mitigation Plan Update; and

WHEREAS adoption by the Select Board demonstrates its commitment to hazard mitigation and achieving the goals outlined in the Town of Burlington 2025 Hazard Mitigation Plan Update: now therefore be it

Resolved: That in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Burlington, the Select Board adopts the Town of Burlington 2025 Hazard Mitigation Plan Update. While content related to the Town of Burlington may require revisions to meet the plan approval requirements, changes occurring after adoption will not require the Town of Burlington to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

ADOPTED by a vote of ___ in favor and ____ against, and ____ abstaining, this _____ day of _____, 2025.

By: _____ (print name)

ATTEST: By: _____ (print name)
APPROVED AS TO FORM: By: _____(print name

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Appendix A. FEMA Review Tool

Local Mitigation Plan Review Tool

Cover Page

The Local Mitigation Plan Review Tool (PRT) demonstrates how the local mitigation plan meets the regulation in 44 CFR § 201.6 and offers states and FEMA Mitigation Planners an opportunity to provide feedback to the local governments, including special districts.

1. The Multi-Jurisdictional Summary Sheet is a worksheet that is used to document how each jurisdiction met the requirements of the plan elements (Planning Process; Risk Assessment; Mitigation Strategy; Plan Maintenance; Plan Update; and Plan Adoption).
2. The Plan Review Checklist summarizes FEMA's evaluation of whether the plan has addressed all requirements.

For greater clarification of the elements in the Plan Review Checklist, please see Section 4 of this guide. Definitions of the terms and phrases used in the PRT can be found in Appendix E of this guide.

Plan Information	
Jurisdiction(s)	
Title of Plan	Burlington Hazard Mitigation Plan
New Plan or Update	Update
Single- or Multi-Jurisdiction	Single-jurisdiction
Date of Plan	11/1/2025
Local Point of Contact	
Title	Town Planner
Agency	Town of Burlington
Address	29 Center Street
Phone Number	781-270-1647
Email	ebonventre@burlington.org

Additional Point of Contact	
Title	Fire Chief
Agency	Town of Bulington
Address	29 Center Street
Phone Number	781-270-1647
Email	aconnerty @burlington.org

Review Information	
State Review	
State Reviewer(s) and Title	Click or tap here to enter text.
State Review Date	Click or tap to enter a date.
FEMA Review	
FEMA Reviewer(s) and Title	Click or tap here to enter text.
Date Received in FEMA Region	Click or tap to enter a date.
Plan Not Approved	Click or tap to enter a date.
Plan Approvable Pending Adoption	Click or tap to enter a date.
Plan Approved	Click or tap to enter a date.

Multi-Jurisdictional Summary Sheet

#	Jurisdiction Name	Requirements Met (Y/N)						
		A. Planning Process	B. Risk Assessment	C. Mitigation Strategy	D. Plan Maintenance	E. Plan Update	F. Plan Adoption	G. State Requirements
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Plan Review Checklist

The Plan Review Checklist is completed by FEMA. States and local governments are encouraged, but not required, to use the PRT as a checklist to ensure all requirements have been met prior to submitting the plan for review and approval. The purpose of the checklist is to identify the location of relevant or applicable content in the plan by element/sub-element and to determine if each requirement has been "met" or "not met." FEMA completes the "required revisions" summary at the bottom of each element to clearly explain the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is "not met." Sub-elements in each summary should be referenced using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each element and sub-element are described in detail in Section 4: Local Plan Requirements of this guide.

Plan updates must include information from the current planning process.

If some elements of the plan do not require an update, due to minimal or no changes between updates, the plan must document the reasons for that.

Multi-jurisdictional elements must cover information unique to all participating jurisdictions.

Element A: Planning Process

Element A Requirements	Location in Plan (section and/or page number)	Met / Not Met
A1. Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement 44 CFR § 201.6(c)(1))		
A1-a. Does the plan document how the plan was prepared, including the schedule or time frame and activities that made up the plan's development, as well as who was involved?	Chapter 2.0 Section 2.1, 2.2, 2.3 Tables 2.1 HMP Planning Timeline, 2.2 Steering Committee Members, 2.3 Steering Committee Schedule, 2.4 LHMC, 2.5 LHMC Schedule	Choose an item.
A1-b. Does the plan list the jurisdiction(s) participating in the plan that seek approval, and describe how they participated in the planning process?	Chapter 1. Introduction Chapter 2. Planning Process	Choose an item.

