Town of Andover

Local Hazard Mitigation Plan

2024-2029

DRAFT of May 19, 2024

Adopted by the Town of Andover
MM DD, YYYY

Prepared by
Town of Andover
and
Mount Ascutney Regional Commission

CERTIFICATE OF ADOPTION

Town of Andover, VT
Selectboard
A Resolution Adopting the
Town of Andover 2024-2029 Local Hazard Mitigation Plan

WHEREAS, the Town of Andover has worked with Mount Ascutney Regional Commission to prepare an updated hazard mitigation plan for the town to identify natural hazards, analyze past and potential future damages due to natural and man-made caused disasters, and identify strategies for mitigating future damages; and

WHEREAS, duly-noticed public meetings were held by the Andover Selectboard on MM DD, YYYY to present and receive public comment on the draft Plan; and

WHEREAS, the updated Town of Andover 2024-2029 Local Hazard Mitigation Plan demonstrates the community's commitment to implementing the mitigation strategies and authorizes responsible agencies to execute their actions; and

WHEREAS, the updated Town of Andover 2024-2029 Local Hazard Mitigation Plan was submitted to Vermont Emergency Management and the Federal Emergency Management Agency for review on MM DD, YYYY; and

NOW, THEREFORE BE IT RESOLVED that the Town of Andover Selectboard hereby adopts the 2024-2029 Andover Local Hazard Mitigation Plan for municipal use and implementation.

Duly adopted this ____ day of _____, 20__.

Selectboard

_____ _____
Chair, Andover Selectboard Member

_____ _____
Member Member

_____
Member

[for FEMA Approval Letter]

EXECUTIVE SUMMARY

The effect of climate change on weather events is being felt by communities around the world. According to the Vermont State Hazard Mitigation Plan, there has been a marked increase in the frequency and severity of weather-related disasters, both globally and nationally, over the past several decades. Vermont has been getting warmer and wetter, with an average air temperature increase since 1900 of 4°F in winter and 2°F in summer which is greater than that experienced globally over that same time period.

The Federal Emergency Management Agency (FEMA), through Vermont Emergency Management, provides funding and technical assistance for this planning effort. Since 2003, as required by the Disaster Mitigation Act of 2000, local governments must have a FEMA approved local mitigation plan that meets all the required elements in regulation 44 CFR §201.6 to be eligible for federal and state disaster recovery funding and pre-disaster mitigation funds.

With the occurrence of extreme weather events becoming more frequent, hazard mitigation planning has become a critical activity for local and state governments. The Hazard Mitigation Planning process is a local effort that analyzes a community's risk from natural hazards and coordinates available resources to implement mitigation actions determined by the community to reduce risks.

This *2024-2029 Local Hazard Mitigation Plan* is an update from the previous five-year plan of 2018-2023. As with the prior plan, this planning effort recognizes the benefits of taking a proactive approach to reduce the impact of natural disasters on the Andover community.

A Hazard Mitigation Planning Team was formed under the direction and oversight of the Selctboard Chair to work with Mount Ascutney Regional Commission (MARC) in the development of this plan update. Beginning in August 2023, the Team conducted publicly noticed meetings during which the historical impact of weather-related hazard events, the probability of future occurrences, and the Town resources and capabilities to address these events were examined. Input from responses to a local climate change survey were considered and incorporated. The Team reviewed related technical and other planning reports and studies and identified and evaluated a comprehensive range of mitigation ideas involving local planning and regulations, natural and built environment protection, infrastructure project development, education and awareness programs, and implementation projects.

The Mitigation Program in **Section 6** is the core of this plan and the culmination of the planning, outreach and assessment activities described above. It outlines plan goals and objectives to provide protection and reduce risk and loss to the community, raise public awareness and improve effectiveness of hazard mitigation planning. Identified mitigation and preparedness strategies and actions prioritized to address vulnerabilities to the natural hazard events of most concern are listed in **Table 6.2-1: 2023-2028 Mitigation/Preparedness Strategies and Actions.**

For Andover, as in the prior plan, **Flooding** and related **Erosion** remain top priority hazard events, given the Town's geographical characteristics and projected probability of occurrence and impact of these hazards. This update recognizes **Ice, Extreme Cold,** and **Heavy Snow** as separate hazards, previously combined in the prior plan. These are now assessed separately rather than as 'Winter Weather' due to changes in climate and the unpredictability of these events throughout the fall, winter and spring seasons.

Ice from winter storm events has become a higher priority with more frequent occurrences due to a trend towards more extreme variations in temperature during the winter season. **High Wind** is identified separately as a significant hazard from thunderstorms, winter storms, tropical storms and other severe weather events and a primary cause of power outages particularly with heavy wet snow and accumulating ice. **Drought** is now recognized as a notable and increasing risk to the State with more frequent extended periods of **Extreme Heat** and variability in precipitation events. However, the Town has yet to experience these trends to a concerning degree. **Wildland** has dropped in priority for the Town although this hazard could potentially worsen with higher frequencies of extreme weather events such as drought, high wind and thunderstorm events. **Invasive Species** is a new priority hazard given the potential impact on town infrastructure from invasive plants and tree infestations.

Particularly important and new this update, is the formal monitoring of plan progress and effectiveness over the five-year planning period. Although the Town is not obligated to implement all the recommended projects in Table 6.2-1, it is expected to formally monitor and evaluate the progress made on an annual basis for public review and input. The town is also committed to improved documentation of future hazard events and their impact on the community for input in future town planning.

This is a dynamic plan which can be modified over the plan period to accommodate changes in priorities and ideas, funding opportunities, and the occurrence of future disaster events. The effectiveness of this plan will be determined based on local awareness and support, and on the recognition and incorporation of hazard mitigation into all other municipal planning efforts.

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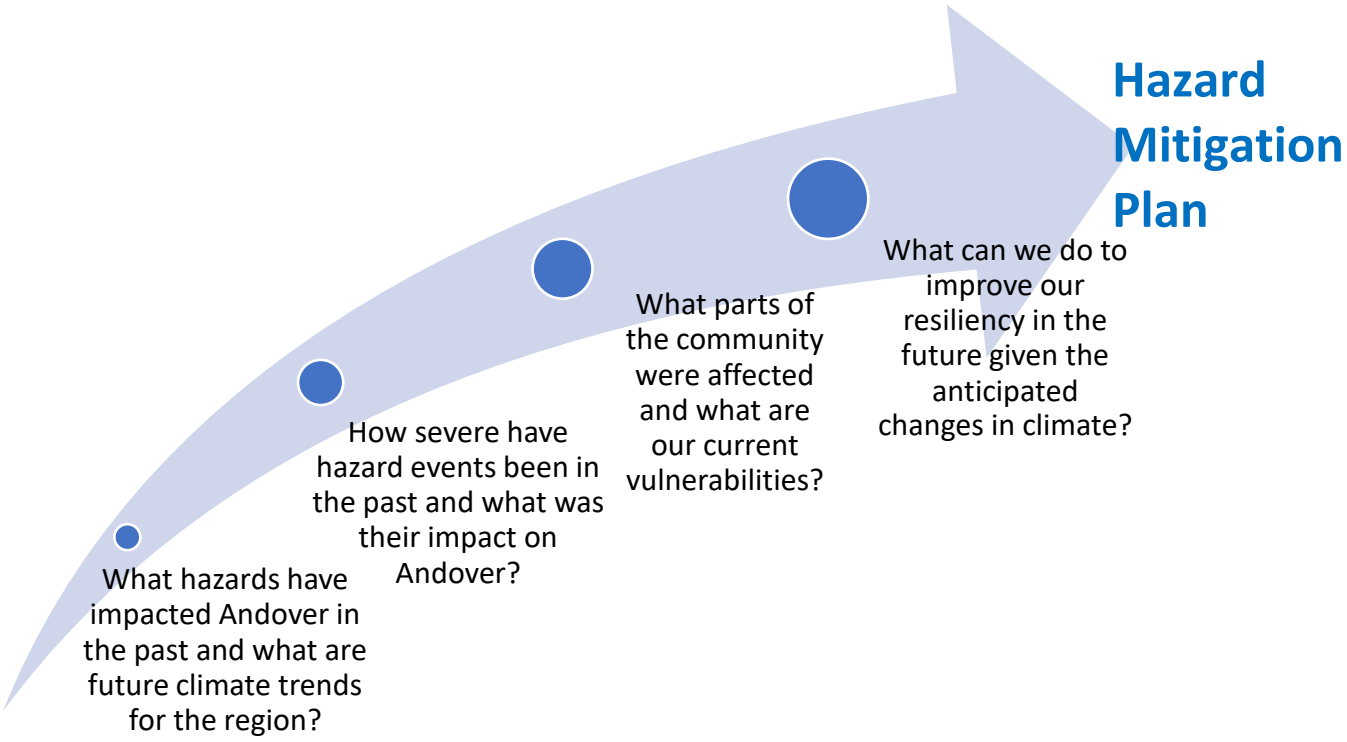
1. INTRODUCTION

This Local Hazard Mitigation Plan is intended to assist the Town of Andover in determining and minimizing the risk of natural hazard events due to climate change and developing strategies and actions that can be taken to improve the Town's resiliency by reducing the financial and physical impacts when an event occurs.

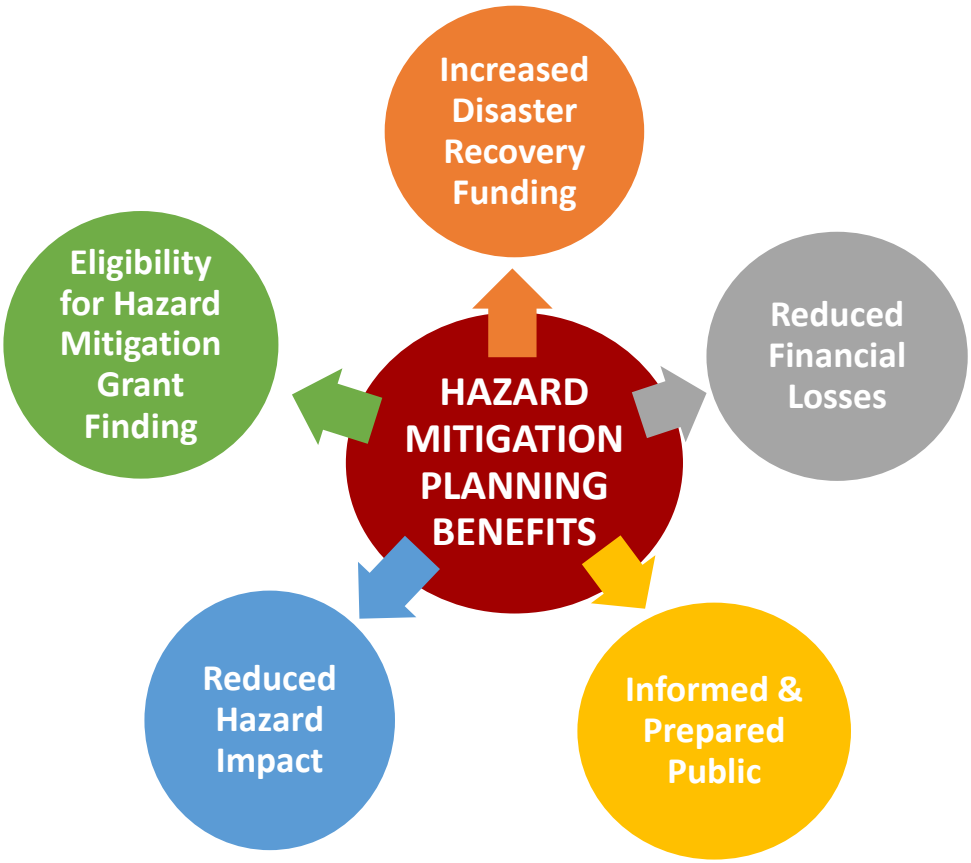
This planning effort involved an evaluation of local capabilities and resources, an assessment of historical and future hazard occurrences and an understanding of the potential impacts to life, local economy, infrastructure and the environment. These efforts concluded in **Section 6** with a Hazard Mitigation Plan that prioritizes natural hazards that are most impactful and pose the greatest future threat to the Andover community, determines areas and populations of vulnerability, and identifies effective strategies and actions to reduce risk over the next five years. The list of actions can be found in **Table 6.2-1** at the end of this plan including a process for monitoring progress over the next five-year period.



2. PURPOSE

The Federal Emergency Management Agency (FEMA), Vermont Emergency Management (VEM), and local towns have come to recognize that it is less costly to take action to minimize the impact of natural hazards than to repeatedly repair damage after a disaster has struck. This plan update is funded by a Building Resilient Infrastructure and Communities Grant Program (BRIC) through Vermont Emergency Management which helps local governments meet the requirements in the Local Mitigation Planning Policy Guide and Title 44 of the Code of Federal Regulations (CFR) for FEMA approval. An approved, adopted mitigation plan is required to be eligible for FEMA Hazard Mitigation Assistance (HMA) and other Hazard Mitigation grant programs. Other Hazard Mitigation Planning Benefits are shown below.

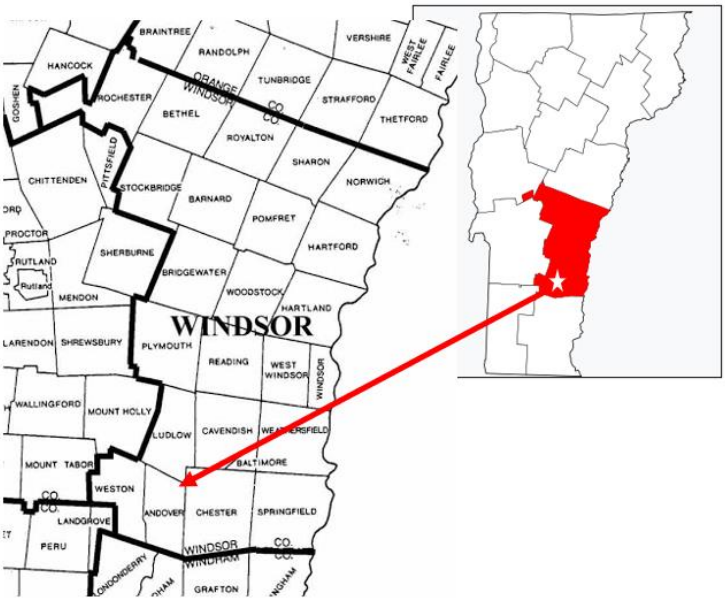
Andover is eligible under the Vermont Emergency Relief and Assistance Fund (ERAF) to receive state funding towards the 25% match required for Federal Public Assistance funds after a federally declared disaster which covers 75% of the Towns damage repairs. Communities that take additional specific steps to reduce flood damage can increase the percentage of state funding they receive from the default rate 7.5% up to a maximum of 17.5%. With the adoption of this LHMP, Andover will receive 12.5%.



3. TOWN PROFILE

Location and Geography

Andover is a small rural community with a population of 612. Located in southern Windsor County in southeastern Vermont, it lies on the eastern slope of the Green Mountains and is bordered by the towns of Chester, Londonderry, Ludlow, Weston and Windham. It has a mountainous terrain with a land area of approximately 30 square miles, the majority of which is forested. Steep slopes, and undeveloped ridgelines not only add to the scenic beauty of the landscape, but are also important habitat areas for deer, moose, bear and other wildlife with much of town forested areas classified as Highest Priority Connectivity Blocks.



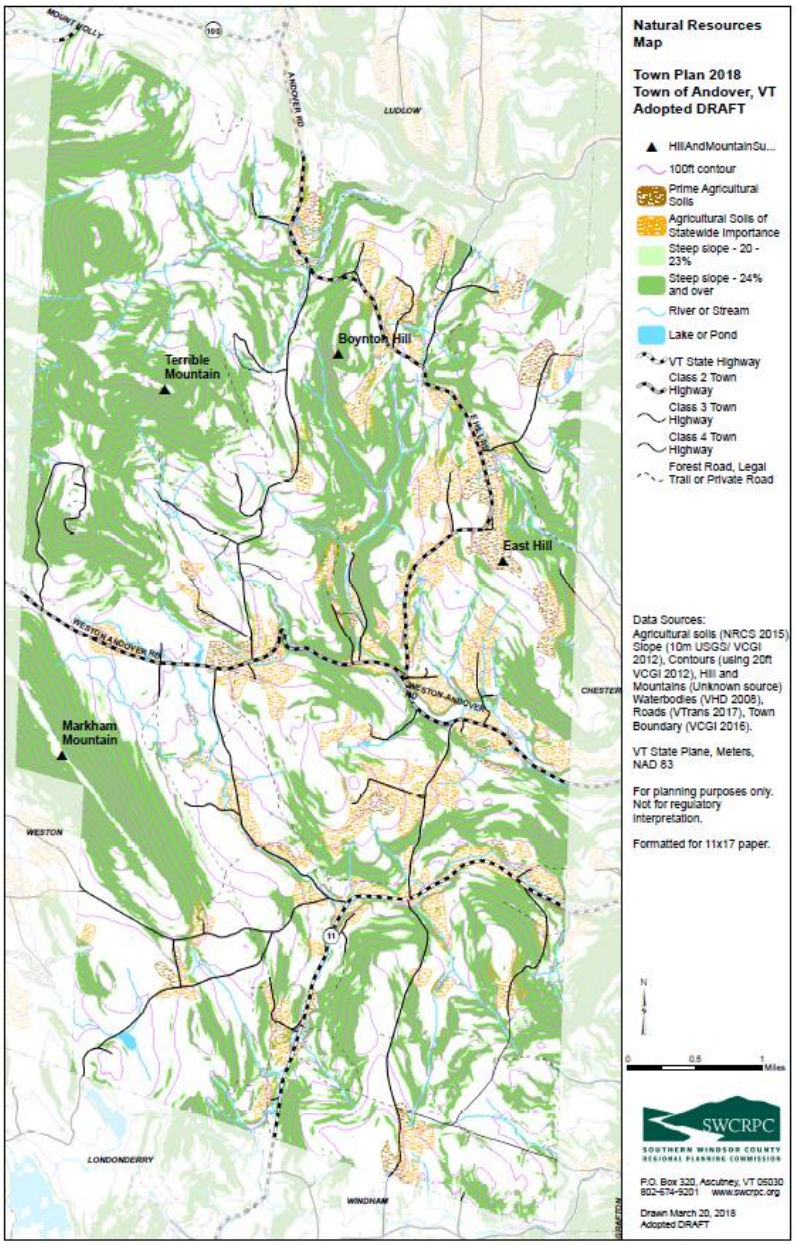
Major transportation routes include VT Route 11 which connects Andover with towns to the east and south, Weston-Andover Road, and East Hill Road for travel north to Route 100.

Andover is home to the headwaters of the upper and middle branches of the Williams River. As can be seen on **Appendix A: Map 3- Natural Resources,** the headwaters originate in the higher elevations in the northern part of town as small flashy streams and descend slopes greater than 25% towards the Middle Branch, a major tributary of the Williams River. The Natural Resource map below highlights the steep slope areas (>24% in darker green) with the highest elevation in town at 2,882 feet on Terrible Mountain. The numerous rivers and headwater streams can also be seen. These headwater streams are sensitive to change and land uses in this part of the watershed and can affect river stability further downstream.

There are two named residential villages, Peaseville and Simonsville, with no urban centers or municipal water or sewer services. The rural character of the town features dirt roads, open fields and small farming and agricultural operations such as forestry and sugaring. Outside of the Town Office, meeting hall and town garage, there are no other public or critical facilities in town. Public schools, health clinics, hospitals, and emergency services are provided by neighboring towns and can be accessed within a 15 mile radius. There are few small-scale commercial businesses for dining or lodging and most residents must travel outside town for employment and amenities including groceries, shopping, healthcare, dining, and entertainment. As such, maintaining the existing road system is important to Andover's economic well-being and future growth, according to the Town Plan. **(See Appendix A: Map 1 – Current Land Use)**.

Because of Andover's small population and limited financial resources, its transportation facilities consist exclusively of its road system and bridges. The Town's Highway Department maintains over 40 miles of public roadway (Class 2 and Class 3) and 5 miles of Class 4 roads which, together with 19 miles of legal

trails, are valuable recreational resources for hikers, horseback riders, mountain bikers, snowmobilers, and cross-country skiers. **(See Appendix A: Map 4 – Transportation Resources)**



Demographics

The population of Andover peaked in 1820 with 1000 people and then dropped steadily to 200 in 1950. Over the past ten years there has been a steady increase of about 2% per year to 568, according to the 2020 census. The town experienced an unusual population increase from 2020 to 2022 of 17% per year due primarily to an influx of those seeking to escape urban areas during the Covid-19 pandemic.

The percentage of population over 65 years of age which had been increasing since 2000 took a notable dive after 2020 reducing the median age from 55 to 44 years of age with the influx of middle-aged adults. Younger populations have remained steady. See **TABLE 3-1: Town of Andover and Windsor County, VT - Demographics (2000-2022).**

Another important trend in recent years that should be recognized is the increasing number of second homeowners and seasonal homes as noted in the Town Plan. This is discussed in more detail under **Development Trends** below.

In 2022, median per capita income for the Town of Andover was $45,943, 28% greater than that of Windsor County of $35,853. The poverty rate was 7% for populations under 18 years of age and 10% for 65 years of age and older, compared to 8% and 7% for Windsor County, respectively. The mean value of owner-occupied housing units was $337,800, approximately 35% higher than that for Windsor County.

TABLE 3-1: Town of Andover and Windsor County, VT - Demographics (2000-2022) *

Year	2000		2010		2020		2022*	
Andover	517		456		568		612	
Age	#	% of total	#	% of total	#	% of total	#	% of total
<5	24	4.6%	22	4.8%	6	2.0%	12	2.0%
<18	98	19.0%	97	21.3%	86	15.1%	105	17.2%
18-64	309	59.8%	257	56.4%	290	51.1%	392	64.1%
65 and over	110	21.3%	102	22.4%	163	28.7%	115	18.8%
Median Age	43.3		47.4		54.7		43.5	

* *Data from U.S. Census Bureau, accessed 4/1/2024 for 2000-2020 [DP1]*
Data from American Community Survey 5-Year Estimates for 2010, 2022 [DP05]

Climate

As in all of Vermont, the climate is temperate with moderately cool summers and cold winters. Historically, typical temperatures reach 80°F in July and drop to 28°F in January. Average annual precipitation is around 40 inches and snowfall generally range from a minimum of 70 inches to as much as 200 inches in the mountains. However, with global changes in climate, average annual temperatures and annual precipitation in Vermont are increasing, as shown in the charts below taken from the 2023 Draft State Hazard Mitigation Plan.