Element A Requirements	Location in Plan (section and/or page number)	Met / Not Met
A2. Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development as well as businesses, academia, and other private and non-profit interests to be involved in the planning process? (Requirement 44 CFR § 201.6(b)(2))		
A2-a. Does the plan identify all stakeholders involved or given an opportunity to be involved in the planning process, and how each stakeholder was presented with this opportunity?	Section 2.2 Engagement and Outreach	Choose an item.
A3. Does the plan document how the public was involved in the planning process during the drafting stage and prior to plan approval? (Requirement 44 CFR § 201.6(b)(1))		
A3-a. Does the plan document how the public was given the opportunity to be involved in the planning process and how their feedback was included in the plan?	Section 2.2 Engagement and Outreach Appendix B Survey Responses	Choose an item.
A4. Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement 44 CFR § 201.6(b)(3))		
A4-a. Does the plan document what existing plans, studies, reports and technical information were reviewed for the development of the plan, as well as how they were incorporated into the document?	Section 2.3 Review of Existing Plans	Choose an item.
ELEMENT A REQUIRED REVISIONS		
Required Revision: Click or tap here to enter text.		

Element B: Risk Assessment

Element B Requirements	Location in Plan (section and/or page number)	Met / Not Met
B1. Does the plan include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction? Does the plan also include information on previous occurrences of hazard events and on the probability of future hazard events? (Requirement 44 CFR § 201.6(c)(2)(i))		
B1-a. Does the plan describe all natural hazards that can affect the jurisdiction(s) in the planning area, and does it provide the rationale if omitting any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area?	Chapter 4, Sections 4.1 -4.15	Choose an item.
B1-b. Does the plan include information on the location of each identified hazard?	Chapter 4, Sections 4.1 -4.15	Choose an item.
B1-c. Does the plan describe the extent for each identified hazard?	Chapter 4, Sections 4.1 -4.15	Choose an item.
B1-d. Does the plan include the history of previous hazard events for each identified hazard?	Chapter 4, Sections 4.1 -4.15	Choose an item.
B1-e. Does the plan include the probability of future events for each identified hazard? Does the plan describe the effects of future conditions, including climate change (e.g., long-term weather patterns, average temperature and sea levels), on the type, location and range of anticipated intensities of identified hazards?	Chapter 4, Sections 4.1 -4.15	Choose an item.
B1-f. For participating jurisdictions in a multi-jurisdictional plan, does the plan describe any hazards that are unique to and/or vary from those affecting the overall planning area?	Not applicable	Choose an item.
B2. Does the plan include a summary of the jurisdiction's vulnerability and the impacts on the community from the identified hazards? Does this summary also address NFIP-insured structures that have been repetitively damaged by floods? (Requirement 44 CFR § 201.6(c)(2)(ii))		
B2-a. Does the plan provide an overall summary of each jurisdiction's vulnerability to the identified hazards?	Chapter 4 Section 4.15	Choose an item.
B2-b. For each participating jurisdiction, does the plan describe the potential impacts of each of the identified hazards on each participating jurisdiction?	Chapter 4, Sections 4.1 -4.15	Choose an item.

Element B Requirements	Location in Plan (section and/or page number)	Met / Not Met
B2-c. Does the plan address NFIP-insured structures within each jurisdiction that have been repetitively damaged by floods?	Chapter 5, Section 5.1	Choose an item.
ELEMENT B REQUIRED REVISIONS		
Required Revision: Click or tap here to enter text.		

Element C: Mitigation Strategy

Element C Requirements	Location in Plan (section and/or page number)	Met / Not Met
C1. Does the plan document each participant's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement 44 CFR § 201.6(c)(3))		
C1-a. Does the plan describe how the existing capabilities of each participant are available to support the mitigation strategy? Does this include a discussion of the existing building codes and land use and development ordinances or regulations?	Chapter 5 Community Capabilities	Choose an item.
C1-b. Does the plan describe each participant's ability to expand and improve the identified capabilities to achieve mitigation?	Chapter 5, Chapter 6, Section 7.2	Choose an item.
C2. Does the plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement 44 CFR § 201.6(c)(3)(ii))		
C2-a. Does the plan contain a narrative description or a table/list of their participation activities?	Section 5.1 NFIP Flood Insurance Program Compliance	Choose an item.
C3. Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement 44 CFR § 201.6(c)(3)(i))		
C3-a. Does the plan include goals to reduce the risk from the hazards identified in the plan?	Section 1.3	Choose an item.

Element C Requirements	Location in Plan (section and/or page number)	Met / Not Met
C4. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement 44 CFR § 201.6(c)(3)(ii))		
C4-a. Does the plan include an analysis of a comprehensive range of actions/projects that each jurisdiction considered to reduce the impacts of hazards identified in the risk assessment?	Section 6.2 Mitigation Action and Adaptation Strategy for 2025-2029	Choose an item.
C4-b. Does the plan include one or more action(s) per jurisdiction for each of the hazards as identified within the plan's risk assessment?	Section 6.2 Mitigation Action and Adaptation Strategy for 2025-2029	Choose an item.
C5. Does the plan contain an action plan that describes how the actions identified will be prioritized (including a cost-benefit review), implemented, and administered by each jurisdiction? (Requirement 44 CFR § 201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))		
C5-a. Does the plan describe the criteria used for prioritizing actions?	Section 6.2.1 Prioritization of Potential Actions	Choose an item.
C5-b. Does the plan provide the position, office, department or agency responsible for implementing/administrating the identified mitigation actions, as well as potential funding sources and expected time frame?	Table 6.6 Burlington 2025-2029 Detailed Mitigation Actions with responsible party, funding, timeframe	Choose an item.
ELEMENT C REQUIRED REVISIONS		
Required Revision: Click or tap here to enter text.		

Element D: Plan Maintenance

Element D Requirements	Location in Plan (section and/or page number)	Met / Not Met
D1. Is there discussion of how each community will continue public participation in the plan maintenance process? (Requirement 44 CFR § 201.6(c)(4)(iii))		
D1-a. Does the plan describe how communities will continue to seek future public participation after the plan has been approved?	Chapter 7, Plan Maintenance, Section 7.5 Public Participation	Choose an item.
D2. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a five-year cycle)? (Requirement 44 CFR § 201.6(c)(4)(i))		
D2-a. Does the plan describe the process that will be followed to track the progress/status of the mitigation actions identified within the Mitigation Strategy, along with when this process will occur and who will be responsible for the process?	Section 7.1 Monitoring the Plan	Choose an item.
D2-b. Does the plan describe the process that will be followed to evaluate the plan for effectiveness? This process must identify the criteria that will be used to evaluate the information in the plan, along with when this process will occur and who will be responsible.	Section 7.2 Evaluating the Plan	Choose an item.
D2-c. Does the plan describe the process that will be followed to update the plan, along with when this process will occur and who will be responsible for the process?	Section 7.3 Updating the Plan	Choose an item.
D3. Does the plan describe a process by which each community will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement 44 CFR § 201.6(c)(4)(ii))		
D3-a. Does the plan describe the process the community will follow to integrate the ideas, information and strategy of the mitigation plan into other planning mechanisms?	Section 7.4 Integrating the Plan	Choose an item.
D3-b. Does the plan identify the planning mechanisms for each plan participant into which the ideas, information and strategy from the mitigation plan may be integrated?	Section 7.4 Integrating the Plan	Choose an item.
D3-c. For multi-jurisdictional plans, does the plan describe each participant's individual process for integrating information from the mitigation strategy into their identified planning mechanisms?	Not applicable	Choose an item.

Element D Requirements	Location in Plan (section and/or page number)	Met / Not Met
ELEMENT D REQUIRED REVISIONS		
Required Revision: Click or tap here to enter text.		

Element E: Plan Update

Element E Requirements	Location in Plan (section and/or page number)	Met / Not Met
E1. Was the plan revised to reflect changes in development? (Requirement 44 CFR § 201.6(d)(3))		
E1-a. Does the plan describe the changes in development that have occurred in hazard-prone areas that have increased or decreased each community's vulnerability since the previous plan was approved?	Section 3.2.2 Subsection Development Since Previous HMP (Page 3-10)	Choose an item.
E2. Was the plan revised to reflect changes in priorities and progress in local mitigation efforts? (Requirement 44 CFR § 201.6(d)(3))		
E2-a. Does the plan describe how it was revised due to changes in community priorities?	Section 1.3.1 Update to Previous Plan	Choose an item.
E2-b. Does the plan include a status update for all mitigation actions identified in the previous mitigation plan?	Section 6.1 Status of 2016 HMP Mitigation Actions column for status	Choose an item.
E2-c. Does the plan describe how jurisdictions integrated the mitigation plan, when appropriate, into other planning mechanisms?	Section 7.4 Integrating the HMP	Choose an item.
ELEMENT E REQUIRED REVISIONS		
Required Revision: Click or tap here to enter text.		