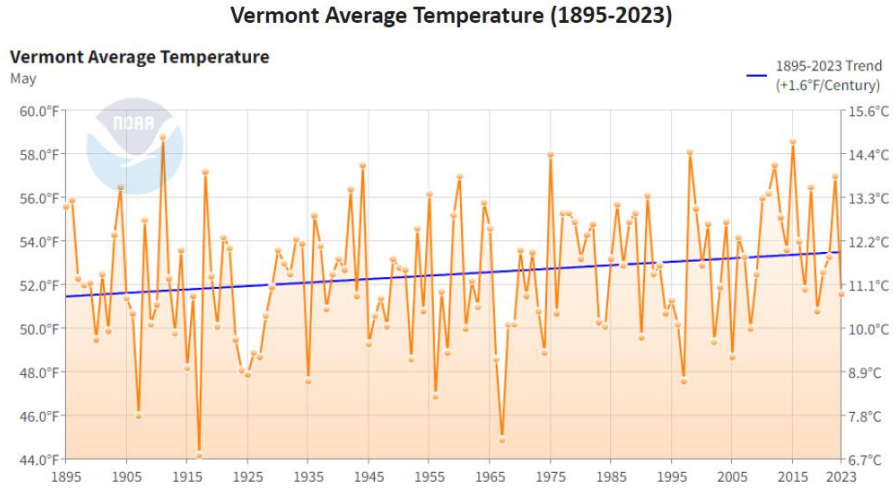


Figure 3: Vermont average temperature (1895-2023)
Data Source: www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/time-series

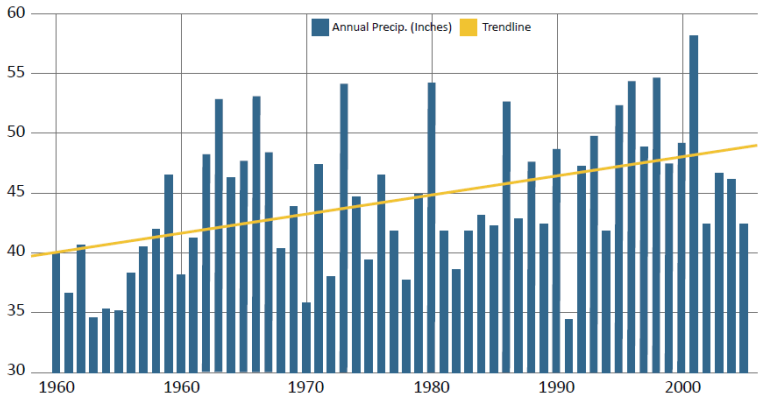


Figure 33: Vermont's annual precipitation (1960-2015)
Source: climatechange.vermont.gov

Andover has experienced extremes in temperature fluctuations and precipitation in recent years, due to climate change. The weather can be unpredictable at times, with dramatic variations in temperature, precipitation, and other conditions occurring both within and between seasons as well as at various altitudes within Andover's residential communities. These changing weather patterns have had a significant impact on the town.

Development Trends

The Town of Andover consists primarily of single-family residential homes and seasonal homes with very little commercial development. There are a few small farms and businesses that operate in town primarily along Route 11, but most people work in surrounding towns. Development in the Town of Andover has been significantly influenced by its topography and road access. Generally, commercial development has occurred along Andover Road and Route 11. Tator Hill, which is shared by the Towns of Windham and Andover, was once a thriving recreational area and golf course but since purchased and closed with its future use unknown at this time. The future of this parcel could have a substantial impact on the Town.

A 2-acre minimum lot size prevails over Andover with development limited to on-site septic systems and private water wells. Andover adopted flood hazard regulations, requiring review by the Planning Commission, over any development proposal within 100-year floodplain or Zone A of the FEMA Flood Hazard Boundary Map which lies along the Middle Branch River. A sizable portion of town lies on slopes greater than twenty-five percent, with soils that are unsuitable for dense development.

Land use patterns are influenced by some limitations (steep slopes, shallow soils), but important factors such as technological advances and availability of capital are providing opportunities for development in areas with mountain views that were once considered severely limited. However, this type of development poses potential hazard risks with land and possible ridgeline clearing increasing stormwater runoff.

Flooding is the most probable hazard event in Andover, with flash flooding posing the biggest risk for the upland community and inundation flooding for residents along the Middle Branch River which runs along VT Route 11. Andover's Flood Damage Prevention Regulations, adopted in 2007, regulate development in special flood hazard areas include provisions for vegetated buffers along wetlands, streams, rivers, and public ponds to prevent erosion and sedimentation of surface waters.

Maintaining forest cover and minimizing impervious surfaces in rural upland and steep slope areas helps to maximize infiltration and minimize stormwater runoff to the residents and village centers downstream. Efforts to minimize heavy cutting in forestry activities, limiting the extent and densities of developments, and effectively managing stormwater in these upland areas will help contribute toward community flood resilience.

Development since the prior plan can be gaged by the permits issued over that period. The table below shows a slight increase in the construction of new residences each year with a total of more than ___ new residences since the prior plan. [2023 not available?]

TYPE	2019	2020	2021	2022	2023
Residence	0	6	8	10	
Additions	1	5	2	7	
Accessory Buildings	8	7	6	15	
Other (decks, ect.)	0	2	1	2	
Certificate of Occupancy	2	1	2	1	
TOTAL	11	21	19	35	

The growth and expansion of the Okemo Mountain Resort in Ludlow and other nearby ski areas and, more recently, the COVID-19 Pandemic put pressure on residential development in Town primarily for seasonal or second homes or for short term rental investors. There are 380 housing units, according to the 2022 American Community Survey. Most are owner-occupied with less than 10% long-term rental units. Andover has a large second homeowner or seasonal population which makes up about 65% of its housing units. Of these there are about thirty short-term rental units, and this number is trending upward. The high percentage of second homes and growth of short-term rentals poses additional challenges for the Town. These residents and transient renters can be unprepared for the weather events and the impacts of climate change in northern New England.

While there has been some new construction and some tree clearing in upland areas since the prior plan, no new primary or permanent structures have been developed in flood zone areas. It can be inferred that development has not increased the Towns vulnerability to natural hazards such as flooding and fluvial erosion.

The population of Andover is not anticipated to grow significantly over the next decade. Therefore, many of the identified public infrastructure goals are based upon maintaining the existing facilities, such as roadway maintenance and culvert and bridge upgrades and replacements. Considering the recent trend in regional loss of local housing to the growth of short-term rental properties, Andover is currently considering regulation of these properties to slow this trend. **(See Appendix A: Map 2 – Future Land Use).**

4. PLANNING PROCESS

This planning process has been designed and conducted based on the guidance provided in FEMA's Local Mitigation Planning Handbook (May 2023) to meet all required elements in the Local Mitigation Plan Review Tool (PRT) which is used to demonstrate how the local mitigation plan meets the regulation in 44 CFR § 201.6 for FEMA approval.

This Section 4 describes the process and preparatory tasks in preparation of the Mitigation Plan in Section 6, which include:

- Formation of a Hazard Mitigation Planning Team (HMPT)
- Public meeting schedule and planning process
- Public involvement outreach efforts
- Review of status and progress made on actions in prior hazard mitigation plan
- Examination of municipal capabilities and available resources for hazard mitigation planning and implementation
- Review of the town plan and other relevant planning and technical resources to identify common strategies for hazard mitigation and to generate ideas for new mitigation actions.

Hazard Mitigation Planning Team

A four-member Hazard Mitigation Planning Team (HMPT) was assembled by the Selectboard Chair to direct the activities of the process with guidance from Mount Ascutney Regional Commission's (MARC) Community Development Specialist.

MARC staff were responsible for conducting all meetings, developing and conducting a public survey, distribution and posting of planning materials, documenting public input, updating hazard data, drafting and circulating the plan and guiding the plan through review to adoption.

Below is a list of members of the HMPT and their responsibilities. Members were tasked with assessing and prioritizing natural hazards, providing local input, status of past actions and identifying vulnerable areas and mitigation action items for the plan.

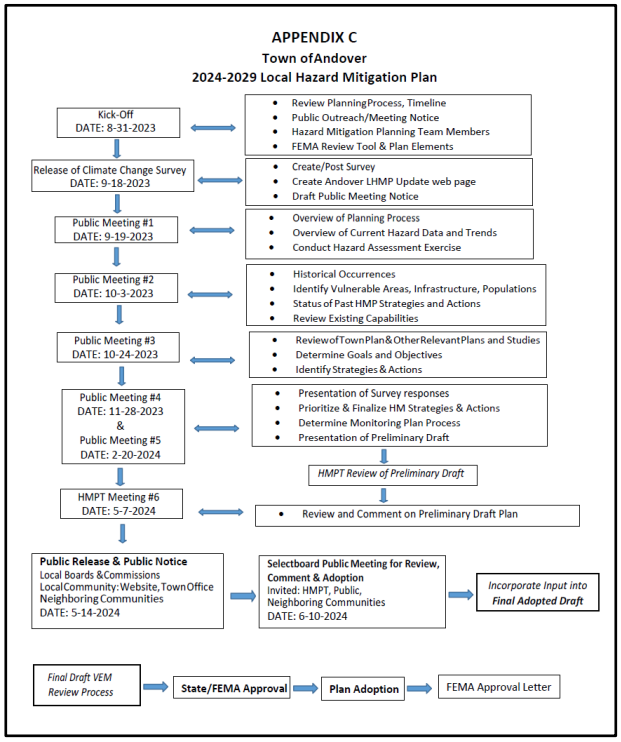
- **Selectboard Chair & Road Commissioner** - Ensure public notice postings, provide information on Capabilities and Resources, Local Flood Regulations, inform Boards of progress, oversee presentation and adoption of the plan.
- **Selectboard Vice Chair**-Obtain input from Selectboard and report on progress, report on past development and trends.
- **Public-**Provide input on historical occurrences, extent of impact of previous hazard events and vulnerability of critical public facilities and other areas of town.
- **Road Foreman-** Provide input on historical occurrences, extent of impact of previous hazard events and vulnerability of road infrastructure.
- **Other-** other municipal staff, including the Town Clerk and a Planning and a Zoning Commission member, provided input throughout the process.

MARC Staff:

- Assistant Planner
- Community Development Specialist

Planning Process and Schedule

MARC staff initiated the process with the Andover Selectboard Chair to review the overall planning and public process and timeline to complete a draft plan. The discussion included the need for town input, the importance of the public participation and public notice procedure, VEM and FEMA review criteria and approval process, and a flow chart of the process steps.



A four-member Hazard Mitigation Planning Team (HMPT) was assembled by the Selectboard Chair to direct the activities of the process with guidance from Mount Ascutney Regional Commission's (MARC) Community Development Specialist. The activities and timeline for the process are depicted in **Appendix C: 2024-2029 Andover Local Hazard Mitigation Plan Process Flow Chart.** There were seven meetings during the update process; five during the planning stage and two during the drafting stage, one of which was a presentation during a Selectboard Meeting. All meetings conducted in person at the Andover Town Office with other correspondence via phone or email. MARC staff opened the first public meeting with a presentation on current available hazard data, including historical occurrences and projected trends, for the more relevant hazards impacting the State of Vermont. A hazard assessment exercise was then conducted with the HMPT which identified and prioritized hazards affecting the Andover community based on the probability of future occurrence and the potential impact each would have on life, infrastructure or built environment, the local economy, and the natural environment. The results of this assessment are shown in **Section 5.1: Hazard Probability of Occurrence and Impact Assessment.** The hazards of greatest concern to the Town detailed in **Section 5.2: Hazard Profile** which provides a description of each hazard with data to support historical occurrences, future trends, and extent of impact to the Town. Throughout the process, the team identified vulnerabilities and high-risk areas, assets and populations also noted in **Section 5.2**.

Following the assessment of natural hazards and discussion of identified vulnerabilities, the HMPT developed plan goals and prioritized new actions and strategies for potential implementation over the 5-year plan period including a monitoring and evaluation process to keep the plan active and current. The complete mitigation plan is in **Section 6: Mitigation Program.**

Changes from Prior Plan

The reader will find this to be an extensive rewrite of the previous plan and includes revisions and improvements in format and methodology, as well as general data and mapping updates. Other changes were an attempt to conform to the Draft 2023 State Hazard Mitigation Plan. The following is a partial list of revisions:

- General updates to Town profile and town maps with new graphics and visuals.
- Inclusion of an easy-to-read Process Flow Chart to depict and manage the planning process.
- Reorganization/restructuring of the plan contents to better reflect required FEMA elements.
- New table for assessing Capabilities and Resources.
- Reevaluation of hazards with a new methodology for scoring like that of the Vermont State 2018 Hazard Mitigation Plan to better recognize the integral natural of hazard events and hazard impacts .
- Update of hazard data using new data sources and more local data.
- Prioritization method for mitigation strategies/actions and incorporation of phasing large projects.
- Review and integration of new relevant reports and documents.
- A formalized Plan Monitoring process to maintain focus on plan goals and to encourage progress, annual reporting, recording of local hazard events, identification of new vulnerable assets, and public outreach over the plan period.

4.1 Public Involvement

Andover Climate Impact Survey

Public outreach included a survey entitled 'Andover Climate Impact Survey' prepared by MARC and released to the local community of Andover on July 24, 2023, by providing a link on the Town's Website and in the weekly Andover Words community email listserv. There were fifty responses to the survey from different areas in Town. Suggestions from this survey are incorporated in this plan as input to **Section 5: Hazard Assessment** or as new strategies and action items in **Section 6: Mitigation Plan**. For a summary of survey results see **Section 5.3: Andover Climate Impact Survey** and **Appendix B: Public Involvement Documents** for the complete survey and responses. The survey will remain open throughout the process until the final draft.

Public Meetings

Of the seven meetings held during the plan update process, six were publicly noticed. The public notice was posted on the Town website and the weekly Andover Words listserv by the Town Clerk, as is customary for the Town. The notice included a link to the MARC webpage for agenda and meeting materials. The notice encouraged participation by attending meetings, providing direct comment to

MARC and to completing the survey. The members of the HMPT were tasked with keeping the Town Selectboard and relevant commissions up to date on planning progress and planning meetings and to help encourage participation of the public. The public notices, sign-in sheets of attendees, and agendas are included in **Appendix B: Public Involvement Documents.**

Planning Phase

Five meetings of the HPMT were held during the planning stage beginning in September 2023 through February 2024. Other than survey responses, there was no other public input or public attendance at these planning meetings.

Draft Phase & Adoption

The HMPT met in May to review the initial plan draft. Comments were incorporated and the plan was then circulated to the members of Andover's boards and commissions and to the local public and neighboring towns. Concurrently, the draft was submitted to Vermont Emergency Management for review.

A link to the draft plan was posted to the Town and MARC websites and circulated to the local public via Andover Words listserve. A copy was circulated via email to Andover's Town Clerk, Selectboard members, Emergency Management, Planning and Zoning Commission members, Highway Department staff and the Zoning Administrator. Accompanying narrative encouraged comments and questions and indicated the availability of a hard copy at the Town Office for viewing. Concurrently, The Town Managers, Selectboard Chair, Emergency Management and Planning and Zoning Commission Chairs of neighboring towns received an email with a link to the draft plan.

All email distribution included an invitation to attend a Selectboard meeting on June 10th for a presentation of the Plan for final comments and questions before adoption. See **Appendix B: Public Involvement Documents** for the public notice, email invitation and list of notified stakeholders and vulnerable populations.

{Summarize comments] Comments received from the Vermont State Hazard Mitigation Officer's review and from public input were incorporated into a final draft for adoption on June 10th, 2024 The adopted plan was submitted to Vermont Emergency Management for referral to FEMA to complete the plan approval and adoption process. The final adopted Local Hazard Mitigation Plan will be posted on the Town and MARC websites and made available at the Andover Town Office.

4.2 Resources Consulted

Relevant plans, studies, reports, and technical information were consulted in addition to local input during the preparation of this plan. These sources provided data on hazard extent and historical trends, and ideas for new hazard mitigation actions. A partial listing of these sources includes the following:

- 2018-2023 Local Hazard Mitigation Plan, Town of Andover (Adopted August 27, 2018)
- Andover Town Plan (2018)
- Andover Flood Damage Prevention Regulations (2007)
- Andover Zoning Regulations (2016)
- Williams River Corridor Plan, (September 2016)

- Bridge and Culvert Inventory (2018)
- Flood Resilience Checklist for Vermont Communities-Andover
- FEMA Regulatory Flood Maps (FIRM) effective date 9/28/2007
- FEMA Flood Insurance Study (FIS) Report for Windsor County (including Andover, VT): FIS 9/28/2007 (50027CV001A.pdf (fema.gov); 50027CV002A.pdf (fema.gov); 50027CV003A.pdf (fema.gov); 50027CV004A.pdf (fema.gov))
- Vermont DEC Watershed Project Database
- MRGP Implementation Table Portal
- U.S. Census Bureau
- Census Data.gov
- NOAA Storm Events Database
- Climate.gov/Climate Explorer
- EPA Climate Change Indicators
- U.S. Climate Data
- USGS WaterWatch
- FEMA Disaster Declarations
- Vermont Agency of Natural Resources-Flood Ready Mapper
- State of Vermont 2018 Hazard Mitigation Plan
- State of Vermont DRAFT 2023 Hazard Mitigation Plan
- Drought.gov
- Vermont Transportation Flood Resiliency Planning Tool
- Mount Ascutney Regional Commission for mapping data
- Slow the Spread of EAB
- EAB - Agency of Agriculture, Food and Markets

4.3 Review of Town Progress, Resources, and Capabilities

4.3a Previous Plan Mitigation Actions

Table 4.3-1 below lists the mitigation and preparedness projects and actions from the previous Andover 2018-2023 Local Hazard Mitigation Plan and indicates the status of each. Seven of these fifteen actions were completed. Remaining actions were reevaluated and/or modified and carried forward along with on-going actions performed on an annual or periodic basis, for inclusion in **Section 6.2**, **Table 6.2-1: 2024-2029 Mitigation/ Preparedness Strategies and Actions**.

TABLE 4.3-1: Status of Previous Plan Mitigation Actions

2017 Mitigation Action (*Indicates Action to be included in this update)	Hazard Addressed	2023 Status
Consider VTculvert.org data, VT Road & Bridge Standards, Geomorphic Assessments, and Resident Input to Prioritize Culvert Replacement	Flooding, Erosion, Transportation Disruption	Ongoing. Used to project upgrades and annual operating budget for Highway Department
Replace and Upgrade Known Undersized Culverts based on above	Flooding, Transportation Disruption	Performed annually based on available funding current inventory.
Keep culvert/bridge inventory updated	Flooding, Erosion, Transportation Disruption	Ongoing. Vermont requires periodic culvert and bridge inventory updates.
Purchase additional emergency generator, or 1 fixed unit to power all 3 buildings, for critical facilities	High Winds, Severe Winter Weather	Completed. Three separate units were installed at each critical facility: Town Office, Town Hall, Highway Garage.
Review Location needs for additional hydrants and as funding becomes available*	Fire	Not completed. Revised/combined and carried forward to updated plan.
Map ponds as emergency water source*	Fire	Not completed. Revised/combined and carried forward to this updated plan.
Update Emergency Operation Plan (EOP)	All Hazards	Ongoing, annually. Now as LEMP. Local Emergency Management Plan
East Hill Road box Culvert #40 upgrade	Flooding	Not completed. Carried forward to this updated plan.
Attend training on floodplain management and flood regulation administration*	Flooding	Not completed. Modified and carried forward to this updated plan.
High bridge replacement	Flooding, Fluvial Erosion	Bridge #B9, completed.
Lovejoy double culvert replacement (upsize needed)	Flooding, Erosion	Completed. Replaced with a single 4ft culvert.
Stone Culvert Little Pond box culvert	Flooding, Erosion	Completed
Outlet Lily Pond on Little Pond new box culvert	Flooding, Erosion	Completed
30” Lovejoy by beaver pond to new box culvert	Flooding, Erosion	Completed. Replaced with a 4ft culvert.
Dorman Road double culvert replacement to new box culvert (near end by Sarley property)	Flooding, Erosion	Completed. Replaced with a single 4ft culvert.

2018 Mitigation Actions carried over to this update and listed in **Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions.*

In addition to the progress made as noted above, the Town has actively sought and received funding from the Vermont Agency of Transportation through the Municipal Roads Grant Program to upgrade culverts and roadways of priority hydrologically connected roads segments to meet Municipal Roads General Permit standards.

4.3b Review of Town Planning and Regulatory Documents

Andover Town Plan Review

Compared to earlier plans, the community has made some progress in its efforts to address sustainable development, protection and conservation of Andover's natural resources and hazard mitigation with the addition of a flood resiliency section.

In general, the Town Plan does refer to protecting its natural resources including forest blocks, ridgelines, wetlands, stream and rivers; maintaining and upgrading road infrastructure to manage stormwater; and encouraging flood resiliency through land conservation efforts. However, hazard mitigation policies and recommendations are limited to the flood resiliency section of the plan which is incorporated within the Natural and Cultural Resources chapter.

The *Flood Resiliency* section was incorporated into the Natural Resource section of the Town Plan with the intent to address statutory requirements of the flood resiliency element approved as Act 16 by the Legislature in 2013. The section has incorporated the following to meet this requirement:

1. Identify areas in the Town of Andover that are at significant risk for flooding and/or fluvial erosion.

2. Designate those areas to be protected from such hazards: Special Flood Hazard Ares, River Corridor, Lands Adjacent to Streams, Wetlands, and Upland Forests.