Element F: Plan Adoption

Element F Requirements	Location in Plan (section and/or page number)	Met / Not Met
F1. For single-jurisdictional plans, has the governing body of the jurisdiction formally adopted the plan to be eligible for certain FEMA assistance? (Requirement 44 CFR § 201.6(c)(5))		
F1-a. Does the participant include documentation of adoption?	Chapter 8, Section 8.1 Plan Adoption	Choose an item.
F2. For multi-jurisdictional plans, has the governing body of each jurisdiction officially adopted the plan to be eligible for certain FEMA assistance? (Requirement 44 CFR § 201.6(c)(5))		
F2-a. Did each participant adopt the plan and provide documentation of that adoption?	Not applicable	Choose an item.
ELEMENT F REQUIRED REVISIONS		
Required Revision: Click or tap here to enter text.		

Element G: High Hazard Potential Dams (Optional)

HHPD Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD1. Did the plan describe the incorporation of existing plans, studies, reports and technical information for HHPDs?		
HHPD1-a. Does the plan describe how the local government worked with local dam owners and/or the state dam safety agency?	Section 4.7.2	Choose an item.
HHPD1-b. Does the plan incorporate information shared by the state and/or local dam owners?	Section 4.7.2	Choose an item.
HHPD2. Did the plan address HHPDs in the risk assessment?		
HHPD2-a. Does the plan describe the risks and vulnerabilities to and from HHPDs?	Section 4.6.6 Vulnerability and Impacts	Choose an item.

HHPD Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD2-b. Does the plan document the limitations and describe how to address deficiencies?	Section 4.6.6 Vulnerability and Impacts	Choose an item.
HHPD3. Did the plan include mitigation goals to reduce long-term vulnerabilities from HHPDs?		
HHPD3-a. Does the plan address how to reduce vulnerabilities to and from HHPDs as part of its own goals or with other long-term strategies?	Section 1.3	Choose an item.
HHPD3-b. Does the plan link proposed actions to reducing long-term vulnerabilities that are consistent with its goals?	See Table 6.4, Action #2.	Choose an item.
HHPD4-a. Did the plan include actions that address HHPDs and prioritize mitigation actions to reduce vulnerabilities from HHPDs?		
HHPD4-a. Does the plan describe specific actions to address HHPDs?	Section 6.2 Mitigation Action and Adaptation Strategy for 2025-2029	Choose an item.
HHPD4-b. Does the plan describe the criteria used to prioritize actions related to HHPDs?	Yes, use of STAPLEE to evaluate all actions. See Section 6.2.1.	Choose an item.
HHPD4-c. Does the plan identify the position, office, department or agency responsible for implementing and administering the action to mitigate hazards to or from HHPDs?	Section 7 Plan Maintenance	Choose an item.
HHPD Required Revisions		
Required Revision: Click or tap here to enter text.		

Element H: Additional State Requirements (Optional)

Element H Requirements	Location in Plan (section and/or page number)	Met / Not Met
This space is for the State to include additional requirements		
Hazard Mitigation Review Meeting	Section 2.2, Section 2.2.2, Table 2.3	Choose an item.

Plan Assessment

These comments can be used to help guide your annual/regularly scheduled updates and the next plan update.

Element A. Planning Process

Strengths

[insert comments]

Opportunities for Improvement

[insert comments]

Element B. Risk Assessment

Strengths

[insert comments]

Opportunities for Improvement

[insert comments]

Element C. Mitigation Strategy

Strengths

[insert comments]

Opportunities for Improvement

[insert comments]

Element D. Plan Maintenance

Strengths

[insert comments]

Opportunities for Improvement

[insert comments]

Element E. Plan Update

Strengths

[insert comments]

Opportunities for Improvement

[insert comments]

Element G. HHPD Requirements (Optional)

Strengths

[insert comments]

Opportunities for Improvement

[insert comments]

Element H. Additional State Requirements (Optional)

Strengths

[insert comments]

Opportunities for Improvement

[insert comments]

Appendix B. Survey Results

Responses Overview Active

Responses	Average Time	Duration
63	41:57	524 Days

1. Which natural hazards are you most concerned about?

Click and drag each option to rearrange or use the up and down arrows. On a computer you may need to hover your mouse for the arrow to appear.

2. Are there any other natural hazards you are concerned about?

21
Responses

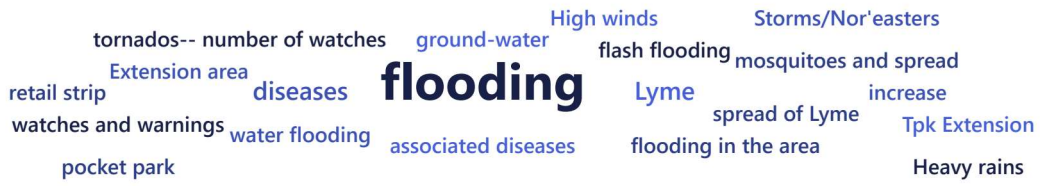
Latest Responses

"vector born diseases like EEE, lyme, etc"

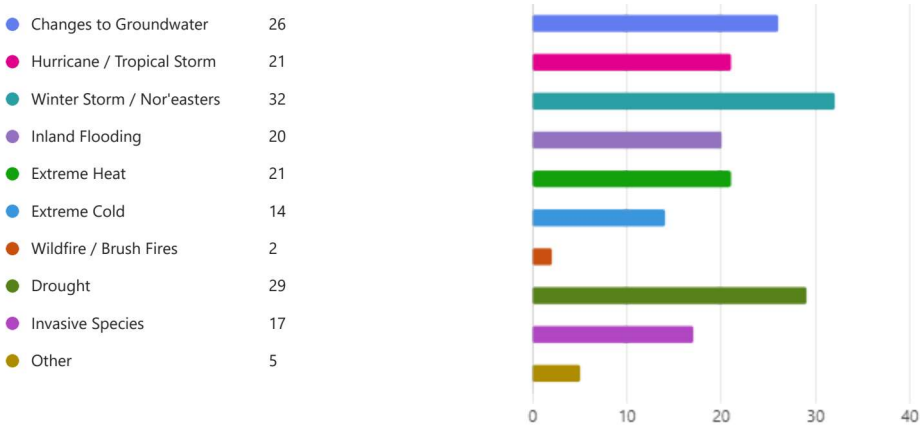
"tornados-- number of watches and warnings seem to have in creased in the last f... "

...

4 respondents (19%) answered flooding for this question.



3. If any, which natural hazards have you personally experienced in Burlington?



4. Tell us more about your experiences with natural hazards. Please add specify areas of Town that are vulnerable to climate hazards and fro m what type of hazard.

32
Responses

Latest Responses

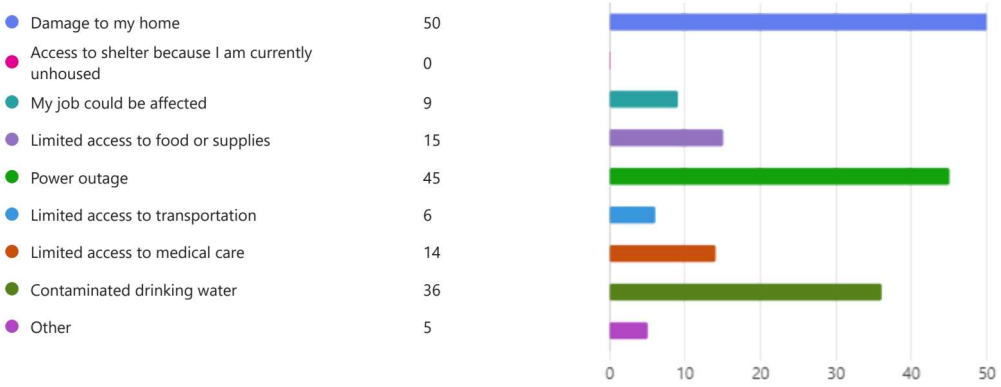
"Invasive plant species, especially japanese knotweed, are taking hold in many areas"

"Mostly power failures during storms. I live in an apartment so there is not an opti... "

...

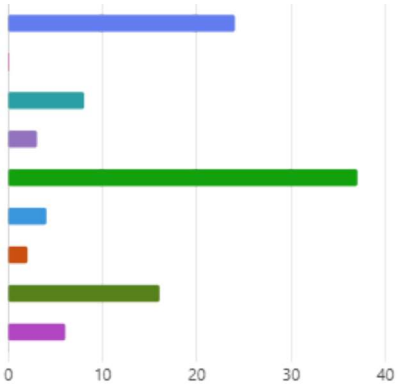
11 respondents (34%) answered areas for this question.

5. What problems from natural hazards concern you the most?



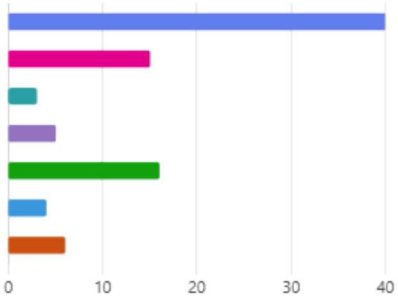
6. If any, what problems from natural hazards have you experienced in Burlington?