3. Articulate policies and strategies that promote community flood resilience.

Appendix D: Review of Town Planning and Regulatory Documents lists the policies, goals and recommendations in the Town Plan related to hazard mitigation. Upon review, the HMPT has identified mitigation strategies and actions that will meet objectives for both the Town and Hazard Mitigation Plans and actions to improve the incorporation of hazard mitigation in the next Town Plan update anticipated for 2025. These proposed actions can be found as noted in **Section 6.2**, **Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions.**

Flood Damage Prevention Regulations

Adopted in September 2007, these regulations are intended to manage all flood hazard areas by regulating development in the Special Flood Hazard Areas (SFHA) as designated by FEMA's National Flood Insurance Program (NFIP) to minimize loss of life and property; disruption of commerce; impairment of tax base; and the extraordinary public expenditures that result from flooding and other flood related hazards. These regulations ensure proper design and construction for permitted development in SFHAs and ensure compliance with NFIP for the Town and residents.

A permit is required for all proposed construction or development in a SFHA or floodway for consideration of conditional use and approval by the Zoning Board of Adjustment (ZBA). The Town Zoning Administer (ZA) is designated as the Administrative Officer (AO) for these Flood Damage Prevention Regulations and is charged with implementing these regulations and advising residents on floodplain development. The AO is responsible for reviewing permits and ensuring compliance with base flood elevation requirements, maintaining flood storge capacity of floodplains, stream alteration permitting, and other State Agency of Natural Resources regulatory compliance. A conditional use approval may be required by the Zoning Board of Adjustments (ZBA) prior to approval by the AO. An update to these outdated flood regulations is a recommended action item as noted in **Section 6.2**, **Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions.**

4.3c Community Resources and Capabilities

Table 4.3-2 below is a review and assessment of community resources and capabilities including town authorities, policies, and programs, which can be integral in reducing hazard risk and improving preparedness and response for the Andover community. Suggestions for improvement identified in **Table 4.3-2** have been added as action items for this plan update and can be found in **Section 6.2**, **Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions.**

TABLE 4.3-2: Status of Community Resources

Plans & Studies	Description	Improvement Opportunity **denotes addition to Table 6.2-1
Town Plan	Plan for coordinated town-wide planning for land use, municipal facilities, housing, transportation, etc. Updated every 8 years. Current draft is 2018.	Incorporate hazard mitigation recommendations into each Town Plan section, if applicable. **
Local Hazard Mitigation Plan (LHMP)	Plan for town-wide mitigation planning for hazard events and impacts. Updated every 5 years.	Begin update process earlier to avoid expiration and formalize annual review process to plot progress during plan period.
Stormwater Plan	No existing plan.	No recommendation.
Local Emergency Management Plan (LEMP)	Basic state managed municipal procedures for emergency response. Updated annually.	Public posting of management plan to raise awareness.
School Emergency Response Protocol	School procedures for emergency response provided by the state for school administrators and first responders.	No schools in Andover.
Forest Management Plan(s)	No existing plan.	Not enough municipal staff to oversee if developed.
Invasive Species Management Plan	No existing plan.	Potential for a volunteer resident to take on if funds are provided to develop and there is

		interest. **
Capital Improvement Plan	Municipal plan to coordinate financing of capital improvements over a 5-year period.	Incorporate a review of plan mitigation actions during budget process. **
Culvert Inventory (VT Culverts)	Statewide program to collect and report culvert locations and conditions.	Incorporate a study on vulnerable areas of repetitive washouts each inventory cycle to determine if further upgrades or additional culverts are needed beyond standards.

Administrative	Description	Improvement Opportunity
Emergency Management Director	The Emergency Management Director has direct responsibility for the organization, administration, and coordination of the local organization for emergency management.	No recommendation.
Planning Commission	Zoning or Subdivision Regulations. MARC assists with Town Plan and Flood Damage Prevention Regulation updates.	Consider subdivision regulations.
Zoning Administrator	Enforces Town zoning regulations and acts as Administrative Officer (AO) responsible for administering the Flood Damage Prevention Regulations (FDPR).	Obtain funding and assistance from MARC to update FHPR. **
Tree Warden	Responsible for and provides consultation on trees on public properties and rights-of-way.	Andover does not have a tree warden.
Fire Warden	Responsible for issuing burn permits, red flag warnings and responds to brush fires.	No recommendation.
Selectboard	Andover has a 5-member governing body charged with general supervision and control over the affairs of the Town and meets bi-monthly.	Include an annual review of progress on and evaluation of LHMP actions during a noticed Selectboard meeting. **
Mutual Aid Agreements	Agreement for regional coordinated emergency services and emergency highway support and resources during atypical events.	Agreements are formalized and maintained. No recommendation.
VEM Training	Training opportunities are provided via in-person and online courses administered through the Learning Management System (LMS).	Emergency Management Director position can benefit from participation.
Highway Department	Town Department responsible for maintaining Town roads and right of ways in accordance with VT's best management standards.	Proactively seek grant funding to improve flood resiliency of road infrastructure. **
Health & Safety	Andover has an individual that addresses public health hazards and health risks.	May be an opportunity for public outreach on risk of natural hazards to public health & safety.
Fire & Rescue	Andover has an arrangement with Chester Fire & Rescue for these services.	No recommendation.

Town Clerk/ Manager/ Administrative Assistant	Andover has no Town Manager. Town Clerk is responsible for recording and filing of all Town documents and website postings.	No recommendation.
Town Planner	Andover does not have a town planner and uses the Regional Planning Commission for these services.	No recommendation.

Financial Resources	Description	Improvement Opportunity
Town Budget	Fiscal spending plan that operates on a fiscal year of July 1st through June 30th.	Review list of LHMP action items with Selectboard and HMPT for potential operating or capital funding to be included in annual budget process.
Capital Improvement Plan	A plan of capital projects proposed to be undertaken during each of the following five years.	No recommendation.
Municipal Bonds	A bond or note or evidence of debt constituting a general obligation of the municipality.	No recommendation.
Taxing Authority	The Town; any governmental authority responsible for the administration of local taxes.	No recommendation.

Zoning & Regulations	Description	Improvement Opportunity
National Flood Insurance Program (NFIP)	Town participation provides eligibility for residents to acquire flood insurance.	Improve outreach efforts to residents and businesses in flood hazard areas on the NFIP program and flood mitigation information to increase participation. **
SFHA bylaws (Flood Damage Prevention Regulations-FDPR)	Regulates development in FEMA flood hazard areas. A permit is required for all development in these areas. Last adopted in 2007.	FDPR should be updated with public involvement. **
Zoning	Town Zoning Regulations regulate development. Last adopted 9/12/2016.	Consider incorporating flood and erosion hazards into zoning regulations.
Road Standards	State regulates design and construction standards for roads and drainage systems through Municipal Roads General Permit (MRGP). Effective at tracking and planning infrastructure upgrades.	Develop 3-5 year plan for compliance with MRGP to help reduce risk of road erosion and washouts.**
NFIP CRS	A voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the NFIP.	No recommendation.
Wetland Protections	Regulates development in wetland areas. State regulated and incorporated in FDPR.	No recommendation.

River Corridor bylaws	Regulates development in the River Corridor as determined by VT ANR. Andover does not currently regulate development in the river corridor.	Consider regulating development in the river corridor. **
Green infrastructure bylaws	Regulates development. Andover has no green infrastructure bylaws	No recommendation.
Building Codes	Under state purview by the Vermont Fire and Building Safety Code section 7 (1) requires a construction permit be obtained before beginning any construction. Andover FDPR may regulate building construction or flood damage repair or rebuild per NFIP.	No recommendation.
Access Permits	Andover regulates driveway access development.	Ensure permit requirements consider, or provide guidance on, flood resiliency to reduce erosion and washouts.**

Outreach and Education	Description	Improvement Opportunity
Town Newsletter	Routinely distributed newsletter containing information and resources for residents. Town uses a Listserv, Andover Words, which has worked well for public outreach.	No recommendation.
Town Website	Official Town website for community information. Town uses website for posting meeting and relevant town documents and for public news and outreach.	Post LEMP and LHMP on website.**
Town Facebook Page	Andover does not use Facebook for relaying municipal information to the public.	No recommendation.

** Included as an action item in Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions.

5. HAZARD IDENTIFICATION and ASSESSMENT

This Section describes the process used to identify the natural hazards that are likely to have the greatest impact on the community in the future and provides a basis for the selected mitigation strategies and actions listed in **Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions.**

The following assessment addresses all natural hazards identified in the 2023 Draft Vermont State Hazard Mitigation Plan. The probability of occurrence and impact to the town were used to assess the town's vulnerability to each hazard and is described in **Section 5.1.-Hazard Impact Assessment.** Following this assessment, hazards that were more likely to occur were prioritized for mitigation action and further examined for historical occurrence, extent of impact, future trends and community risk as outlined in **Section 5.2-Hazard Profile.** Hazards that were identified in the State Hazards Mitigation Plan as trending

higher due to climate change but not a priority during this planning cycle, are also covered in anticipation that these hazards may become of greater concern to the Town in the future.

5.1 Hazard Impact Assessment

This assessment began with identifying all possible natural hazards as addressed in the 2023 Draft Vermont State Hazard Mitigation Plan. Prior to the exercise, MARC presented projected trends of these hazards per the 2023 Draft State Hazard Mitigation Plan and talked about the difference between a weather event and a hazard as being the impact of these weather events. For example, **Wind** is a natural hazard which can impact a community from different types of weather events: Hurricanes, Thunderstorms and Winter Storms; **Erosion and Flooding** can result from Tropical Storms, Thunderstorms, Ice Jams or spring melt from an extreme heat event during the winter. This discussion also allowed for better understanding of the relationship among these natural hazards and with the potential secondary hazards, such as structure fire, power outages, and ice jams.

Types of Hazards and Potential Impacts:

Fluvial Erosion/Erosion	Landslides/Slope Failure	Inundation Flooding	Power Outage
Ice	Heavy Snow	Hail/Lightning	Dam Failure
Extreme Heat/Cold	Drought	Tornado	Earthquake
High Wind	Water Contamination	Infectious Disease	Ice Jams
Wildland/Structure Fire	Invasive Species	Transportation Incidents	

The group considered historical occurrences and projected trends to determine the ***Probability of Occurrence Score***. The potential severity and extent of damage and disruption to public infrastructure, economy, natural environment, and quality of life which includes damage to personal property and potential for injuries, were scored separately and averaged for the ***Average Impact Score***. The overall ***Hazard Assessment Score*** was obtained by multiplying the ***Probability of Occurrence Score*** by the ***Average Impact Score*** for each natural hazard as shown in **Table 5.1-1: Hazard Probability of Occurrence and Impact Assessment.** The methodology used for this exercise is detailed below the table.

TABLE 5.1-1: Hazard Probability of Occurrence and Impact Assessment

Hazard Impacts	Future Probability of Occurrence Score (1-4)	Potential Hazard Impact (Score 1-4)					Hazard Assessment Score (1-16)
		Public Infrastructure	Life & Property	Economy	Natural Environment	Avg. Impact Score	
Inundation / Flash Flooding	3.00	3.25	2.75	3.25	3.25	3.13	9.38
Fluvial Erosion/Erosion	3.00	2.25	2.00	2.00	2.50	2.19	6.56
Slope Failure	2.67	1.75	1.75	1.50	2.50	1.88	5.00
Ice	3.67	2.50	2.25	2.50	2.25	2.38	8.71
Heavy Snow	3.67	2.50	2.50	3.00	2.75	2.69	9.85
High Wind	3.00	2.50	2.50	2.25	2.00	2.31	6.94

Hail	2.00	1.25	1.25	1.00	1.00	1.12	1.12
Lightning	2.00	1.25	1.50	1.25	1.25	1.31	2.63
Extreme Heat	1.67	1.25	2.00	1.25	2.00	1.63	2.71
Extreme Cold	2.33	2.00	2.25	2.00	2.00	2.06	4.81
Wildland Fire	1.00	1.00	1.00	1.00	2.00	1.25	1.25
Earthquake	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Drought	2.00	1.50	2.00	2.25	2.25	2.00	4.00
Tornado	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Invasive Species	2.33	1.75	1.75	2.00	1.75	1.81	4.23
Infectious Disease Outbreak	2.00	1.25	2.25	2.00	1.25	1.69	3.38

Probability of Hazard Occurrence - Scoring Methodology

Probability of Future Occurrence: Probability of occurrence over the next 5 years

1 = Not Likely	Not expected or unlikely to occur during the plan period
2 = Occasionally	Could plausibly occur at least once every 5 years
3 = Likely	Likely to occur in any one year
4 = Highly Likely	Highly likely to occur at least once in any one year

Potential Hazard Impact - Scoring Methodology

Potential Impact: Probability of a Significant Impact defined as 'Severity and extent of damage and disruption to population property, environment and the economy'

1 = Negligible	Isolated occurrences of minor property and environmental damage, minor disruption of critical facilities and infrastructure, potential for minor injuries, no to minimal economic disruption.
2 = Minor	Isolated occurrences of moderate to severe property and environmental damage, brief disruption of critical facilities and infrastructure, potential for injuries, and minor economic disruption.
3 = Moderate	Severe property and environmental damage on a community scale, temporary shutdown of critical facilities, injuries or fatalities, short-term economic impact.
4 = Major	Severe property and environmental damage on a town-wide or regional scale, shutdown of critical facilities, and/or multiple injuries or fatalities, significant economic impact.

5.2 Hazard Profile

The assessment scores in **Table 5.1-1** are intended to highlight the hazards of greatest concern to the Andover community. The HMPT had determined that only those natural hazards with a Hazard Assessment Score of over a '4.0' out of a possible 16 were considered for mitigation. These are highlighted

in **Table 5.1-1** above. Other hazards which are trending higher in the region due to climate change, as determined in the 2023 Draft Vermont State Hazard Mitigation Plan, are also profiled here.

Subsections provide additional detail of each of these natural hazards and include a description of the hazard and its general impact on a community; a discussion of historical local occurrences and extent of the hazard impact based on available data; hazard trend and discussion of vulnerability to populations and community assets at risk. Andover is a small rural town, and much of the town-specific data for these natural hazards does not exist. Previous occurrence hazard data specific to Andover has been provided where available. Where no town-specific data exists, the most relevant available data or information has been provided, such as county, regional or state data, or data from a neighboring town.

Excluded Hazards

For purposes of the plan update, the following hazards have been excluded from detailed discussion given the likelihood of occurrence is either very low with no account of recent local occurrence or the hazard impact is very isolated or minimal as described below. For more information on these hazards, the reader is directed to the 2023 Draft Vermont State Hazard Mitigation Plan.

Hail and **Lightning** do occur but very rarely and have not resulted in reported damage to the Town of Andover. The greatest threat from lightning would be the ignition of a wildland or brush fire during the dry seasons which is covered in more detail under **Wildland Fire**. These incidents are very difficult to predict or mitigate and can only be addressed through preparedness and effectiveness of emergency response. Regional weather warnings and safety measures are issued when an extreme event is projected.

Although **Earthquakes** and **Tornados** can be significant hazards, the likelihood of occurring in northern New England over the plan period would be negligible per the Vermont State Hazard Mitigation Plan. However, as of the writing of this plan on April 8th, a 4.8 magnitude earthquake originating in New Jersey rattled the tri-state area and was followed by a 2.6 magnitude aftershock. Local regional recollection of this type of hazard occurring has been the sensation of minor tremors felt from distant events.

Drought and **Extreme Heat** are recognized as a natural hazard and trending higher due to climate change and are profiled below. However, Andover has rarely experienced these hazards over the past several years with minor isolated impact from residents with dug wells. The HMPT does recognize that drought, extreme heat and resulting wildfires can become more significant hazards in the future.

Infectious Disease Outbreak is defined by the Vermont Department of Health as one that is caused by micro-organisms, such as bacteria, viruses and parasites as noted in the State Hazard Mitigation Plan. A Covid-like pandemic may be plausible but is unlikely to occur during the plan period. While Tick borne diseases have been experienced and will continue to be a seasonal challenge, the Andover residents believe protection from this hazard risk is local common knowledge.

Changes from Prior Plan Hazard Assessment

A comparison was made to the prior plan's hazard assessment with notable changes listed below. Changes in the methodology used for the hazard assessment exercise and recent and trending climate extremes in wind, temperature and precipitation events are reflected in these differences.

- **Inundation and Flash Flooding** and **Fluvial Erosion** continue to be a high priority given the Town's geographical characteristics and development near flood hazard areas and the river corridor.
- **High Wind** is now identified separately as a significant hazard impact from winter storms and severe weather events with a high probability of occurrence and prevalence of higher wind gusts.
- **Infectious Disease Outbreak** has been added as a new natural hazard according to the State Hazard Mitigation Plan to be considered.
- **Hurricanes** and **Tropical Storms** are now considered events whose impacts are addressed under Flooding and High Wind.
- **Ice Jams** and **Dam Failure** are now recognized as potential impacts or secondary events due to winter temperature fluctuations and infrastructure deficiencies and are covered under Flooding, the primary natural hazard that triggers them.
- **Structure Fire** and **Hazardous Material Spills** are now recognized as secondary human-caused incidents that can result from a natural hazard occurrence. The Town recognizes that structure fire incidents may be secondary hazards to Wildland Fire, lightning, drought, and improper heating methods during extreme cold and can be addressed or reduced through outreach. Brush Fire has been incorporated into Wildland Fire. Hazardous spills would be considered a secondary man-made hazard caused primarily by winter road conditions and addressed through mitigation of hazards such as ice and heavy snow.
- **Variability** in temperatures, as well as the extremes for heat or cold, was discussed by the Town and worth noting here. Team discussions noted that the extreme variability during the fall, winter, and spring seasons has become a trigger for the frequency of occurrence and severity of several hazards such as ice, heavy snow, slope failure, ice jams, flooding and erosion.

Regional Overview

The types of hazards having the greatest impact on a regional basis can be gleaned from **Table 5.2-1**, a listing of **FEMA Disaster Declarations for Windsor County** since 1990. It can be seen from this table that these are typically severe storms with heavy rains that cause flooding.

TABLE 5.2-1: Federal Disaster Declarations for Windsor County VT[1]

Federal Disaster Declarations: Windsor County 1990 – 2023(current)			
FEMA Disaster Number	**Date of Declaration**	**Description**	**Date Occurred**
DR-4720-VT	July 14, 2023	Severe Storm and Flooding	July 7, 2023
EM-3595-VT	July 10, 2023	Vermont Flooding	July 9, 2023 (statewide)
EM-3567-VT	August 22, 2021	Tropical Storm Henri	August 22, 2021 (statewide)
DR-4532-VT	April 8, 2020	Vermont COVID-19	January 20, 2020
EM-3437	March 13, 2020	Vermont COVID-19	January 20, 2020
DR-4445-VT	June 14, 2019	Severe Storms and Flooding	April 15, 2019
4330	August 16, 2017	Severe Storms and Flooding	June 29, 2017
4207	February 3, 2015	Severe Winter Storm	December 9-12, 2014
4140	August 2, 2013	Severe Storms and Flooding	June 25-July 11, 2013

[1] FEMA Disasters Declaration Website, Accessed 12-20-2023

4022	September 1, 2011	Tropical Storm Irene	August 27-September 2, 2011
1790	September 12, 2008	Severe Storms and Flooding	July 21-August 12, 2008
1715	August 3, 2007	Severe Storms and Flooding	July 9-11, 2007
1698	May 4, 2007	Severe Storms and Flooding	April 15-21, 2007
1488	September 12, 2003	Severe Storms and Flooding	July 21-August18, 2003
1336	July 27, 2000	Severe Storms and Flooding	July 14-18, 2000
1307	November 10, 1999	Tropical Storm Floyd	September 16-21, 1999
1228	June 30, 1998	Severe Storms and Flooding	June 17-August 17, 1998
1101	February 13, 1996	Storms and Flooding	January 19-February 2, 1996
938	March 18, 1992	Flooding, Heavy Rain, Ice Jams	March 11, 1992

5.2a Inundation & Flash Flooding/Fluvial & Other Erosion

Hazard Assessment Score: 9.38 / 6.56

Flooding, including **flash flooding** and overbank or **inundation flooding**, and **Fluvial and Other Erosion** are significant natural hazard events for Vermont and Windsor County. Both **Flooding** and **Fluvial Erosion** have a high probability of occurrence and directly impact mostly those properties located near or in flood prone areas. However, during severe events they can indirectly impact the whole community. Both hazards are profiled here as they are intrinsically linked.

Flash flooding can occur near smaller upstream tributaries in mountainous terrain. It is characterized by intense, high velocity torrent of water moving downstream following a heavy rainstorm. Flash floods are very dangerous and destructive, causing severe land erosion and property damage. This type of flooding threatens high-elevation drainage areas called alluvial fans where water transitions from steep grades to flatter terrain. These events typically occur during summer when a single or series of weather events result in excessive rainfall over a short period of time on already saturated soils from a spring melt. Flash floods can also be triggered by a dam breach causing further damage downstream.

The damage from spring flooding events can vary greatly depending upon the amount of precipitation, snow cover, spring melt, soil saturation, existing erosion, and topography. Road infrastructure within the narrow stream valleys receive drainage from the higher elevations and are often the most vulnerable to damage from flooding caused by spring melt.

Inundation Flooding occurs in lower lying areas when water levels rise overflowing the banks of a river or lake. In hilly or mountainous areas, drainage from higher elevations flows to the lower reaches or valleys of a watershed causing these waters to rise quickly. Instances of inundation type flooding can occur long after precipitation has ended or when no precipitation has occurred, such as an extreme winter warming event causing river ice to melt resulting in ice jams obstructing the flow of river waters. These waters often carry with it debris which can block culverts or bridge underpasses exacerbating flooding.

Stable river channels naturally meander adjusting with periodic flooding. Floodwaters will rise and enter low lying **floodplain** areas temporarily which lessen the volume and velocity of water flowing downstream reducing the flood risk to downstream properties, villages and town centers. When floodwaters are restricted from their natural corridor, water velocity increases and **fluvial erosion** occurs with the scouring of riverbeds and riverbanks as the river tries to adjust. This action destabilizes nearby roads, bridges, residential properties and other man-made structures built within the river's natural corridor.