Damage to my home	24
Access to shelter because I am currently unhoused	0
My job was affected	8
Limited access to food or supplies	3
Power outage	37
Limited access to transportation	4
Limited access to medical care	2
Contaminated drinking water	16
Other	6



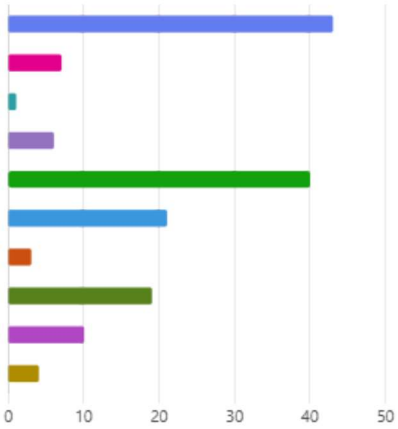
7. If anything, what do you do to prepare for an natural hazard event?

I have an emergency kit with supplies, food, flashlight, batteries, etc.	40
I have a back up generator in case of power outage that I know how to operate safely	15
I know where the nearest shelter is	3
I know what the evacuation routes are	5
I check on a vulnerable neighbor and help them with food, snow removal, or other support	16
A neighbor checks on me to offer food, snow removal, or other support	4
Other	6

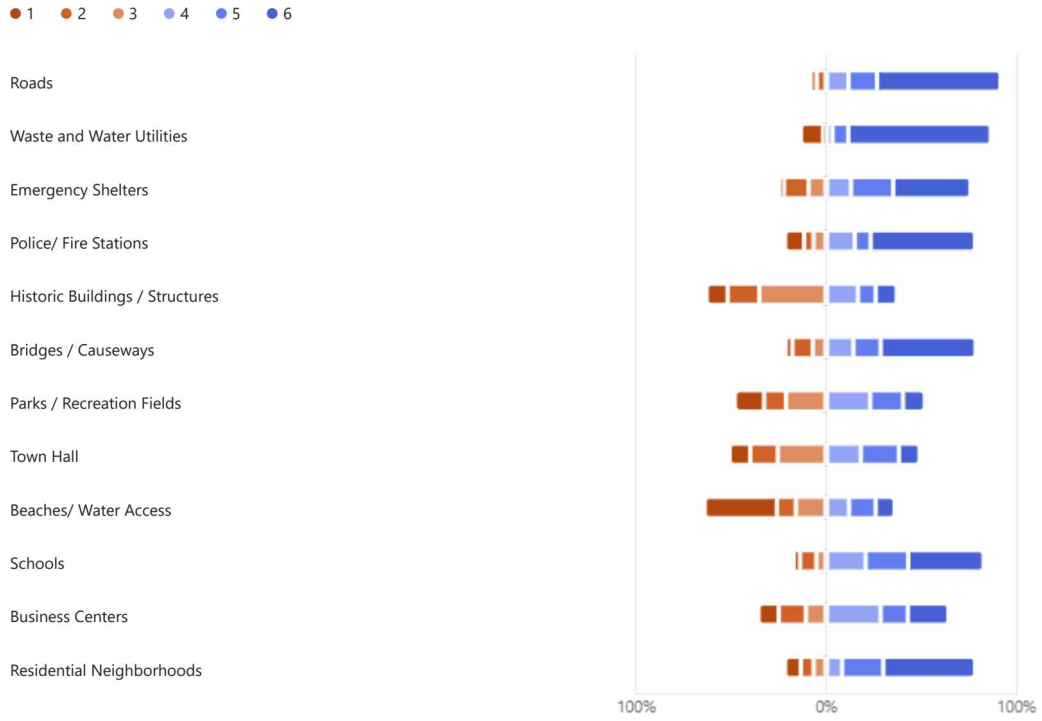


8. What actions have you taken to reduce the risk of Natural Hazards for your property?

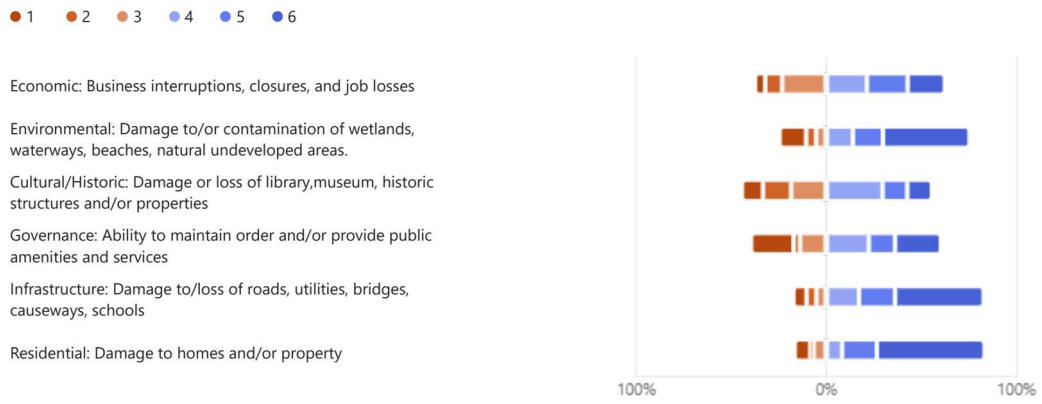
Purchased a homeowners/renters insurance policy	43
Purchased flood insurance	7
Elevated HVAC above floodplain	1
Replaced windows with impact rated glass	6
Trimmed or removed trees close to house	40
Installed sump pump	21
Replaced roofing with high wind rated shingles	3
Bought a generator	19
Installed flood protection measures	10
Other	4



9. How important is it to you for Burlington to prioritize protecting each of community assets listed below from natural hazards? Please rank 1-6, 1 being the least important and 6 being the most important.



10. Which of the following categories are most susceptible to natural hazards in Burlington? Please rank 1-6, 1 being the least susceptible a nd 6 being the most susceptible.



11. What does the Town do well to prepare for natural hazards?

For example: Warming or cooling stations, snow removal, winter road treatment, public notifications about extreme events, resources fo r the unhoused, prioritizing vulnerable populations.

41
Responses

Latest Responses

"The Board of Health always seems on top of everything. The reverse 911 system ... "

"snow removal, road treatment, notifications"

"Good communication system to inform residents"

• • •

21 respondents (51%) answered Snow removal for this question.

12. What could the Town improve on or begin doing to prepare for natural hazards?

For example: Warming or cooling stations, snow removal, winter road treatment, public notifications about extreme events, resources fo r the unhoused, prioritizing vulnerable populations.

39
Responses

Latest Responses

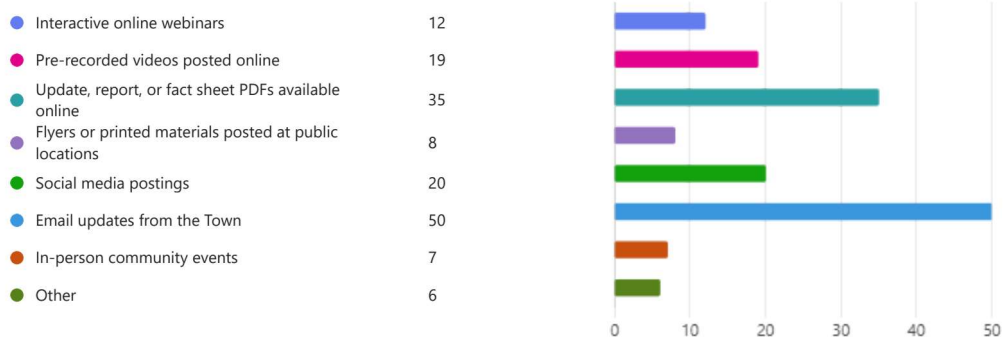
"I don't know"

"I don't think apartment dwellers often feel the same inclusion as residential negh... "

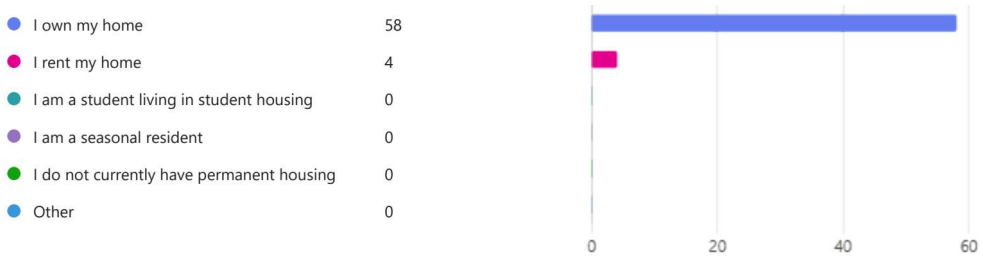
• • •

8 respondents (21%) answered roads for this question.