Flood Zones Explained

The Federal Emergency Management Agency (FEMA) has designated flood zones, as defined below. The designated *Special Flood Hazard Areas* (SFHA) have the highest risk of flooding. These areas include the floodway and the river's floodplain.

Flood Zone Definitions	
Floodway	The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height; also known as the regulatory floodway. As designated and determined by FEMA.
Special Flood Hazard Area (SFHA)	The land in the flood plain within a community subject to a 1 percent or greater chance of flooding in any given year; also known as **floodplain.** As designated by FEMA. Key part of the *National Flood Insurance Program* (NFIP). Includes Floodway Fringe (Zone A and Zone AE).
River Corridor	The land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition and for minimization of fluvial erosion hazards. Generated automatically as a 50-foot buffer on each side of the meander belt width. As delineated by the Agency of Natural Resources in accordance with river corridor protection procedures. (See figure below)
Fluvial Erosion	The erosion or scouring of riverbeds and banks during high flow conditions of a river. Fluvial erosion can be catastrophic when a flood event causes a rapid adjustment of the stream channel size and/or location. These areas are found within the River Corridor.

The land area that a river accesses to meander and overtop its banks to release flood energy without excessive erosion is known as the **River Corridor.** This is a depiction of a typical stream with its River Corridor area highlighted and an example of the meandering pattern of the stream over time within that corridor.

Areas within the river corridor are considered areas of both flood and erosion risk as rivers and streams seek equilibrium in accommodating the high flows causing major flood and erosion damage even outside of SFHAs.

Flood damage within and outside of the river corridor is becoming more frequent due, impart, to the relative frequency of these storms which continue to scour unvegetated streambanks before they've had the time to regenerate and dislodging loose debris in streambeds that are washed downstream blocking bridges and culverts causing flooding in atypical areas.

Vermont Agency of Natural Resources has mapped FEMA Special Flood Hazard Areas (SFHA) and River Corridors for the Williams River and its tributaries and can be found on-line.[2] These maps are in the process of being updated with new maps to be released in 2026. River Corridors are currently being modified to reflect the valley topography more closely and will allow for improved identification of elevated fluvial erosion hazard areas.

Fluvial Erosion, which often accompanies flood events, is the predominant form of flood damage in Vermont and in mountain valley towns like Andover. Rivers are dynamic and move both water and sediment. As a result, river channels may move vertically or horizontally. High flows can cause sediment to become detached from a riverbed or riverbank, which can range from gradual bank erosion or massive **slope failure** to catastrophic changes in river channel location and dimension. The sediment and stone that is dislodged can expose tree roots and wash away vegetative buffers which are carried downstream blocking culverts and bridges causing further flood damage.

Vermont is vulnerable to this hazard because of its topography, extreme climate, heavy snow, destructive ice jams and intense rainstorms. Centers of commerce in villages and towns became concentrated along riverbanks, and over time as forests were cleared, many rivers moved or were channelized to accommodate this development rendering them unstable and prone to fluvial erosion.[3] Fluvial erosion can severely threaten mountain communities as most rural town development lies in valley areas along rivers and streams.


Courtesy Brattleboro Reformer: Kristopher Radder

Ice Jams can also cause a secondary event of flooding and threaten many of the same properties located within the FEMA SFHA. Common in New England, ice jams occur during winter and spring months when river water levels rise, or a spring or mid-winter thaw breaks the ice into large chunks which become jammed at manmade and natural obstructions. Ice can build up against bridge abutments and expanses, undersized structures, and other obstructions to create a temporary dam impounding large volumes of water that has the potential to damage infrastructure and flood surrounding areas as depicted here. Frequent thawing and milder temperatures during winter months may prevent deep ice from forming, reducing the likelihood of this hazard.

[2] The ANR FLOOD READY link shows river corridors overlays and FEH zones, http://floodready.vermont.gov/assessment/vt_floodready_atlas.

[3] Municipal Guide to Fluvial Erosion Hazard Mitigation, Vermont Agency of Natural Resources

Flooding and Erosion: History and Extent of Impact

Flooding and erosion are the most common types of natural hazards that occur frequently in Vermont. During the hazard assessment exercises, flooding and erosion hazards were identified as outcomes from various weather events including **hurricanes, tropical storms, ice jams, severe thunderstorms, or heavy rain events**.

State and Regional Flood and Erosion History and Impact

Although **hurricanes and tropical storms** rarely impact Vermont, they have historically caused the greatest state natural disasters.

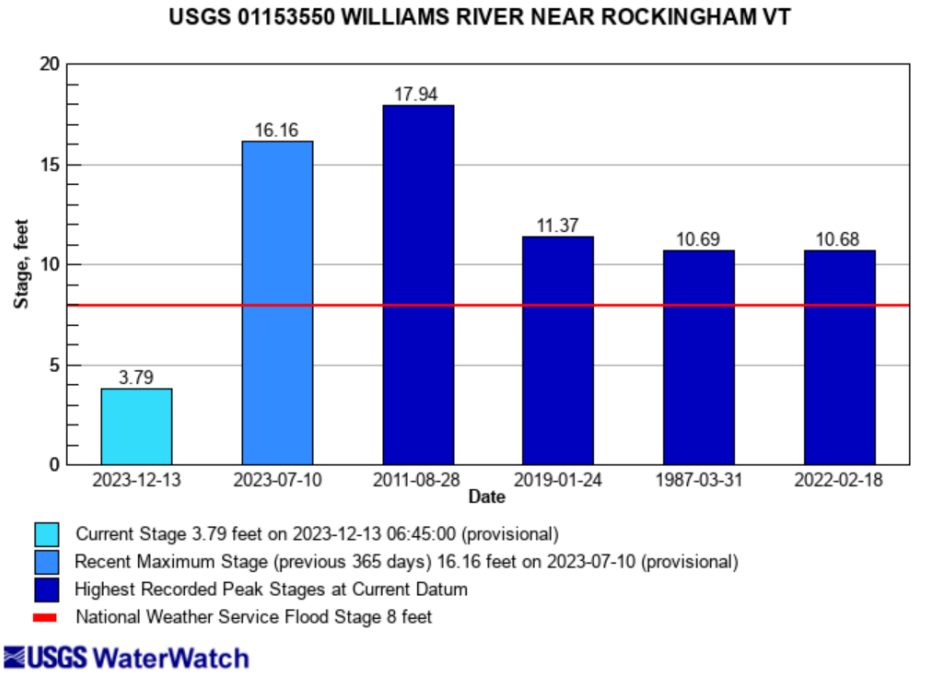
The Flood of 1927 termed 'the greatest natural disaster' was a 500-year flood event caused by a tropical system in Vermont in November with over 9 inches of rain falling on frozen ground that caused the most extensive flooding and structural damage and greatest loss of life in recorded history for the state. The Great New England Hurricane of 1938, one of the most powerful and destructive hurricanes to hit southern New England and the southeastern region of Vermont, was claimed to have changed the landscape of the state. With winds over 100 mph, the storm caused extensive tree damage with over $300M in total damages ($5 billion in current dollars). These significant state-wide historical flooding events and their impact on the region are detailed in **Appendix E: Vermont Historic Flood Events.**

On a regional level, FEMA assistance for the most recent of these Declarations impacting Windsor County is shown below in **Figure 5.2-2: Regional Impact of Federally Declared Disasters**. Tropical Storm Irene, in late August, 2011 brought much devastation; record flooding was reported across the state and was responsible for several deaths. Irene dumped as much as 11 inches of rain on parts of Vermont and caused $733 million in damage. In all, it checked in at $15.8 billion, the seventh-costliest hurricane in American history. FEMA Public Assistance provided $232,000,000 to cover damage from flooding and erosion. These flood damages are associated with both inundation flooding and fluvial erosion; however, data indicate that greater than 75% of flood damages are associated with fluvial erosion.

In the year 2011, four regional disaster declarations were issued in Vermont due to flooding and fluvial erosion. The fourth was Tropical Storm Irene, estimated at over a 100-year flood event, occurred in late August when up to 11 inches of rain fell in some areas of the State. The recently declared flood disaster of July 2023 is still under assessment and damages are not included here.

On a local level, relative flooding events are measured by the United States Geological Survey (USGS) which maintains a streamgage on the Williams River in Rockingham, VT located 15 miles downstream from Andover that monitors the daily height of the river. During Tropical Storm Irene, and again in July 2023, the gage height exceeded major flood stage, as shown below in **Figure 5.2-1**.

FIGURE 5.2-1: Historical Gage Heights for Williams River near Rockingham, VT[4]



Major Flood Stage:	15
Moderate Flood Stage:	12
Flood Stage:	8
Action Stage:	6

***Note** the gage height approached 'Major Flood Stage' of 15 feet during Tropical Storm Irene at 14.95 feet. Since Irene, flood stage has been exceeded in 2019 and 2023.*

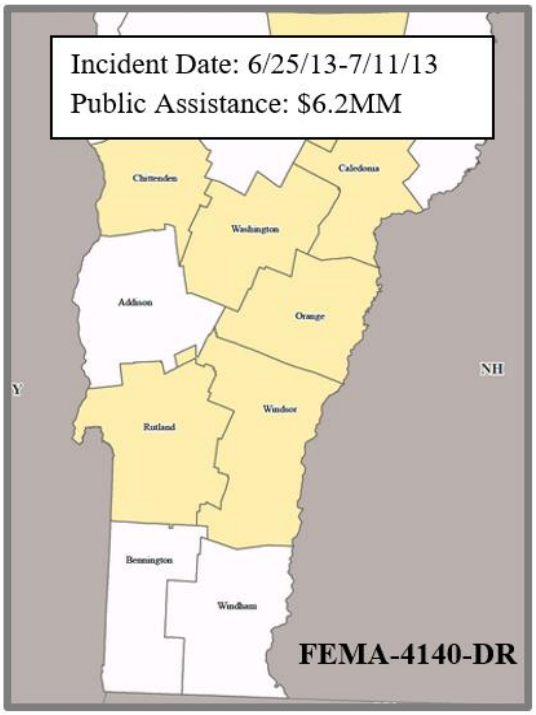
[4] http://waterwatch.usgs.gov accessed in 12.13.2023, Toolkit, Flood-Tracking Chart

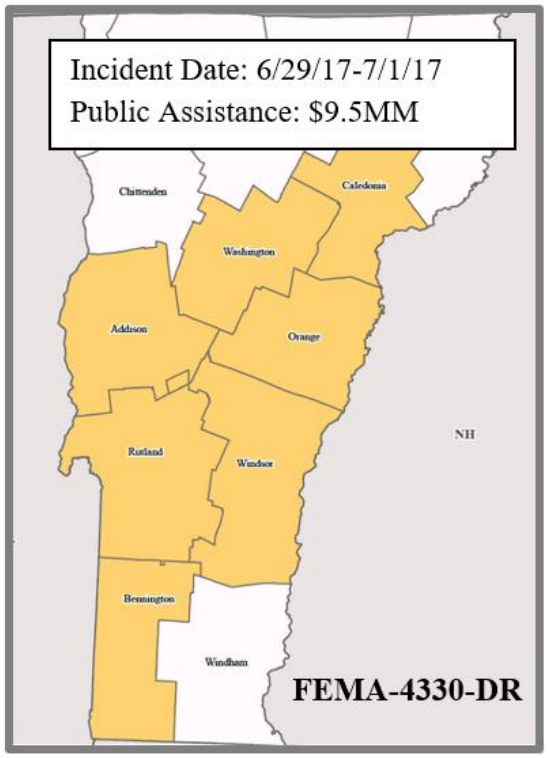
FIGURE 5.2-2

Designated Counties
- No Designation
- Public Assistance
- Individual Assistance and Public Assistance

Regional Impact of FEMA Declared Disasters

Severe Storms and Flooding





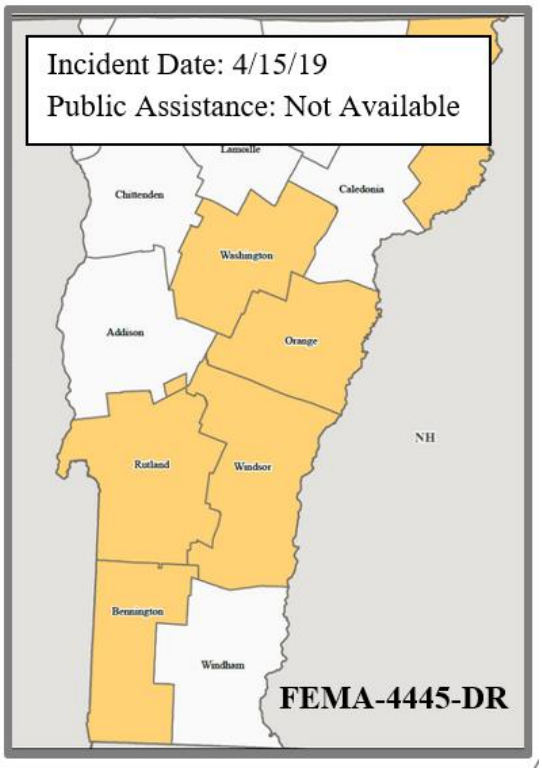
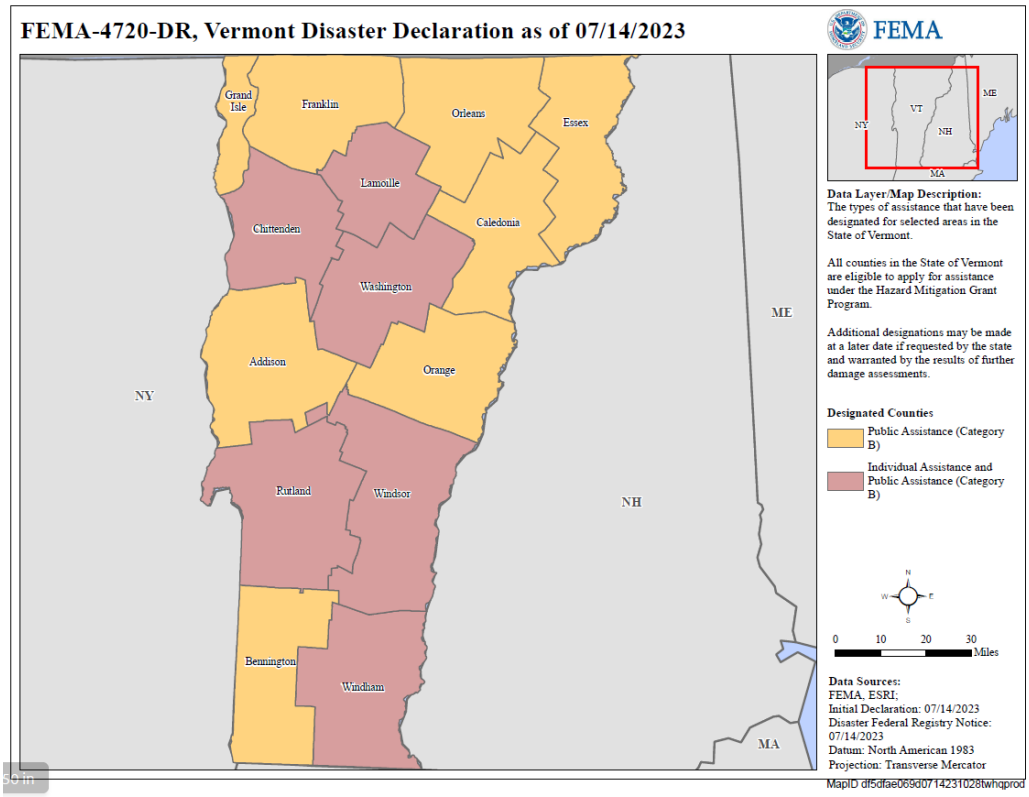
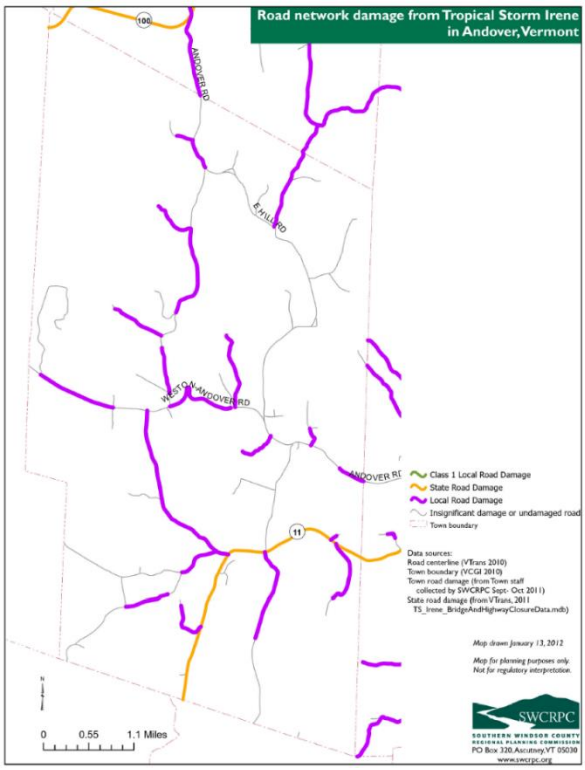


FIGURE 5.2-2 (cont.)
Regional Impact of
FEMA Declared Disasters
Severe Storms and Flooding

At the time of this plan writing, severe storms and flooding in Vermont have severely impacted several counties in Vermont prompting a Federally Declared Disaster #DR-4720-VT, announced on July 14th, 2023. Severe storms and heavy rainfall on July 7th, following weeks of prior persistent precipitation, caused catastrophic flooding, erosion, and infrastructure damage in Windsor County. The Towns of Andover and neighboring Cavendish, Londonderry, Ludlow and Weston were the hardest hit in the region. Damage is currently being assessed.



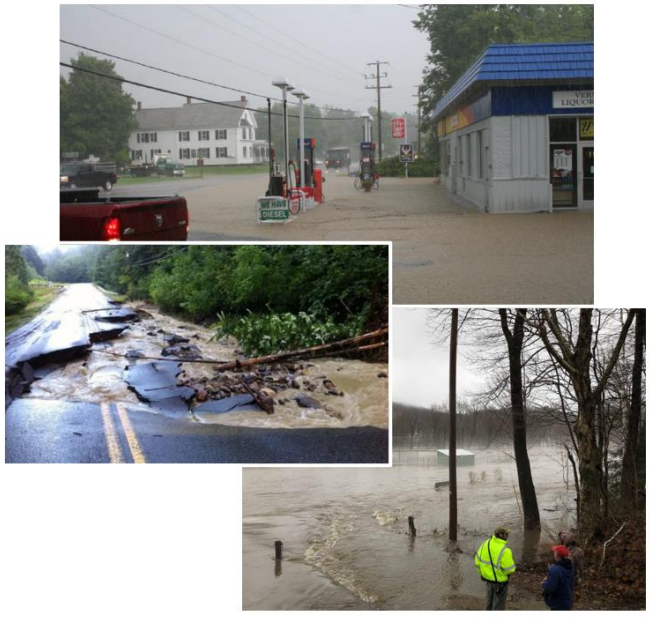


Local Flood and Erosion History and Impact

Flooding is the most probable hazard event in Andover, with flash flooding posing the biggest risk for the upland community and inundation flooding for residents along the Middle Branch River which runs along VT Route 11 (**Appendix A: Map #3 -Natural Resources and Flood Maps #8-#11).** The Andover community has experienced four significant flood events within the last 15 years following Tropical Storm Floyd in 1999, Tropical Storm Irene in 2011, isolated events in 2013 and 2014 and most recently, July 2023. Most of Andover's Road network was impacted by Irene.

Since Irene, flooding and fluvial erosion damage have occurred in limited areas of the State from intense, scattered storm events and ground saturation from persistent and excessive rainfall. Damage from more recent localized flooding events impacting the region is described below. Events in 2013 and 2014 were the result of localized heavy rainfall causing flash flooding in upland areas of Andover and washed out steep sloped communities and roadways.

- In July 2013, two to three inches of rain fell in two hours over eastern Windsor County. This followed a record spring rainfall and resulted in flash flooding (Estimated damage: $25k).
- In July 2014, a stationary thunderstorm developed that dropped three inches of rain an hour resulted in the region causing significant damage to transportation infrastructure, residential and commercial properties, and agricultural areas. Main access roads to dozens of homes within the watershed were severed (Estimated damage: $1M).

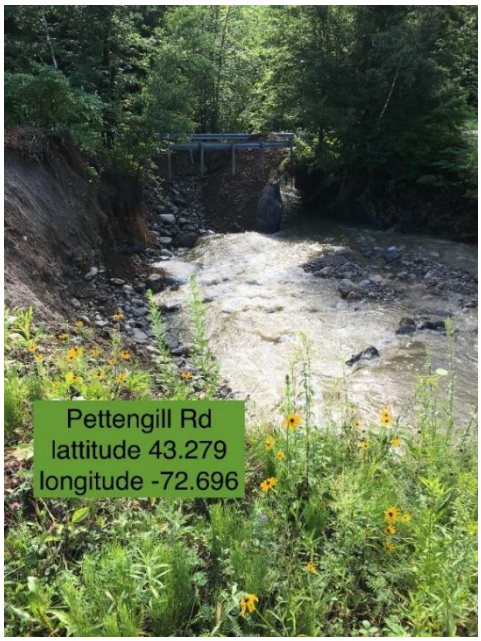


Like many other towns within southern Windsor County, Andover is at risk for fluvial erosion and upland erosion from flash flooding and heavy rain events resulting in failure of infrastructure including washout of gravel roads and culverts and bridges damage. Damage from erosion because of flooding can be costed

by the capital required to repair and replace these structures, however, these reparation costs from past fluvial erosion events are not specifically identified as separate from the flooding event that caused it.

In recent history, severe damage from repeated flooding and fluvial erosion flooding events in Andover, have widened the riverbed of the Middle Branch, a major tributary of the Williams River, and stripped riverbanks bare of natural vegetation making them more susceptible to further erosion and landslides. Riverbeds have become shallow with additional silt and gravel forming islands in the middle of the river causing the channel to divert in new directions outside of the mapped SHFA and floodplains. These river islands vegetate over time with shallow roots invasives, such as knotweed, that are then uprooted in the next high flow event and carried to block a downstream underpass or culvert causing additional flooding in areas that would not have otherwise occurred.