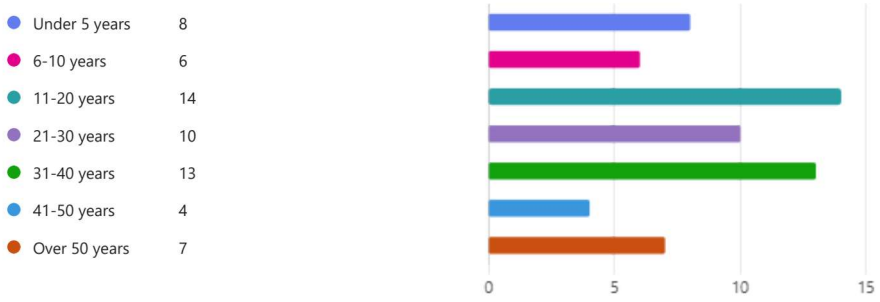
13. How would you like to receive information about hazard mitigation in Burlington?



14. What is your current housing situation?



15. How long have you lived or worked in Burlington?



16. What else would you like us to know about hazards that you or others face in Burlington?

21
Responses

Latest Responses
"I am concerned about PFAS in the drinking water. I know filters are now in place f... "
"Thank you for working on this."
...

5 respondents (23%) answered town for this question.

Update

Appendix C. Prioritized Mitigation Actions with STAPLEE Scoring

Action #	Description of Strategy	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Total	Priority
1	Investigate the locations reported in the public survey (Cambridge St, Harriett Ave, Fox Hill, Sandy Brook, Long Meadow Brook)	3	3	1	3	3	2	3	18	Medium
2	Update the Emergency Action Plan for the Mill Pond Reservoir Dam spillway area every two years. Investigate the risk of overtopping with climate change.	3	3	2	3	3	3	2	19	High
3	Determine where drought has created the highest likelihoods of brushfires starting, using public feedback including the public survey from this Update, to target drought-tolerant landscaping especially in private residential lots	3	2	3	3	3	2	2	18	Medium
4	Determine which buildings may be most vulnerable to earthquake damage and conduct a structural assessment if needed.	3	3	2	2	3	2	1	16	Low
5	Assess the vulnerability of roadways and utilities in high liquefaction susceptibility areas	3	3	2	3	2	2	2	17	Medium
6	Site Design to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways. Increase tree plantings or shade structures in the Burlington Mall complex and Market Basket shopping complex. Increase tree plantings in urban heat islands with socially vulnerable residents.	3	3	2	3	3	2	2	18	Medium
7	Promote Green Buildings and Cool Roof designs	3	1	1	3	3	1	1	13	Low
8	Make regulatory updates to allow for new petroleum generators (which will enable additional shelters) at public buildings	3	3	3	3	3	3	3	21	High
9	Analyze urban heat islands with social vulnerability in Burlington to prioritize location of future cooling centers and location of greener site design projects/retrofits	3	3	2	2	2	3	3	18	Medium
10	Incorporate climate resilience/adaptation components into the next amendment to Comprehensive Plan	3	3	3	3	3	3	3	21	High
11	Seek funding to play for Climate Action / Sustainability plan	3	3	3	3	3	3	3	21	High
12	Continue to monitor flooding around Sandy Brook Road	3	3	3	3	3	2	3	20	High
13	Acquire land along Sandy Brook	3	3	2	2	3	1	2	16	Low
14	Implement Stream Cleaning and Drainage Repair under CIP	3	3	3	3	3	2	3	20	High

Action #	Description of Strategy	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Total	Priority
15	Provide homeowner and renter flood protection educational resources via Town-wide emails and online factsheets	3	3	3	3	3	3	3	21	High
16	Determine where invasive species plant growth is occurring and deploy the Department of Public Works to cut them down and replace with native species	3	2	3	3	3	2	2	18	Medium
17	Determine where mudflows have been reported and are projected to occur due to heavy storms and precipitation; reinforce areas and communicate to nearby residents on how to protect their homes	1	2	3	3	3	2	3	17	Medium
18	Increase brush fire risk awareness by adding links to wildfire resources like the MassGIS wildfire dashboard of USDA Risk to Communities Dashboard to the Town website.	3	2	3	3	3	2	3	19	Medium
19	Utilize social media and in-person events to educate residents about the most vulnerable areas for brushfires and increase their knowledge of the risks.	3	3	3	3	3	3	3	21	High
20	Increase community education about creation of defensible spaces around properties by clearing vegetation and using fire-resistant materials.	3	2	3	3	3	2	3	19	Medium
21	Evaluate public buildings for the ability to withstand snow loads; retrofit if needed to the greatest degree feasible.	3	2	2	3	2	2	2	16	Low
22	Assist vulnerable populations by identifying specific at-risk populations that may be exceptionally vulnerable during long-term power outages.	3	3	3	3	3	3	3	21	High