Flashy streams from Andover's steep slope terrain in the upland headwater areas are vulnerable to flash flooding during heavy rain events causing townwide erosion damage.



The July 2023 event followed a wet June. Heavy rainfall in early July of up to 10 inches caused widespread river flooding throughout the central part of the state shutting down entire neighboring communities of Ludlow, Londonderry and Weston. Below are photos from these neighboring towns during this event.

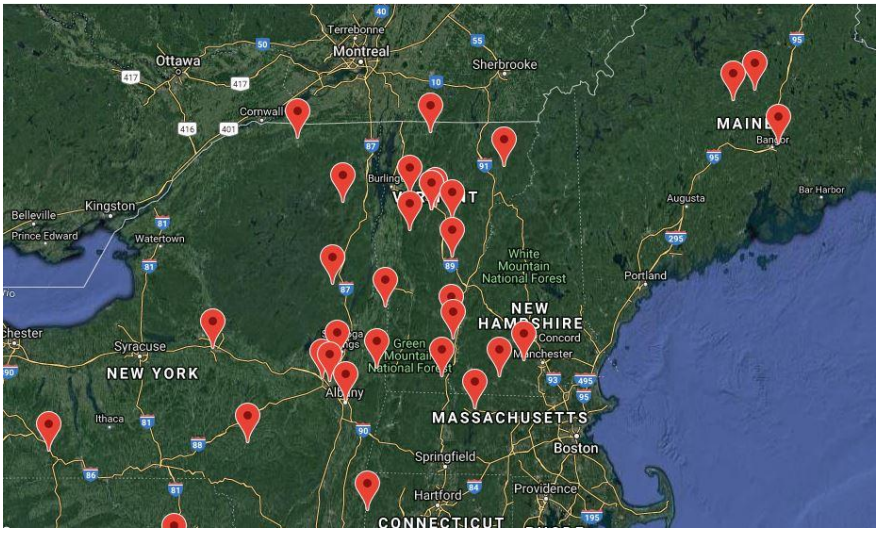
While statistics and damages are still being assessed as of the writing of this plan, the Town of Andover has documented severe damage, currently estimated at $985,000. Road washouts in Andover reached lengths of 2,500 feet and depths of over 9 feet. Details of road damage during Irene and the July 2023 flood events can be found in **Appendix F: Documented Flood Damage**.

Ice Jams remain a threat to riverside communities like Andover. The most devastating winter floods have been associated with a combination of heavy rainfall, warm temperatures, and rapid snowmelt. Winter weather with less than average snowfall can result in greater ice buildup on streams and rivers, potentially resulting in greater ice jam damage. [5]

Vermont ranks tenth with a total of 987 ice jam events in 310 locations between 1/1/1785 and 2/26/2017, according to the Ice Jam Database State Summary Report, which is maintained by US Army Corps of Engineers' Cold Regions Research and Engineering Laboratory (CCREL). **Figure 5.2-3** below identifies the location of ice jam events in the region during 2019.[6] Vermont had experienced more ice jams in 2021 than any other New England state. Many ice jams go unrecorded and are of minor threat to Andover. Below are ice jams recorded along the Williams River and its tributaries.

- Ice jams on Williams River, and tributaries Middle Branch and South Branch (2/1976)
- Ice jam on Williams River (1/1990)
- Ice jam on Williams River (1/1996)
- Ice jam on Williams River (1/1999)
- Ice jams (2) on Williams River (12/2000)
- Ice jams on Williams River (2007)

FIGURE 5.2-3 : 2019 Ice Jam Locations, CRREL Database

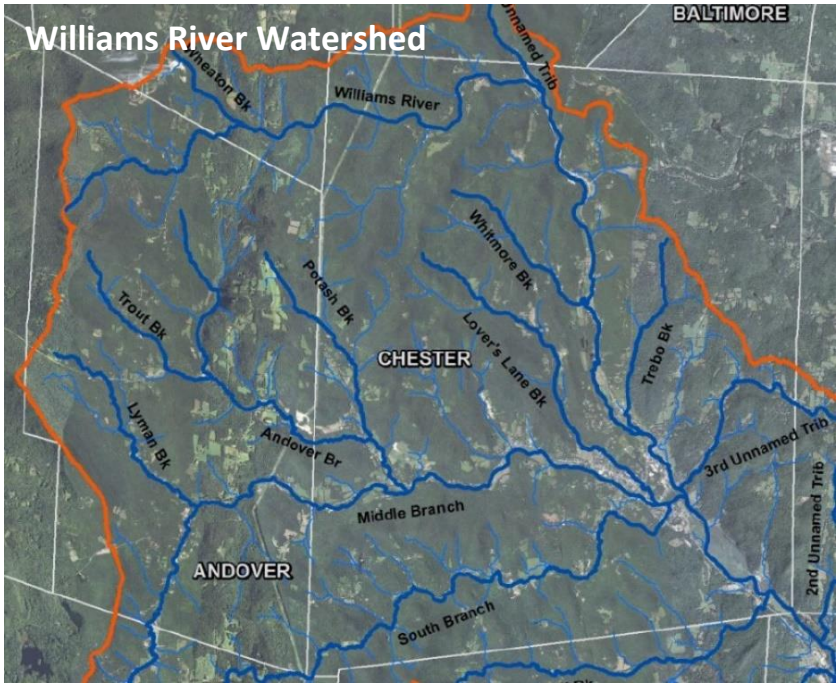


[5] CRREL Ice Jam Database
[6] CRREL Ice Jam Database

Flooding and Fluvial Erosion: Trends and Vulnerability

Over the past several years, flooding has occurred in limited areas of the State from intense, scattered storm events and ground saturation from persistent and excessive rainfall. In the past 13 years, since Tropical Storm Irene, Windsor County has experienced 8 FEMA declared flooding events. The prior 19 years saw a total of 9 declared flooding events which indicates a trend of increasing frequency. In recent years, flood intensity and severity also appear to be increasing. According to prior *State of Vermont Hazard Mitigation Plans*, studies show that areas of the State can expect a greater frequency of flooding with an increase in extreme rainfall amounts.[7] The frequency and extent of Fluvial Erosion is also increasing given the frequency of flash and inundation flooding which leaves stream banks eroded and unable to revegetate before the next heavy rain or flood event. Extreme fluctuations in temperature during winter months with late winter rainstorms exacerbates these trends which can be expected to increase in frequency and intensity with climate change.

A region's **vulnerability** to flooding and erosion depends on topography, as well as meteorological events. The Town of Andover lies almost entirely within the Williams River watershed, part of Basin 11, a sub-watershed of the Connecticut River Drainage Basin. The Middle Branch, a major tributary of the Williams River, flows through the southeast corner of Andover merging confluences with smaller headwater streams Trout Brook, Andover Branch, and Lyman Brook. Residential properties along these streams are most at risk from this hazard as shown in flood hazard maps in **Appendix A: Local Flood Maps 8-11.**



The valley areas along Route 11/Simmonsville Rd., which run along the Middle Branch are at risk for both inundation flooding and fluvial erosion, particularly the properties and roadway that are located where the river bends. According to a Williams River Stream Geomorphic Assessment and 2016 River Corridor Plan the channel is highly active and dispositional through these sections. Five residential properties were identified where houses were at risk of damage due to eroded banks and unstable slopes. One property completed a FEMA buyout following the 2014 flood event and the site pictured below shows an eroded slope which began during Irene and has continued to worsen. The garage foundation is exposed and undercut as shown in the photo below. The property owner is now considering a buyout.

[7] 2018 State of Vermont Hazard Mitigation Plan

[photo]

During the most recent July 2023 flood event, a swift water rescue was performed at the Horseshoe Acres mobile camping grounds rescuing 13 campground members from rapid moving waters. Horseshoe Acres is a particularly vulnerable area at the confluence of Trout Brook and Andover Branch (**See Appendix A: Local Flood Map #8).**

Horseshoe Acres Campground

For the Town of Andover, vulnerability from a major flood event is influenced by several factors:

- Approximately, 5% of all structures in Andover are located within a SFHA or River Corridor.
- There are numerous expanding beaver impoundments that flood adjacent roadways, particularly along Little Pond and Middletown Rd., cutting off access to evacuation routes.
- Andover has several large residential ponds that threaten properties and roads if breached.
- Headwater streams that run through wooded areas are vulnerable to fallen trees blocking the stream channel and catching debris causing overtopping that flood and erode gravel roads.

Table 5.2-2 below lists the number and types of vulnerable structures in Andover that lie within the Special Flood Hazard Zones (Floodway and Floodway Fringe) and the River Corridor. This map assessment has identified 29 at-risk structures, or 5% of Andover's total number of units, located within the river corridor or SFHA. Note that this map source does not consider the new river and stream channels that have formed from the most recent events, nor the individual units as part of the Horseshoe Acres Mobile Campground shown above. (**See Appendix A: Flood Maps #8-#11).**

TABLE 5.2-2: Andover Structures Located within Flood Hazard Zones and River Corridor [8]

		Flood Zone			
	Total Units in Town	Special Flood Hazard Zone	River Corridor	Total Units at Flood Risk	Percent of Total Units in Town
Building Type	# Units	# Units	# Units	# Units	%
Accessory Bldg	121	1	3	3	2%
Camps	17	0	1	1	6%
Commercial	34	0	0	0	0%
Civic/Religious	6	0	1	1	17%
Mobile Home	11	0	1	1	9%
Multi-Family	1	0	0	0	0%
Single-Family	453	2	21	21	5%
Other	12	0	2	2	17%
Totals	**655**	**3**	**29**	**32**	**5%**

Populations most at risk for flash flooding include those within the Horseshoe Acres Campgrounds during the spring, summer and fall seasons when it is most active, properties along Trout Brook, Andover Branch, and Lyman Brook, and residents residing along roadways that that are most likely to incur substantial damage during a flood or heavy rain event identified in the **TABLE 5.2-3** below. This is based on information on extent of damage from the Highway Department.

TABLE 5.2-3: Relative Roadway Damage Assessment

Damage from Tropical Storm Irene		Roads With Notable Damage	Damage from July 2023	
minor	major		minor	major
✓		East Hill		✓
	✓	Gates		✓
	✓	Howard Hill		✓
	✓	Little Pond	✓	
	✓	Lovejoy Brook		✓
	✓	Marsh Hill	✓	
	✓	Middletown		✓
	✓	Newton		✓
	✓	North Hill		✓
	✓	Old Gulf		✓
	✓	Pettengill		✓
	✓	Schmidt		✓
	✓	Simmons		✓
	✓	Stigers	✓	
	✓	Trombley	✓	
✓		Weston-Andover		✓

The vulnerability of Andover's infrastructure is a main concern for the Town. A comparison of damaged roadways, bridges and culverts from Tropical Storm Irene and the latest July 2023 flood event highlight the areas of greatest risk. Although these two events affected different sections of town, overlap of repeated damage is apparent. The Table below shows the relative damage that occurred from the last two noteworthy events. The damage consisted of road washouts, damaged or washed out and lost culverts, plugged culverts, lost guardrails, debris accumulation and damaged pavement. Based on this data, the highlighted roads in the table are the most vulnerable. These were severely impacted by both events sustaining damages of $200k or more. Details of extent of road damage can be found in **Appendix F: Documented Flood Damage.**

[8]GIS analysis using E911 building points (2023), FEMA-mapped floodplains (2022), and ANR-mapped River Corridors (2019). Some structure locations may have changed since this data was compiled.


Schmidt Road
latitude
43.332
longitude
-72.73


Shmidt Rd
latitude 43.332
longitude -72.729


Middletown Road
latitude 43.264
longitude-72.729

In addition, future development must consider areas susceptible to fluvial and other erosion. New residential property buyers tend to seek out high sloped areas for the mountain view to build homes, access ways and install ponds. These projects often require extensive clearing of forested areas threatening ridgelines and increasing stormwater runoff and flood risk to properties below.

National Flood Insurance Program (NFIP)

The National Flood Insurance Program (NFIP) aims to reduce the impact of flooding on public and private structures by both providing insurance and encouraging proactive adoption and enforcement of floodplain management regulations. [9]

Andover has been a participatory, non-sanctioned member of the National Flood Insurance Program since August 5, 1985. Andover will continue to regulate floodplain use through the **Flood Damage Prevention Regulations** as adopted in 2007. These regulations apply to the Special Flood Hazard Areas, as determined by the most current published flood insurance maps by NFIP/FEMA, FIRM effective date 9/28/2007 and as published by the Vermont Agency of Natural Resources. Base flood elevations and floodway limits provided by NFIP and in the Flood Insurance Study and accompanying maps are used to administer and enforce these regulations. The Zoning Administrator is the acting Administrative Officer and is charged with implementing these regulations and advising residents on floodplain development.

Current NFIP policies and claims are summarized in **Table 5.2-4**[10]. Based on these statistics there have been no repetitive loss properties to date.

TABLE 5.2-4: Andover National Flood Insurance Program Statistics (Report Date 4/4/2024)

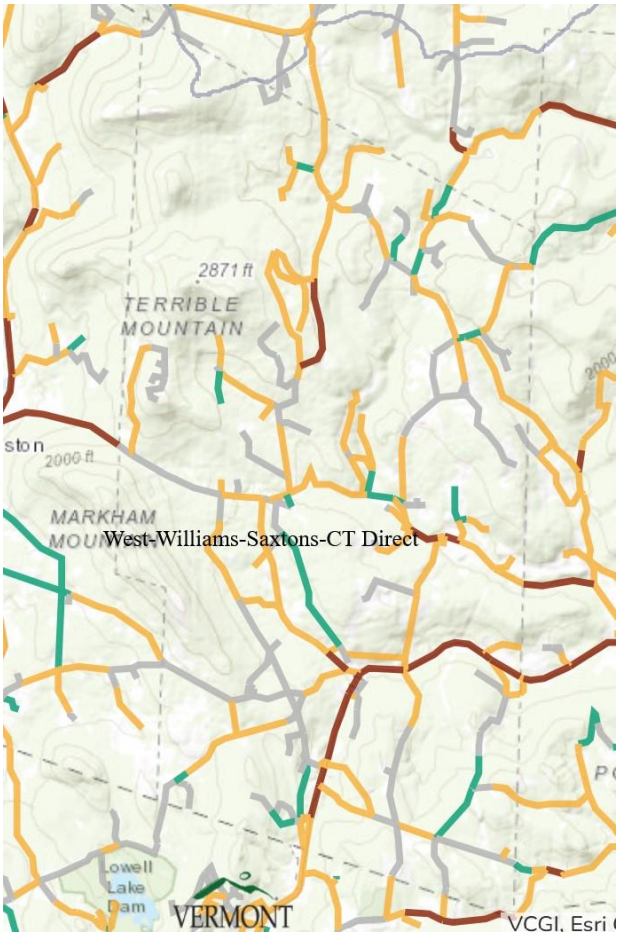
# of Policies	# of Policies in A Zone	Total Premium	Total Coverage	# LOMCS	# of Claims Since 1978	Claims Paid Since 1978	# of Repetitive Losses
4	0	$2,149	$1,230,000	0	4	$40,665	0

The community areas most at risk for flooding and erosion as described above became apparent following Irene and more recent storm events. Properties on the highlighted roads listed above in Table 5.2-3 and those parcels along the Middle Branch are most at risk. Although repairs and culvert upgrades have reduced the Town's flooding and erosion risk and other best management practices to control stormwater runoff, most of the impacted areas in Town remain vulnerable. Continued fluvial erosion from heavy rain events causes stone, gravel, and woody debris from upstream to be swept downstreet filling the river channel and blocking culverts and bridge underpasses. This has flattened riverbeds allowing easier overflow from now shallow banks resulting in the formation of new stream channels creating new at-risk areas outside of the flood hazard areas and river corridors.

[9] FEMA Flood Insurance

[10] Vermont Flood Ready Community Reports for FEMA Policy & Claim Statistics for Flood Insurance -Claim Information by Town, accessed 4/4/2024.

Town Bridges and culverts are also vulnerable to flood and fluvial erosion damage. Although previous repairs and upgrades following Irene held up during the recent July 2023 flood event, much of the Town infrastructure remains undersized constricting flow or is poorly aligned, particularly larger structures which are more costly to replace. Blocked culverts compromise the structural integrity and safety of the road crossing resulting in damage to adjacent properties. Bridge and Culvert Inventory assessments are conducted every three years and provide the Town with information used to plan for infrastructure replacements and upgrades. In addition, the Williams River Corridor Plan identifies culvert and bridge upgrades or removal projects for reducing flood and erosion hazard risk, as well as opportunities for increasing access to natural floodplains.



Vermont State has focused its efforts over the past four years on "hydrologically-connected" road segments as part of the ***Municipal Roads General Permit (MRGP) Standards***. These standards will help to increase flood resiliency and reduce the risk of road erosion. The last road inventory, completed in 2018 based on these new standards, provides the Town with information on roads most vulnerable to erosion and is consulted in prioritizing road work each year. Andover has made significant progress in bringing high priority segments into compliance.

The Vermont Transportation Resilience Planning Tool (TRPT) combines river science, hydraulics and transportation planning methods and is applied at a watershed scale. The Tool identifies bridges, culverts, and road embankments that are vulnerable to damage from floods, estimates risk based on the vulnerability and criticality of roadway segments, and identifies potential mitigation measures based on the factors driving the vulnerability. A snippet is shown here. The full map for Andover can be found in **Appendix A: Map #7-TRPT Map**.

5.2b. Heavy Snow/Ice/Extreme Cold

Hazard Assessment Score: 9.85 / 8.71 / 4.81

Heavy Snow and **Ice** are significant natural hazard events for Vermont, Windsor County and the Town of Andover. Both have a high probability of occurrence and can have a substantial widespread impact on town infrastructure isolating some residents at higher elevations.

Winter storms and **blizzards**, with **snow**, **ice**, **wind** and **extreme cold** in varying combinations, are commonplace in Vermont, Windsor County and occur town wide in Andover. Heavy accumulation of snow can be accompanied by strong winds, cold and low wind chills. Drifting snow from high winds causes low visibility and makes it difficult to keep roads clear. Heavy wet snows of early fall and late spring, as well as ice storms and **freezing rain**, often result in power outages and property damage, leaving people without adequate heating capability. Ice glazed roadways and sidewalks, difficult to detect, are extremely hazardous to pedestrians and motorists. Power and communication loss is often the result of downed trees from heavy wet snow or ice accumulation combined with strong wind gusts which pull down utility lines and can disrupt traffic and emergency response by making roads and driveways impassable. Severe winter storms with heavy accumulations of snow, cold/wind chills, strong winds, and power outages can result in high rates of damage and even higher rates of expenditures.[11]

Severe winter storms in the northeastern United States develop through the combination of weather and atmospheric conditions including the moisture content of the air, direction of airflow, collision of warm air masses coming up from the Gulf Coast, and cold air moving southward from the Arctic.[12] Winter weather related Warnings, Watches and Advisories are issued by the local National Weather Service office based on local criteria.

A Nor'easter is a large weather system traveling from South to North, passing along, or near the Atlantic seacoast. Cyclonic winds impact the coast and inland areas from a northeasterly direction. The sustained winds may meet or exceed hurricane force.

Blizzards are defined by the National Weather Service as "sustained winds or frequent gusts of 35 mph or greater (and) considerable falling and/or blowing snow reducing visibility frequently to 1/4 mile or less for a period of three hours or more[13]."

Ice Storms are defined by the National Weather Service as "occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice are considered to be of ¼" or greater."[14] Multiple sources state that a ¼ inch of ice accumulation from an ice storm can add 500 pounds of weight on the lines between two power lines.

Flash Freeze occurs when temperatures rapidly fall below freezing during precipitation with sudden severity in travel conditions. Extreme variations in topography and altitude on Vermont roadways make this a common hazard for motorists. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

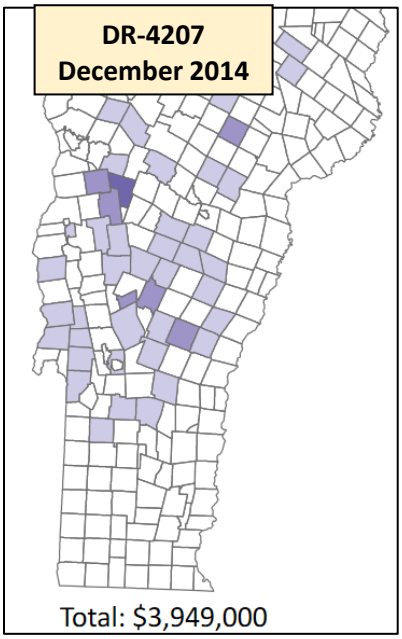
Black ice is a deadly driving hazard defined as patchy ice on roadways or other transportation surfaces that cannot easily be seen. It is often clear (not white) with the black road surface visible underneath. It is most prevalent during the early morning hours, especially after snowmelt on the roadways has a chance

[11] 2018 State of Vermont Hazard Mitigation Plan
[12] 2018 State of Vermont Hazard Mitigation Plan
[13] National Weather Service Glossary
[14] National Weather Service Glossary

to freeze over night when the temperature drops. Black ice can also form when roadways are slick from rain and temperatures drop below freezing overnight.

Extreme Cold temperatures are part of Vermont's climate tendency to stray above or below expected temperature values. What constitutes 'extreme cold' can vary and is based on what a population is accustomed to in their respective climates. For Andover, a mountainous town, this hazard was assessed as having a relatively high probability of occurrence but a low potential impact.

Heavy Snow/Ice:/Extreme Cold: History and Extent of Impact



There are no standard models or methodologies for estimating loss from winter storm hazards, however, extreme winter weather is considered a way of life in Vermont and many rural Towns are accustomed and prepared for these events.

While the history of winter storm events in Vermont and the historical damaged caused is extensive, Windsor County has been a designated area in only one federally declared disaster event over the past 20 years. DR-4207 occurred over a four-day period in mid-December 2014 when heavy, wet snow and ice resulted in more than 175,000 power outages in the region, the 2nd most power outages due to weather in Vermont.[15] The damage assessment for Windsor County was estimated to be over $200,000 and impacted the northwest corner of the county.

According to the State Hazard Mitigation Plan, on January 12, 2020, a moisture laden storm tracking along a cold front progressed south from Vermont's north-western border. With temperatures ranging in the 50s to 60s, moderate to heavy rain fell across the region. As the cold front dipped south, ¼ to ½ inches of ice accretion was widespread, resulting in hazardous travel and scattered power outages.[16]

A review of NOAA's database for Winter Storm events for Windsor County suggests that a snowfall of over 10 inches is likely to occur two to three times in a winter/early spring season. Snowfalls of over 24 inches have occurred at least once most winters but typically just in higher terrains in Andover. Reports of ice accumulation of 1/10th inch or more are common over the course of a winter season.

Over the past five years the NOAA has recorded 23 Winter Storm events for Windsor County, an average of four per year with the most impactful events occurring in the month of March. **Table 5.2-4** below is a sampling of historical winter storm events and the extent of their impact.

[15] 2018 Vermont State Hazard Mitigation Plan
[16] 2023 Vermont State Hazard Mitigation Plan-adopted draft

TABLE 5.2-4: Notable Winter Storm Events in Windsor County, Jan/2016 – Dec/2023[17]

Occurrence Date	Estimated Property Damage	Event Description
2/2015	>$1,000,000	20 days of below zero temperatures region-wide with windchills of 30 below or colder. Coldest month on record. Damage to infrastructure, frozen water mains.
11/29/2016	$25,000	Ice accumulation less than one tenth of an inch. Numerous vehicle accidents from icy roads. Accident between a vehicle and a tractor-trailer resulted in a fatality.
3/14/2017	$20,000	Snowfall totals across Windsor County generally ranged from 12 to 24 inches.
3/31/2017	$25,000	Widespread 8 to 16 inches of heavy, wet snow across the region. Scattered power outages from the snow loading on trees and power lines.
4/1/2017	$25,000	Widespread 8 to 16 inches of a heavy, wet snow fell across the region with scattered power outages from snow loading on trees and power lines.
12/12/2017	$20,000	A widespread 8 to 16 inches of snow fell across the region.
3/7/2018	$40,000	A long duration snow event dropped 12 to 26 inches across the region, with highest totals along the southern Green mountains. Scattered to numerous power outages occurred in areas of the heaviest snow fall.
3/13/2018	$20,000	Long duration snowfall event eventually delivered 10 to 20 inches across the region. Some isolated to scattered power outages were reported.
11/26/2018	$250,000	Light rain changed to a pasty, heavy wet snow that resulted in downed tree limbs and power outages. across VT. Snow accumulated 3 to 6 inches in the valleys but quickly rose to 12 to 20 inches above 1000 feet.
1/19/2019	$20,000	A widespread snowfall of 10 to 18 inches occurred across the region.
3/22/2019	$15,000	A heavy wet snow fell across the region with snowfall totals of 8 to 12 inches and higher totals in the higher elevations.
3/23/2020	$5,000	A period of heavy snow with 2-3 inches per hour rates moved through during the evening hours with storm total snowfall of 7-10 inches. Minor, isolated power outages.
12/16/2020	$ 20,000	Record snowfall described below
1/16/2021	$50,000	A heavy, wet snow fell across the region with totals ranging from 3 to 5 inches in the valleys to 18 inches in the higher terrain. Numerous power outages reported.
12/25/2021	NA	Ice accumulation of up to ¼" from freezing rain caused numerous vehicle accidents resulting in the closure of portions of I89 and 25 miles of I91.
1/27/2022	NA	Artic air masses caused bitterly cold temperatures. Air temperatures of 10-20 below and 15-30 below with windchill. Third extreme cold event of January 2022.
2/3/2022	$50,000	Heavy snow and ice combination with 6-12 inches of snow followed with ¼" of ice causing numerous power outages.
3/13/2023	NA	Heavy wet snow fell at a rate of 1-2 inches per hour with winds gusting 35-45 mph causing 90,000 without power in the southern Green Mountain communities. Vehicle accidents, downed trees and school closings. Total snowfall of 10 to 24+ inches.
12/11/2023	NA	Heavy wet snow causing 10,000 without power and hazardous travel conditions in the Green Mountain communities.

[17] NOAA, National Centers for Environmental Information , accessed July 23, 2023

Local snow totals can vary tremendously. A recent snowfall event in December 2020 recorded snow rates of 4+ inches per hour for 6 to 8 hours across much of Windsor County. Storm total snowfall ranged from 8-12 inches in the north to 30-40 inches in the southeast upslope hilly terrain. Local reports for the December snowfall event had nearby towns of Springfield and Ludlow the hardest hit with recorded totals of 41 inches. The National Weather Service is investigating a snowfall report for this event of 44.8 inches in Peru, VT, which, if verified, will become Vermont's highest 24-hour snowfall on record. The current state record stands at 42 inches from 1995 in Jay Peak. [18]

Valley News, December 17, 2020

In 2021, for the Windsor County region, there were a total of seven winter weather events as listed in NOAA. Three of these storms were heavy snow events of 8-12 inches, and four were heavy wet snow, freezing rain or sleet causing power outages which is indicative of the extreme variance in temperatures during the winter season due to climate change.

More recently, a heavy wet snow and wind event in March 2023 caused road closures in Windsor County with over 90,000 without power. Snow totals reached over 24 inches in some areas of Town. The event activated the State Emergency Operations Center and was reported to be the worst winter event in five years.

During the writing of this plan, there were two major late season snow events in Andover and the region. Winter storms on March 23 and on April 4 in 2024 both brought 2 to 3 feet of wet snow in higher terrains with gusty winds of 45mph causing downed trees and power lines.

There is no specific region in Vermont that is more vulnerable to **Ice Storms**, according to the 2018 Vermont State Hazard Mitigation Plan. The state plan identifies accumulations for ice storms in December 2008 and January 1998 of 1/2-3/4" of ice plus 1-2" of sleet and 3" of ice, respectively. Local data for ice storms is not available. "There are no standard loss estimation models or methodologies for the winter storm hazards. Potential losses from winter storms are, in most cases, indirect and therefore difficult to quantify."[19]

Heavy Snow /Ice/Extreme Cold: Trends and Vulnerability

"According to the 2014 National Climate Assessment, there is an observable increase in severity of winter storm frequency and intensity since 1950. While the frequency of heavy snowstorms has increased over the past century, there has been an observed decline since 2000 and an overall decline in total seasonal snowfall." [20]

[18] https://snowbrains.com/peru-vermont-record-snowfall/ (December 21, 2020)
[19] 2018 Vermont State Hazard Mitigation Plan
[20] 2018 Vermont State Hazard Mitigation Plan

This is consistent with historical low temperature and snow data for the nearby Town of Springfield obtained from U.S. Climate Data from 2008 to 2019.[21] This can be visualized when a trendline is applied as shown in **Figures 5.2-4 and 5.2-5**. It is also worth noting that based on this data, the area is seeing a **greater range in temperature extremes** which make for more hazardous conditions for flooding and icing. In the most current recorded year, 75-degree swings in winter temperatures ranged from -20.9 to 53.1°F in January and -2.9 to 72.1°F in February.

FIGURE 5.2-4: Annual Snowfall Trend

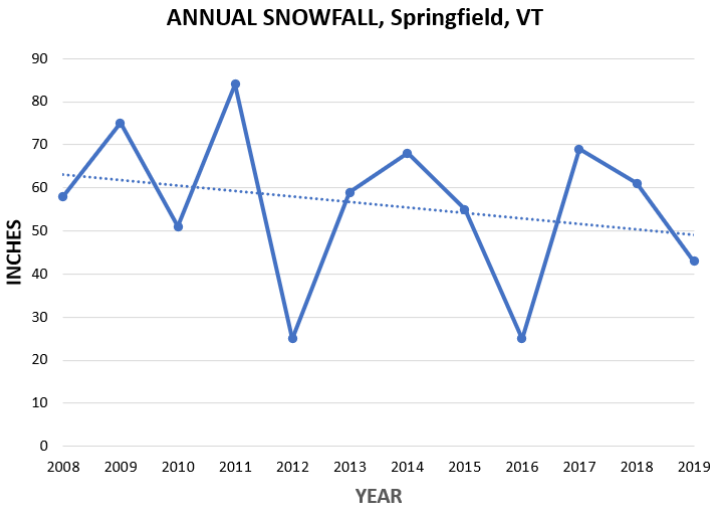
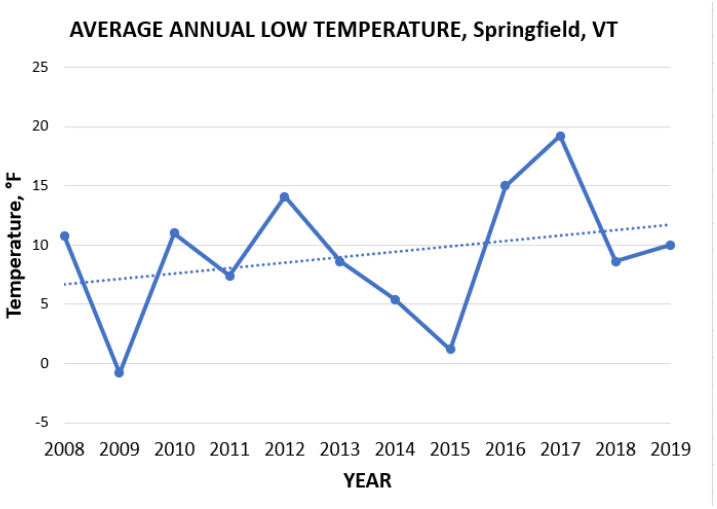
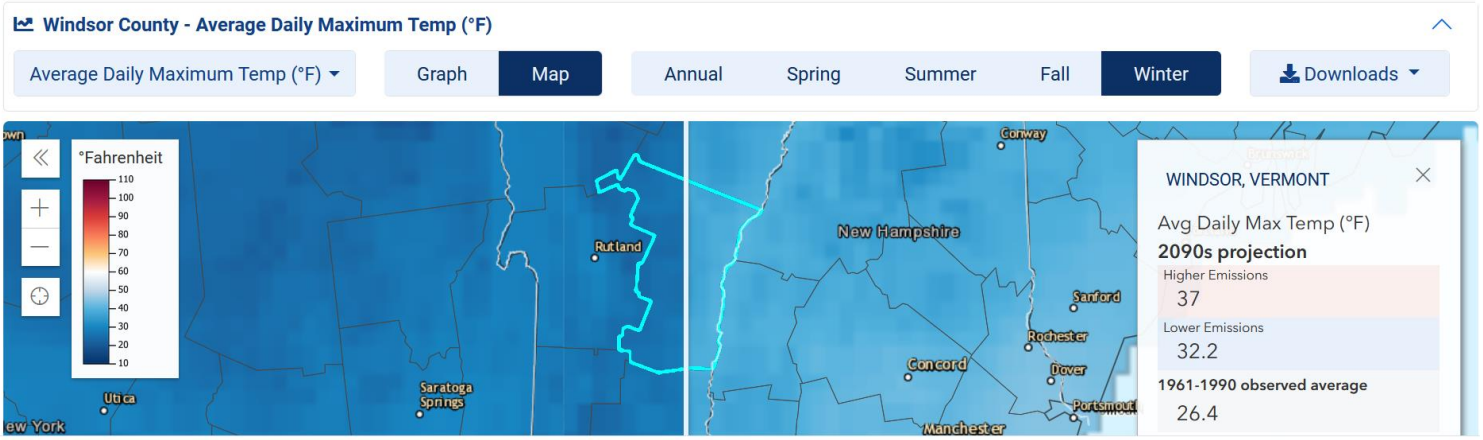


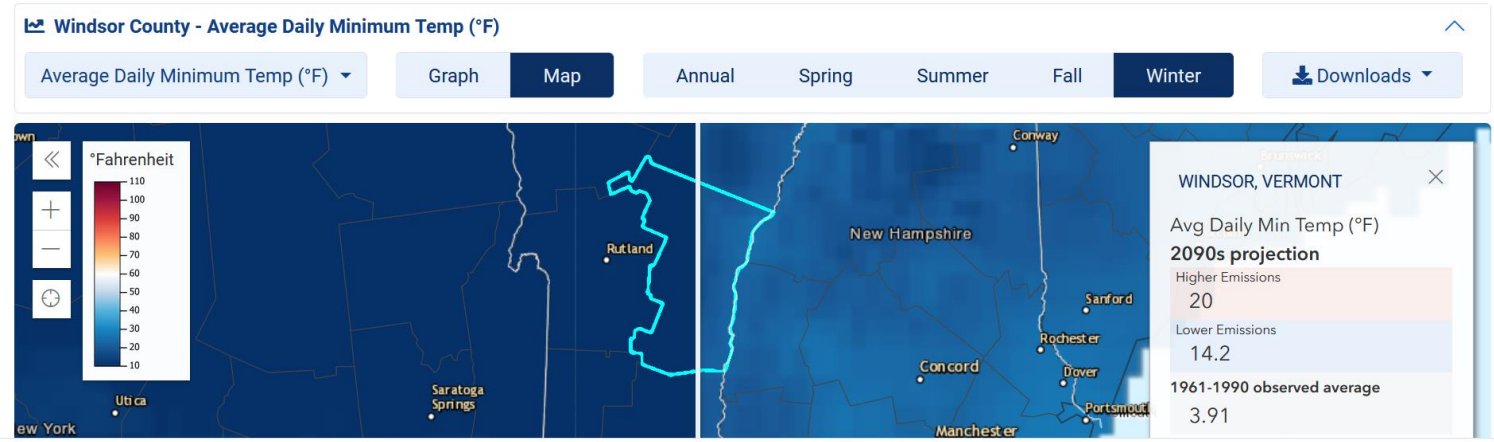
FIGURE 5.2-5: Annual Low Temperature



Data from Climate.gov's map generator, Climate Explorer, compares historical to projected temperatures in the divided images below. According to this source, **average daily maximum winter temperatures** are projected to rise above freezing to 37°F by the 2090's for Windsor County with higher emissions compared to observed historical averages of 26°F. If emissions are lower, the maximum will reach 32°F. The **average daily minimums winter temperatures** will also rise to 20°F over the same period compared to 4°F, observed historical averages.[22]



[21] US Climate Data, accessed July 23, 2023
[22] Climate Explorer, Climate.gov, accessed July 24, 2023



The 2024 State Hazard Mitigation Plan[23] considered the trend for **Ice** events and determined that "the probability of a plausibly significant extreme ice event to be Likely, with minor impacts on built environment and natural environment, and moderate impacts on people and economy. According to the 2018 National Climate Assessment, there is an observable increase in the frequency of the most severe winter storms in the Northeast since observations began in 1950[24]."

Statewide, damage from winter storms can vary depending upon wind speeds, snow or ice accumulation, storm duration, tree cover and structural conditions such as heavy snow and ice accumulation on roof tops, barns or aged structures in deteriorating condition. A roof may collapse with little or no warning, and one common misconception is that only flat roofs are susceptible to collapse. Residents can expect at least 60 pounds of weight per square foot on their infrastructure during winter months.

Vermont communities are well prepared to handle heavy snowfall. However, it is typically the secondary hazards that are most concerning to the town. Depending on the event power may be out for a few hours or days due to downed powerlines from heavy wet snow, accumulated ice, and fallen trees, particularly in combination with gusty winds. This is a time when residents are most vulnerable to structure fire hazard or carbon monoxide poisoning, primarily for the many residents heat their homes with open flame heating sources including fireplace, wood or pellet stoves, or supplement with kerosene space heaters. Extended periods of extreme cold with loss of power during the winter months require continued vigilance on the safety of heating to reduce the risk of a structure fire as a secondary hazard.

[23] 2023 Vermont State Hazard Mitigation Plan-adopted draft

[24] https://nca2018.globalchange.gov/chapter/2#key-message-8

With approximately 20% of Andover's residents over 65 years of age, there is always a concern for a higher risk of falls or injuries clearing snow. Renters or second homeowners can tend to be less prepared for these events and unaware of the travel hazards they can encounter. This is concerning given the growth of Airbnb properties in Town.

Smaller residential communities in Town located at higher elevations, such as on Andover Ridge Rd. or Stigers Rd, can see higher amounts of snow and ice and become isolated for a period. Steep sloped roads in these areas require more frequent maintenance and observation by local road crew during winter events, as conditions at these elevations can be very different from valley portions of Town. The frequency of ice events in the region requires sufficient Town inventories of sand and salt which can be difficult when supplies are limited.

Extreme weather conditions can also lower the distribution of cellular signals from a cell tower to the receiving device. Reliability of these communications for reporting an emergency can be compromised during extreme winter weather events. This can become a greater concern as there is a trend to eliminate home landlines to save utility costs is growing. In 2023, a cell tower for use by emergency and rescue personnel was installed to cover dead zones along Andover's main thoroughfare, Route 11.

5.2c. High Wind

Hazard Assessment Score: 6.95

In Vermont, **High Wind** can be generated from a thunderstorm, hurricane or tropical depression, a localized microburst, Nor'easter, or simply just a windstorm. Any of these events can produce wind gusts up to 50 mph or greater causing property damage and disruption in electric and telecommunication utilities, transportation, and commercial businesses. Although difficult to predict, these events also pose a high risk of injuries and loss of life but tend to be localized.

Severe thunderstorms are a relatively common hazard in Vermont, particularly in the spring and summer months. Although typically short in duration, they can produce damaging winds, heavy rain and flooding, dangerous lightning and large hail. Multicell cluster thunderstorms are likely to cause local flash flooding. It is the winds from these storms that have most impacted the town. "In Vermont, high winds are most often seen accompanying severe thunderstorms. In fact, straight-line winds are often responsible for most of the wind damage associated with a thunderstorm. These winds are frequently confused with tornadoes because of similar damage and wind speeds; however, they are not rotating like the winds of a tornado."[25]

Thunderstorms and associated hazards can occur anywhere in Vermont at any time of the year; however, spring and summer are the most common times for severe thunderstorms.

The downward draft from these storms can produce **microbursts** which are not uncommon in Vermont. These events can come with wind speeds more than 80 mph, and pose an additional threat to low flying aircraft, making it difficult for them to maintain altitude. Although less common in Vermont, **super cell thunderstorms** are the largest, longest lasting, and most devastating thunderstorms, which can produce

[25] 2023 Vermont State Hazard Mitigation Plan-adopted draft

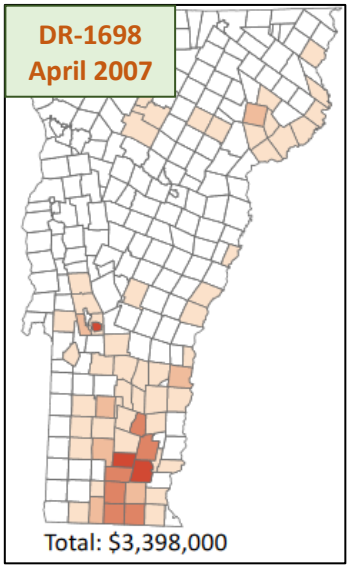
tornadoes and widespread destruction of crops and property. **Tropical storms, hurricanes, nor'easters,** and **winter storms** can also cause high wind damage throughout the state.

The **Beaufort Wind Scale** shown below can be used to predict damage based upon wind speeds. The National Weather Service will issue Wind Advisories when sustained winds of 31-39 mph are reached for at least one hour or gust between 46-57 mph and High Wind Warnings for winds of 58 mph or higher. Thunderstorm winds tend to affect areas of Vermont with significant tree stands as well as areas with exposed property and infrastructure and aboveground utilities. [26]

Power Failure is a common secondary hazard caused by high winds and occurs frequently within Windsor County. Power outages are most often isolated but can occur on a town-wide scale and are typically the result of power lines damaged by high winds, heavy snow or ice storms, but may also result from disruptions in the New England or national power grid as occurred in the Northeast Blackout of 2003. Dead or dying trees in proximity to power lines pose a particular threat for power failure, as these trees are often brought down by triggering events such as high winds during a thunderstorm or a Nor'easter.

Beaufort Wind Scale		
Classification #	**Wind Speed**	**Land Conditions**
6	25 to 31 mph	Large branches in motion; whistling in telephone wires
7	32 to 38 mph	Whole trees in motion; inconvenience felt walking against wind
8 to 9	39 to 54 mph	Branches can break off trees; wind generally impedes progress; slate blows of roof; slight structural damage
10 to 11	55 to 72 mph	Damage to chimneys and TV antennas; trees broken or uprooted; considerable widespread structural damage
12 to 13	73 to 112 mph Hurricane	Peels surfaces off roofs; windows broken; mobile homes overturned; moving cars pushed off road; devastation
14 to 15	113 to 157 mph	Roofs torn off homes; cars lifted off ground; widespread devastation

High Wind: History and Extent of Impact



Since 2000, there have been six (6) Federal Disaster Declarations for high wind events in Vermont, excluding those related to Tropical Storm Irene and Hurricane Sandy. One example of the extent of a **high wind** event in Vermont was the Nor'easter of April 2007 that resulted in a Federal Disaster Declaration, DR-1698. "High winds during this April storm resulted in many trees down and damage to some private homes and public infrastructure, primarily in Southern Vermont." [27] Total Public Assistance for this event was $3,398,000 with the costliest damages in neighboring Windham County.

NOAA National Centers for Environmental Information's Storm Events Database recorded 30 High/Strong Wind events and 103 Thunderstorm Wind events over this period that impacted Windsor County causing tree damage

[26] 2018 State of Vermont Hazard Mitigation Plan
[27] 2018 State of Vermont Hazard Mitigation Plan

and power outages. Three of the strong wind events were the result of Tropical Storm Irene in August 2011, Hurricane Sandy in October 2012 and remnants of Tropical Storm Isaias in August 2020. Most of the thunderstorm wind events recorded sustained winds of 40-45 mph with damaging wind gusts of 50-65 mph and isolated damage. Other High Wind events are more widespread causing power outages up to 25,000 countywide. Most of the wind reported damage is due to **thunderstorm** activity from June through September and winter storms with **heavy snow** and **ice**. Over the past 5 years from 2018-2022, the Windsor County region averaged close to 10 strong wind events a year causing, on average, $30,000 per event.[28]

Reports of damage due to downed trees in Windsor County are common when wind gusts begin to exceed 40 mph. Damage is typically localized in the form of downed trees and powerlines and isolated structural damage to buildings and vehicles. The most damaging local incident in recent history occurred in July 2003. A strong storm classified as a tornado, with heavy rain, lightning and severe winds ravaged the neighboring Town of Cavendish causing extensive damage.

July 21, 2003: Classified as a tornado, the storm destroyed one mobile home (while occupied), blew apart several outbuildings, damaged several other homes in Cavendish, VT.

Winds: > 100mph

Damage: $100,000 (estimated)

"A path of tree damage approximately 3 to 4 miles long was about 1/4 mile wide at the beginning impact point and about 3/4 mile wide at the end of the damage path. An estimated 500 to 700 trees were destroyed. Pine trees were snapped while hard wood trees were uprooted. Power lines were blown down with a number of residents without power. The actual thunderstorm winds were reported to have lasted 30 seconds or less. In the town of Reading, a number of trees were uprooted with some structural damage." [31]

High Wind: Trends and Vulnerability

The State Hazard Mitigation Plan considers wind highly likely to occur with a moderate for the built environment and minor for the natural environment, people and the economy risk, compared to other hazard impacts. However, with continued warming of ocean temperatures, we will likely see exacerbation of wind events such as hurricanes, tropical storms, and thunderstorms. Thunderstorms and associated hazards can occur anywhere in Vermont at any time of the year; however, spring and summer are the most common times for severe thunderstorms." [29]

The strength and frequency of high wind events in Andover has increased according to the local community, which has experienced more frequent power outages over the past 10 years. It is anticipated that extreme weather conditions, due to climate change, will continue to impact the community in the form of high winds throughout Windsor County. This is supported by the NOAA data which shows that of

[28] NOAA, National Centers for Environmental Information , accessed 4/4/2024.
[29] 2023 Vermont State Hazard Mitigation Plan-adopted draft

the 98 reported Thunderstorm and High Wind events since 2000, 29, or 30%, have occurred over the past 5 years.

Some project that the expected magnitude for future high wind events will fall between around 40 and 50 mph, or Beaufort scale number 8-9, and will likely result in downed trees, power lines, and small damage. However, the possibility does remain for larger high wind events such as the 1998 F3 tornado on the Enhanced Fujita Scale and localized microbursts.

Power failures often have only minimal impact to people and property; however, longer duration events may result in major disruptions and business losses. Outages in Andover typically last only a few hours but can last for days if the outage is regional. The Town states that GMP is adequately responsive in making any needed repairs to bring the power back online. Potential loss estimates are difficult to predict as they are typically isolated in geographic area and short in duration. Power outages in winter months may result in the loss of home heating, ruptured water pipes, and the resulting structural damage. The loss of home heating may be a contributing factor to the increase in structure fires during the winter months. Local data on historical occurrences, extent of outage and associated costs are not available.

The local wind flow is influenced by the topography. While many winds tend to blow parallel to the valley, mountainous areas tend to experience more damaging winds. Andover is situated on the low eastern slopes of the Green Mountains. According to the State Hazard Mitigation Plan, wind, which typically flows from west to east across Vermont, is most significant on mountain peaks, where wind speeds are highest. Downslope windstorms can occur when cold dense air travels over a mountain peak and accelerates down the slope, reaching high wind speeds at the base of the mountain causing more damaging downslope windstorms than wind flow running parallel. Towns at the base of the Green Mountains are especially vulnerable to wind-related hazards.[30]

Andover's mountainous communities are most at risk for damaging wind events, particularly those with westerly exposure. Powerlines to these properties typically run through forested areas and are at greater risk of impact from fallen trees. Andover's Town Hall and Office are in open areas with less trees and are not particularly vulnerable to this hazard. Heavily tree-lined roads can experience frequent outages. Clearing overhanging, leaning, and dying trees near power lines is part of annual town-wide maintenance to minimize impact from high winds. Green Mountain Power has worked well with Andover in managing and removing trees that threaten lines utility lines.

As climate change accelerates, we can expect stronger hurricanes and tropical storms. Although Vermont is landlocked within New England, hurricanes and tropical storms that travel up the east coast can lead to inundation flooding, fluvial erosion, and high winds. As the severity and frequency of these storms intensify, these impacts may become even more damaging to towns that lie within floodplains.[31]

5.2d. Extreme Heat / Drought

Hazard Assessment Score: 2.71 / 4.00

Extreme Heat and prolonged hot weather and resulting **Drought** have not been of concern to Vermonters, historically, given typically cooler climate conditions. Only recently have these potential hazards captured

[30] 2023 Vermont State Hazard Mitigation Plan-adopted draft
[31] 2023 Vermont State Hazard Mitigation Plan-adopted draft

the attention of Windsor County communities. Although these hazards scored lower during the hazard assessment they are profiled here for the first time in Andover's hazard mitigation planning. It should be noted that the ranking of extreme heat as a priority hazard showed the greatest discrepancy between the State and local assessments, according to the State Hazard Mitigation Plan.

Extremely high temperatures can occur when a high-pressure system develops and intensifies. Under such conditions, the potential for a heat wave exists. A heat wave is a period of three or more consecutive days during which the maximum temperature meets or exceeds 90°F. Extreme hot temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure. Prolonged periods of above normal temperatures along with increases in average annual temperature, also have direct and indirect effects on other hazards such as drought, Wildland Fire, invasive species, and infectious disease. [32]

What is considered "extreme heat" can vary around the world and across the country. Populations in warmer climates are more accustomed to higher temperatures and have acclimated to withstand higher temperature thresholds and developed ways to cope with heat and humidity as a way of life.

The Heat Index is a measure of how hot it feels when relative humidity is considered together with the actual air temperature. For example, if the air temperature is 88°F and the relative humidity is 70%, it will feel like 100°F. The National Weather Service heat related advisories are shown below.

National Weather Service Heat Advisories		
Classification	**Advisory**	**Expected Conditions**
Excessive Heat Outlook	Warning	A period of excessive heat is possible within next 3 to 5 days.
Heat Advisory	Take Action	The combination of hot temperatures and high humidity will create a situation in which heat related illnesses are possible. Heat Advisories are issued when heat indices are expected to reach at least 95°F.
Excessive Heat Watch	Warning	A prolonged period of dangerous excessive heat is possible within about 48 hrs.
Excessive Heat Warning	Take Action	A prolonged period of dangerous excessive heat is expected within about 24 hours. The combination of hot temperatures and high humidity will create a situation in which heat related illnesses are possible. Excessive Heat Warnings are issued when heat indices are expected to reach at least 105°F.

Drought can be defined as a shortage of water relative to need. Is a complex hazard in that it develops slowly during extended periods of low or no precipitation combined with extreme heat and high winds. It is typically widespread and can linger after normal precipitation returns. Although the surface waters may appear to have recovered from a period of drought following a return to normal precipitation, replenishing groundwater levels is a longer process.

The severity of a drought depends on the duration and extent of the water shortage, as well as the demands on the area's water supply. Drought Severity Classification categories, as shown below, range from 'D0' for abnormally dry conditions to 'D4' for widespread crop devastation and water emergencies. Vermont has experienced D2 drought conditions characterized by likely crop and pasture losses, common water shortages and imposed water restrictions.

[32] 2023 Vermont State Hazard Mitigation Plan-adopted draft

Extended periods of drought during a Vermont growing season can be devastating for state agriculture and can result in loss of potable water when wells run dry. Drought conditions are also favorable for Wildland Fires while small town fire departments that rely on river water will have limited capacity for fighting fires.

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures Coming out of drought: some lingering water deficits pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures Streams, reservoirs, or wells low, some water shortages developing or imminent Voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely Water shortages common Water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses Widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies

Source: http://droughtmonitor.unl.edu/AboutUSDM/DroughtClassification.aspx

Drought differs from other hazards in that it is not always apparent, develops slowly and is spread over a larger geographic area. The beginning and end of a drought event is also difficult to determine. Although surface water may have appeared to recover, ground water takes longer to replenish, and aquifers can take years to recharge.

According to the U.S. Drought Monitor's archived data, the southeastern portion of the State is more vulnerable to prolonged periods of more significant drought, likely due to its lower elevation and landlocked location.

Extreme Heat and Drought: History and Extent of Impact

While **Extreme Heat** and Drought are less likely to occur in Vermont compared to other regions of the country due to the historically cool climate. However, Vermonters may find it difficult to adjust to warmer temperatures as it takes time for a person's body to acclimate to activity during hotter weather, and many buildings in Vermont do not have air conditioning. Although most Towns in this region have not historically experienced heat or drought related impacts to people or the built or natural environments, they do recognize the signs of a warming trend. For the Town of Andover, as with many rural towns, do not recognize these as priority hazards. However, in other parts of the State, heat-related events are beginning to occur in Vermont in much greater frequency and intensity.

The following notable **Extreme Heat events** were gleaned from the Vermont Hazard Mitigation Plan:

- Between 2000 and 2017, the number of recorded days per year with a daily temperature high greater than or equal to 85°F peaked during the 2016 summer at 45 days, closely followed by the summer of 2015 at 41 days in Burlington.

- August 2006, temperatures rose into the 90s but significantly more important were dewpoints that reached the middle to upper 70s to produce excessive heat index values of 100°F to 105°F, some of the highest values in nearly a decade.
- In July 2011, during a 4-day heat wave, temperatures across southern Vermont warmed into 90s. With dew points in the 70s combined with the hot temperatures, heat indices reached 104°F. Heat index values reached 100°F to 108°F across the Champlain and Connecticut valleys as well as some interior valleys. One death is attributed to this event in Windsor County.
- In the summer of 2018, in Windsor County, high temperatures in the upper 80s to upper 90s with dewpoints in the 60s and 70s created dangerous heat indices in the 95-to-110-degree range between June 30th and July 5th. A substantial increase in hospitalizations occurred due to the excessive heat and duration and at least 3 deaths were contributed to the heat.
- In 2020, the 2nd longest heatwave in modern history occurred across portions VT from June 18th through June 23rd. Temperatures exceeded 90°F for up to 6 consecutive days in portions of the Champlain and Connecticut River valleys.

A review of summer temperature data from 2010 to 2019 for the Town of Springfield suggests no identifiable warming trend during that period. In July and August, average high temperatures varied from 79 to 86°F with highest maximum summer temperatures ranging from 90 to 98°F. Three to six consecutive days of >90°F occurred in 2011, 2013, 2015, 2018 and 2019. It should also be noted that, while temperatures have exceeded 90°F each year over the past 10 years, it has exceeded that temperature for multiple days in 3 of the last 5 years.[33]

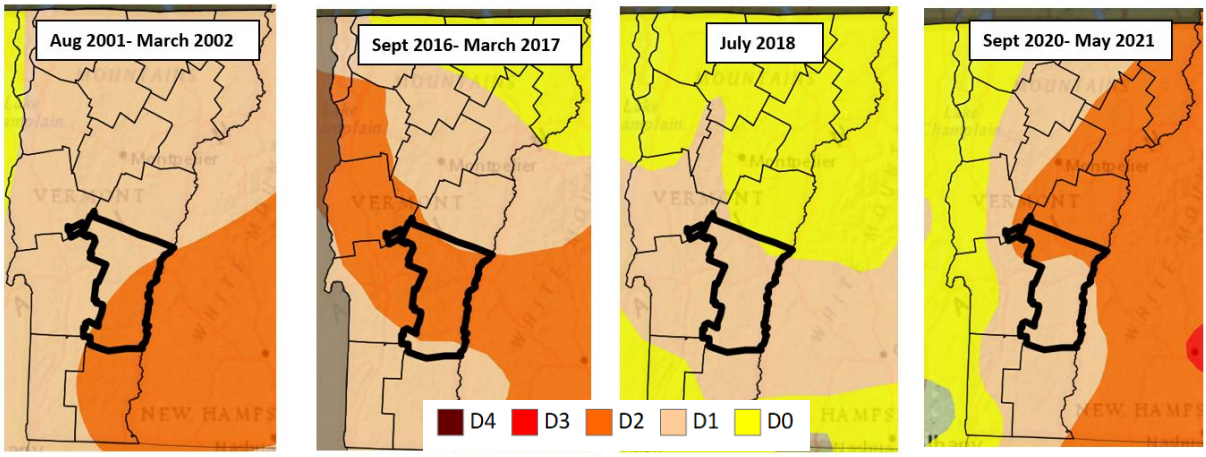
Drought in Vermont is infrequent as precipitation in the northeast has been reliable. Several severe droughts have been recorded during the last century, while moderate and mild droughts are much more common. The droughts in the mid-1960s were the most severe in Vermont. Every county in the State experienced Exceptional Drought (D4) conditions in May of 1965. Since the 1960s Vermont has experienced several less severe periods of drought. [34]

There were two declared statewide droughts in June and July 1995, due to a lack of rainfall, which required water usage restrictions. Lack of rain combined with some of the highest temperatures led to crop loss in some areas. Later that summer a more severe drought affected Southern Vermont. [35]

Figure 5.2-6 together with **Figure 5.2-9,** show regional and statewide historical occurrences since 2000 and the level of drought as a percent of the State affected. Since 2000, there have been four distinct periods of Severe to Moderate Drought in Vermont. In 2001-2002, drought which began in early winter and continued through July impacting nearly 100% of the state in at least Moderate Drought (D1). In 2016-2017, a Severe Drought (D2) from October through April, affected 29% of the State with 80% in at least Moderate Drought (D1). As of the writing of this plan, Moderate Drought (D1) which began in September 2020 continues through May 2021 but has ended by July 2021. Windsor County was affected by all of these recent droughts as shown in **Figure 5.2-6** below.

[33] Current Results, Burlington accessed July 24, 2023
[34] 2023 Vermont State Hazard Mitigation Plan-adopted draft
[35] 2023 Vermont State Hazard Mitigation Plan-adopted draft

FIGURE 5.2-6: Extent of Historical Drought in Windsor County (2000 – 2021)[36]



Extreme Heat/Drought: Trends and Vulnerability

Heat-related events are, historically, less likely to occur compared to other areas of the country. However, taking a more regional view, they are beginning to occur in much greater frequency. Both state annual minimum and maximum averages show a steady increase from 1960 (**Figure 5.2-7**[37]), with a greater rise in the minimum average rate, or winter temperatures. The Northeast region warmed more than any other region in the lower-48 over the last five decades, according to data from NOAA, and is projected to warm at a rate 50% greater than the global rate by some analysis.[38]

FIGURE 5.2-7: Vermont Average Annual Temperature Trends

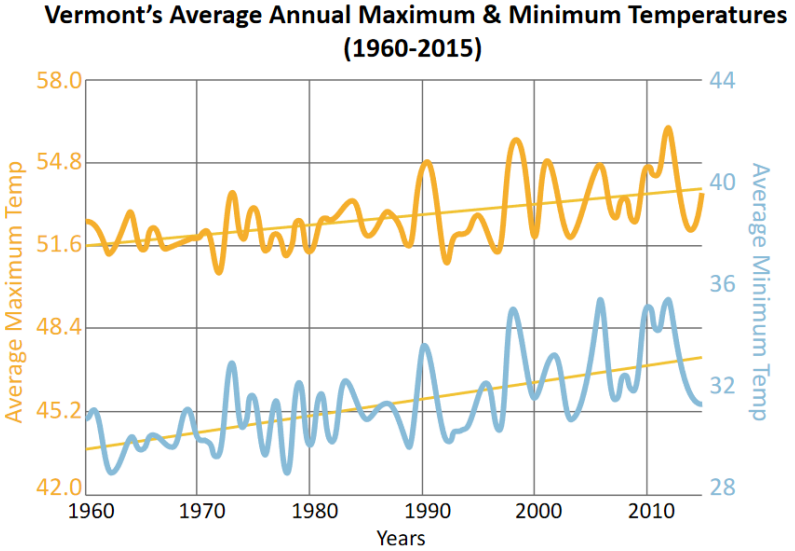


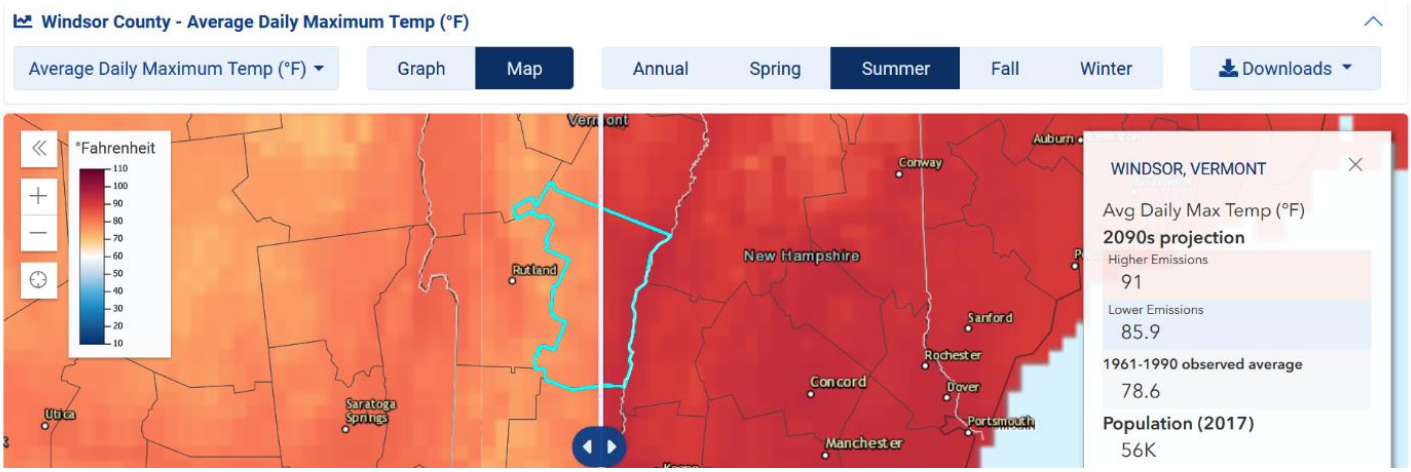
Figure 48: Vermont's average annual maximum & minimum temperatures (1960-2015)
Source: climatechange.vermont.gov

Data shown below from Climate Explorer, in **Figure 5.2-8**[39], compares historical to projected temperatures in the divided image below. According to this source, average daily maximum summer temperatures are projected to rise

[36] U.S. Drought Monitor
[37] 2018 State of Vermont Hazard Mitigation Plan
[38] https://www.usgs.gov/center-news/northeast-warming-faster-rest-us
[39] Climate Explorer, accessed July 24, 2023

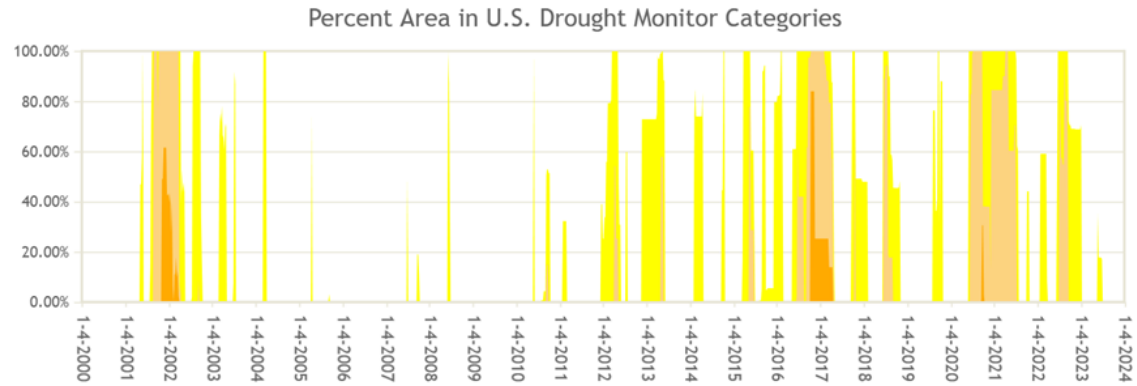
above 90°F by the 2090's for Windsor County with higher emissions compared to observed historical maximum averages of 78.6°F. If emissions are lower, the maximum will reach 85.9°F.[40]

FIGURE 5.2-8: Projected Average Daily Maximum Summer Temperatures for Windsor County



Periods of drought for Vermont and Windsor County are also expected to occur with more frequency as can be surmised from the timeline below in **Figure 5.2-9** which plots the percent of area in Windsor County, VT, within the indicated drought level or category.[41] Over the past 20 years, since the 2002 drought, more frequent periods of D1 and D2 drought have occurred in the past six years.

FIGURE 5.2-9: Drought Monitor for Windsor County, VT



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

The primary impact of extreme heat or prolonged periods of hot weather is on human life, especially when combined with high humidity. Exposure to hot conditions can lead to heat exhaustion or heat stroke which require medical attention and can be fatal. Older adults, children, and people with chronic medical conditions, such as asthma, are at greater risk for serious heat-related illnesses. Studies by the Vermont

[40] Climate Explorer, accessed July 24, 2023
[41] US Drought Monitor, accessed July 24, 2023

Department of Health suggest that the heat threshold in which hospitals in the State see a rise in heat-related emergency room visits is 87°F. [42]

Based on the Vermont Department of Health's town-level Heat Vulnerability report of 2016, which considers demographics, population health, socioeconomic status, and environmental characteristics, the Andover residents are less vulnerable to heat than the average Vermont resident.

Of greater concern to the Town is extreme heat for prolonged periods that can have an impact on town infrastructure causing asphalt to soften and then crack and buckle when cooled. Town forests and ecosystems can be negatively impacted due to drying soils and lack of moisture. Species common to Andover such as northern hardwood species like maple, yellow birch and American beech are anticipated to be nearly eliminated in the State, replaced by those tree species that thrive in warmer, drier conditions, like oak and pine. [43]

Warmer conditions also favor insect populations that cause Lyme, West Nile and Eastern equine encephalitis and other vector-borne diseases which have become more prevalent earlier in the spring and later in the fall. Much of Vermont recreational and agricultural economies rely on outdoor activities and are at greater risk of tick and mosquito borne illnesses. Some types of cyanobacteria proliferate in warmer waters and can release natural toxins into the water. Swimming or wading in these waters can cause minor rashes and stomach problems or more serious health problems. Children and pets are at higher risk of exposure because they are more likely to play and drink water while swimming. Andover would be susceptible to insect borne diseases given the Town's scattered wetlands, residential and natural ponds, and extensive beaver impoundments along with high grass meadows that favorable environments for the proliferation of these insects.

Critical Vermont economic sectors such as logging, farming, and maple sugaring which are prevalent in Andover's economy, can be disrupted by impacts from a warming climate. Although specific data is not available, to date, Andover has experienced only isolated issues with extreme heat and drought over the past 10 years and recent summers have been extremely wet and cool. However, according to a recently published article, New England has been experiencing a faster warming rate than the rest of the United States. [44]

Residents of rural towns typically feel the impacts of drought first, like Andover. Drought can cause extensive damage to gardens, agricultural crops and farm animals and lead to dry or low water levels in wells needed for drinking water. In addition to threatening water supplies, low ground water can also concentrate water contaminate levels resulting in potential health concerns.

Although structural impact from drought is rare, the impact on the natural environment can be extensive.

Soil moisture, streams, and groundwater are all depleted due to drought. Drought depletes water from both surface and ground waters critical to both cultivated and wild plants and animals. During past droughts in Vermont, deciduous trees have experienced leaf scorch, leaf yellowing, and early leaf color, but also subdues fall foliage color, which fuels Vermont's fall economy. In addition to warmer winter

[42] 2018 State of Vermont Hazard Mitigation Plan
[43] 2023 Vermont State Hazard Mitigation Plan-adopted draft
[44] Boston Globe: New England Winters are Getting Much Warmer

temperatures, drought during summer and fall can impact the availability to make snow during the winter ski season which would severely cripple southern Vermont ski resorts.

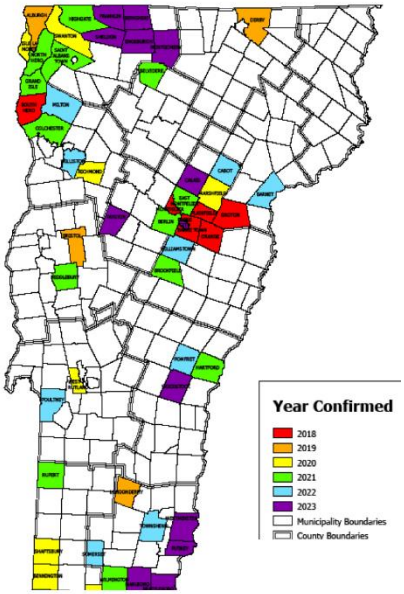
5.2e Invasive Species

Hazard Assessment Score: 4.23

The National Invasive Species Council defines an invasive species as one that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Invasive species can overwhelm native species and their habitats and have contributed directly to the decline of 42% of the threatened and endangered species in the United States and pose the second greatest threat to biodiversity globally. [45]

The eastern United States have long been susceptible to plants or organisms brought from overseas. Infestation can be at the aquatic, terrestrial and forest pest level and will spread and migrate when and where climate conditions are favorable. Frigid winter weather has historically kept a check on colonization of unwanted invasives, but increasingly milder temperatures are allowing these species to overwinter and reproduce in Vermont.

The HMPT expressed concern over the proliferation of two common invasives, Emerald Ash Borer (EAB) and Japanese knotweed as most impactful to the Town of Andover and are covered here. See the Vermont State Hazard Mitigation Plan for a list of additional invasives species impacting the State or go to Vermont Invasives for most current news and information.



The ***Emerald Ash Borer*** **(EAB),** now present in thirty states, was first reported in Vermont in 2017 and has since spread to 46 municipalities and almost every county as shown in the map below. "This invasive pest has serious financial implications for forest landowners and municipalities alike. EAB feeds on ash trees in Vermont, deeply damaging each tree and hindering its ability to move carbohydrates and water resources as necessary. Infected trees will die between three and five years after the introduction of EAB. Productive timber is destroyed by EAB and trees along roads become hazards as they die and pulldown powerlines. Preventative measures are crucial to prevent the further spread of these insects and protect native ash populations." [46]

[45] 2023 Vermont State Hazard Mitigation Plan-adopted draft
[46] 2023 Vermont State Hazard Mitigation Plan-adopted draft

Emerald ash borer larvae burrow through the inner layer of the ash tree's bark, impeding the tree's ability to conduct water and nutrients throughout the tree. Once infected, a healthy ash tree can die within 1-4 years. Most ash trees infested with the emerald ash borer will die, causing public hazards from standing dead trees that may impact structures and infrastructure, as well as add to riverine debris during high precipitation events.

Japanese knotweed is a severely invasive plant that spreads by sprouting from broken plant rhizomes. It was introduced into the United States in the 1800s and has been established in New England ever since. It is particularly prevalent along riverbanks or in dry riverbeds, and along roadsides and other disturbed areas in Andover and throughout the State. This dense growing plant rarely supports other vegetation beneath leaving the bare soil very susceptible to erosion. It continues to spread uncontrollably, pushing out native species upon which insect populations depend. This in turn affects other wildlife like fish, birds and mammals. Its shallow root system reduces streambank stability, thereby exacerbating fluvial erosion. As these plants are swept away during heavy flood events, they will block culverts and bridges causing overtopping and further flooding and road erosion. Road maintenance efforts near ditches infested by Japanese knotweed allow for quick spread of the knotweed's rhizomes and stems.

Invasive Species: History and Extent of Impact

As shown in the map above[47], the presence of EAB has been identified in Windsor County. The neighboring Town of Londonderry had confirmed the presence of EAB in 2019 at which time Andover gathered a team of trained residents and conducted an inventory of ash trees within the town's road right-of-way that fall. Approximately 2,400 trees were identified and assessed. Tree health was rated as Good, Fair or Poor with those in poor health determined to be most at risk for infestation. In summary, 72% were found to be in good condition, 20% in fair condition and 8% in poor condition. Ash trees on North Hill Rd. fared worse,

[47] 2023 Vermont State Hazard Mitigation Plan-adopted draft

with 17% assessed in poor condition and 60% in fair condition of the total 230 trees assessed. Details of this inventory are found in **Appendix G: Emerald Ash Borer Inventory.**

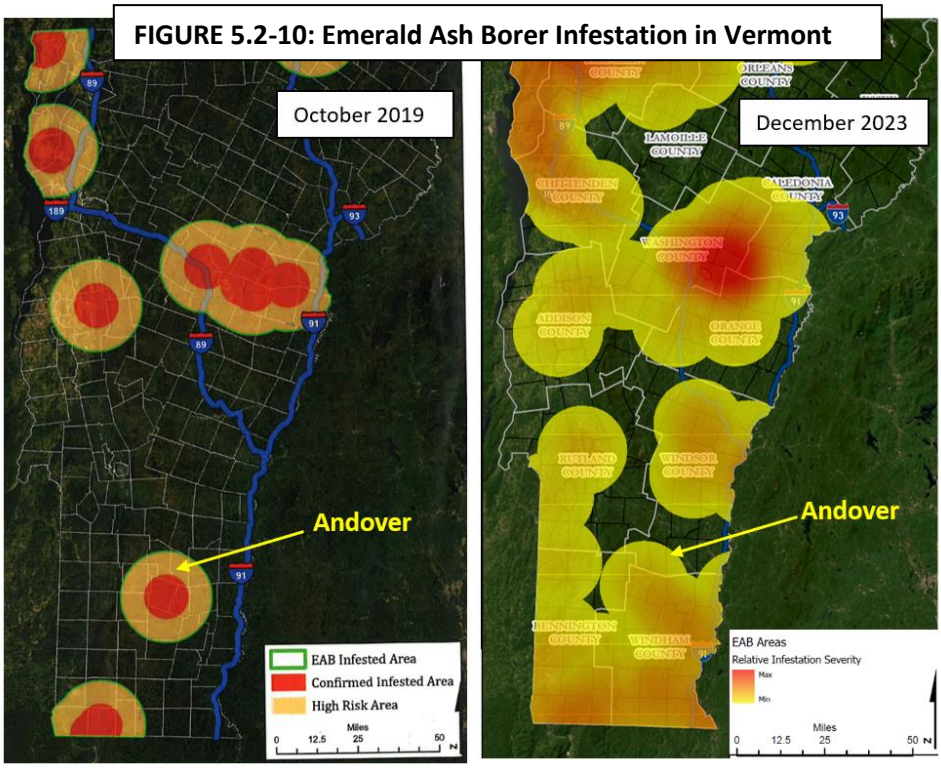
Japanese knotweed arrived in North America from Europe in the late 1800s for ornamental use and for forage and erosion control. It's considered invasive in 42 states and eight Canadian provinces. It grows quickly in spring from underground rhizomes into a 10-to-15-foot-tall mass of greenery. In Japan, knotweed is kept under control by a variety of native insects and diseases, however, management of the spread this species is extremely challenging to eradicate. It grows extremely fast, and removal is difficult and must be performed thoroughly or risk additional spread.

According to the State Hazard Mitigation Plan, Japanese knotweed is typically found in wet habitats, along river and stream banks, and in disturbed areas such as roadsides and old fields. In Vermont, knotweed covers miles of shoreline on every major river in the state. There is no specific data on the extent of the spread of Japanese Knotweed in Andover, however, their presence is found along Route 11 and the riverbanks of the Middle Branch, as well as on gravel islands within the riverbed.

Invasive Species: Trends and Vulnerability

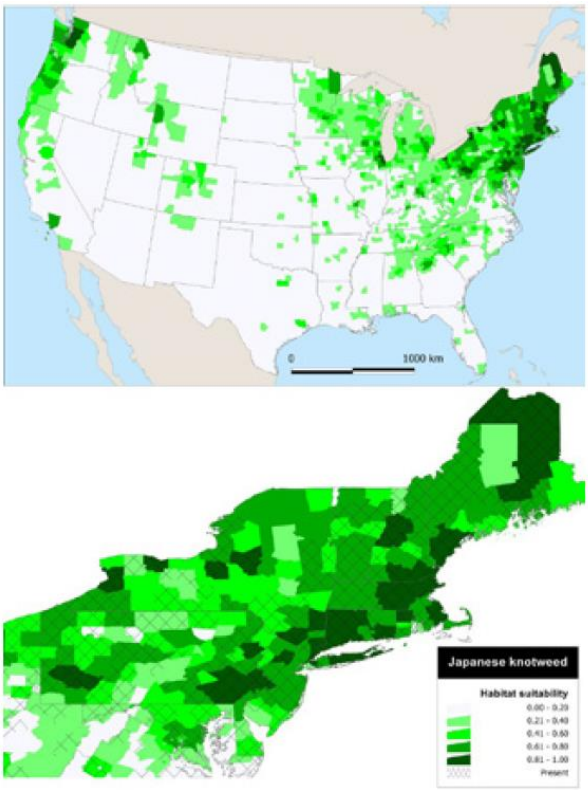
The rate of spread for the ***Emerald Ash Borer*** is depicted in maps shown in **Figure 5.2-10** below provided by Vermont Invasives. Red areas indicate a more severe infestation. Yellow areas indicate a less severe infestation. Although EAB is not necessarily present throughout these infested areas, it indicates the likelihood based on where EAB has been detected. The Department of Forests, Parks and Recreation will annually assess the severity of infestation.

FIGURE 5.2-10: Emerald Ash Borer Infestation in Vermont



EAB targets all species of ash, resulting in ash stand mortality within 5 years. This drastic decline will leave dead trees still standing threatening transmission lines, roadways, buildings requiring additional maintenance and repair costs. Infected trees have the potential to fall or drop branches that can harm workers and recreationalists. With the vast distribution of ash populations, residential properties will eventually be impacted. Homeowners with ash trees on their properties are at risk for damage or injury if dying trees are not identified and addressed. Andover does not currently have a sense of the extent of inventory on residential properties.

In Andover, roads with several noted ash trees in poor health within the right-of-way were identified along North Hill, Little Pond, Middletown, Old Gulf South, Marsh Cross, Schmidt, and Spruce. (See **Appendix G: Emerald Ash Borer Inventory**) for more detail. Although there was no conclusive detection of EAB at that time, the Town should consider a reassessment along these high-risk roadways and conduct outreach for the residents in these areas.



The potential spread of ***Japanese Knotweed*** mapped here illustrates the area of potential spread based on habitat suitability.[48] Sunny riverbanks will be most susceptible to the spread of Japanese Knotweed. As occurred during Tropical Storm Irene, these shallow rooted plants will be swept up and travel downstream creating new colonies. Knotweed will impact the natural environment by reducing species diversity and altering natural ecosystems which will negatively impact wildlife habitat. It can grow through pavement and block culverts damaging infrastructure. Their introduction can compromise power plants, wastewater treatment facilities, transmission lines and hydroelectric dams in neighboring towns impacting electrical service to Andover. As Andover continues to experience flooding and erosion of river and stream banks, requiring repairs of road infrastructure, it is anticipated that the spread of this species will continue uncontrolled unless a cohesive management plan can be implemented.

The Department of Forests, Parks & Recreation's Forest Health Program has launched a new tool, the *Vermont Forest Invasive Pest Status Map*, an interactive platform to track the spread of invasive species. The intent is to foster awareness on the local level and encourage residents to seek information on what they can do to help control spread.

The State Hazard Mitigation Plan considered the probability of a plausibly significant extreme invasive species event to be Likely, with major impacts to the economy and natural environment, followed then by minor impacts to the built environment and negligible impacts to people. "Also, as the climate models

[48] 2023 Vermont State Hazard Mitigation Plan-adopted draft

project increases in both temperature and precipitation, it is anticipated that invasive species infestation in Vermont will continue to grow and, as such, the State's efforts concerning education and outreach of the hazards associated with invasive species need to be bolstered in the years to come."[49]

5.2f Slope Failure

Hazard Assessment Score: 5.00

Slope Failure or "landslide" is a phenomenon that a slope collapses abruptly or can slowly due to weakened self-retainability of the earth under the influence of a rainfall or an earthquake. The downward and outward movement of slope-forming materials including rock, soil, fill, trees and other vegetation. Slope instability can be the result of slope saturation from heavy rainfall or snowmelt; undercutting of the slope toe due to stream erosion; earthquakes or artificial vibration or added load onto slope by human activity. Landslides that move a significant amount of material quickly and over a large area have the capacity to cause substantial damage to infrastructure, buildings and the natural environment, as well as cause injuries and fatalities.

Factors that can trigger a landslide or a slope failure include fluvial erosion, soil saturation, the freeze-thaw cycle in soils and bedrock, human modification of a slope due to excavation and development, surface drainage patterns, loss of vegetation, and earthquakes. Landslides are commonly initiated in the same areas more than once, and if a landslide occurs the best practice is to exercise caution in the area as it may still be unstable[50].

Landslides in Vermont are most common along rivers where erosion occurs and are triggered by heavy rain events and fluvial erosion. Because of the elevation of high slope streambanks, these fluvial erosion hazard areas are not identified as a significant hazard in FEMA flood hazard area mapping which restricts the State's ability to mitigate this prevalent hazard. Vermont Geographical Survey is currently working on developing a mapping protocol to address this shortcoming and provide some guidance to municipalities for future development.

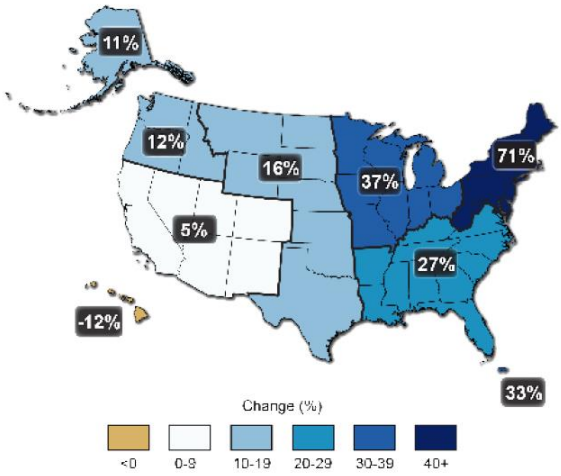
Slope Failure: History and Extent of Impact

"Extensive landslide activity occurred because of the heavy rains of 2011. In central Vermont, high water conditions resulting from the melting of thick snowpack and heavy spring rains, as well as from a flash flood event in late May, led to an increase in reported landslides. Widespread slope failures also occurred throughout much of central and southern Vermont because of Tropical Storm Irene later that year. Many of these landslides appear to have occurred on the sites of earlier slides that were reactivated by the heavy rains and powerful floodwaters." [51]

Although Landslides are primarily associated with mountainous regions, they are observed beyond the slopes of the Green Mountains. In Vermont, these are commonly the result of roadway and building excavation, slope failures with quarries and open-pit mines, cut and fill failures, and river bluff failures.

[49] 2023 Vermont State Hazard Mitigation Plan-adopted draft
[50] https://www.uvm.edu/news/cas/landslides-take-team-solve-geology-professor-says
[51] 2023 Vermont State Hazard Mitigation Plan-adopted draft

For Andover, as for many rural towns with river systems, river bluff failure is more commonly observed. Other landslides that occur away from rivers and streams are more often found in developed areas on top of a steep sloped land mass where development extends to the ridge of the slope edge. If stormwater is not property directed, over time stormwater runoff can channel a path to the slope's crest and can expand to a large crevice or gully and cause a major landslide threatening residential properties, structures and road infrastructure. This was the case in neighboring Springfield's Meadow Drive community, the Lincoln Street Health Care facility, and Paradise Park in Windsor.



Observed U.S. Percent increases in the amount of precipitation falling during very heavy events (1958-2012)[52]

Severe river bluff failure is evident in Andover along Route 11 on the steep banks of the Middle Branch, a main tributary of the Williams River. These high-risk areas, which were dramatically stripped of all vegetation during Tropical Storm Irene, have continued to erode with repeated flooding. They are typically located where the river bends and then crosses under Route 11. As flood waters travel downstream they hit the river bend undercutting the slope toe exacerbating erosion and releasing additional sedimentation which builds up the river bed narrowing the underpass. Flow is further restricted by woody debris which accumulates in front of the underpass during flood events overtopping Route 11 requiring substantial state repairs, as occurred during the recent July 2023 flood event.

Area slope failures with photos and extent of impact can be found in **Appendix H: Slope Failure Photos**. Costs specifically associated with the damage caused by landslides, outside of FEMA buyout projects, are not available as these events occur and are costed with damages caused by significant rainfall, flooding and erosion events.

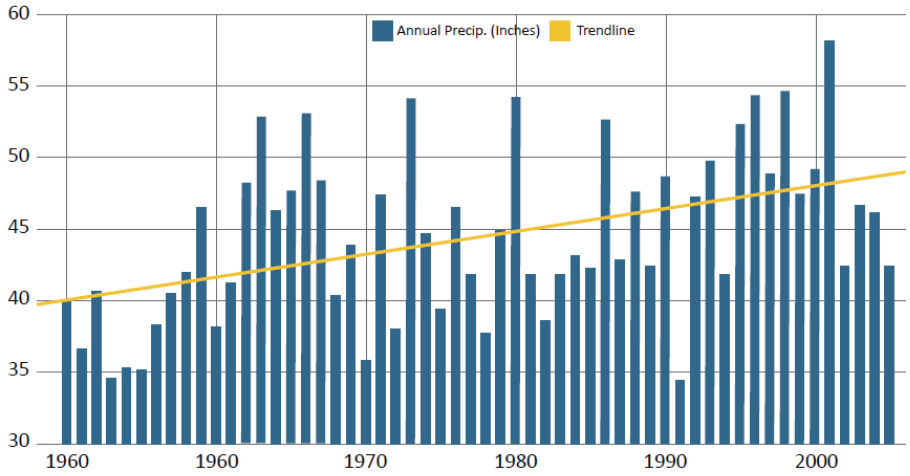
[52] 2023 Vermont State Hazard Mitigation Plan-adopted draft

Slope *Failure*: Trends and Vulnerability

The anticipated increases in both frequency and magnitude of precipitation in Vermont will lead to alterations of hydrology and water availability. Increased flood inundation, fluvial erosion, and subsequent landslide hazards will result in impacts to ecological and geomorphic integrity of river and floodplain systems, and to the built environment. Vermont's historic settlement pattern, in association with the widespread channelization of rivers and loss of functioning floodplains due to encroachments and fill, make Vermont particularly vulnerable to climate change-related increases in flood frequency and magnitude. Moreover, increases in frequency of periodic drought will not only lead to greater demand for new and more reliable water supplies, but will also reduce the ability of soils to quickly absorb floodwaters, thereby exacerbating flood-related impacts and negatively impacting the natural environment. [53]

Data from the State Hazard Mitigation Plan depicted in the charts below show a historical increase in annual precipitation in Vermont from 1960 to 2015. The amount of precipitation during heavy downpours in the Northeast has increased by 71% from 1958 to 2012.

FIGURE 5.2-11: Vermont Annual Historical Precipitation



Source: climatechange.vermont.gov

Vermont's rugged topography makes many regions susceptible to landslides, with heightened risk around areas with steep slopes or moving water which can erode steep banks. Major state roadways run along these rivers at the toe of these slopes.

The built environment and vulnerable populations located near or on top of these unstable slopes are at risk. As can be seen in the photos from the area properties along the Middle Branch River in **Appendix H**, these identified sites are threatening not only state road infrastructure, but residential properties and structures.

[53] 2023 Vermont State Hazard Mitigation Plan-adopted draft

5.2g Wildland Fire

Hazard Assessment Score: 1.25

Wildland Fire was not identified as a priority hazard for the Town of Andover primarily because of low historic occurrence and low probability of future occurrence. Although wildfires are currently uncommon in Vermont, However, they are covered here given the potential for increased occurrences due to climate change with projections of extended periods of warming, drought and increased frequency of thunderstorms and accompanying lightning.

A fire in the root system of a forest in Killington is difficult to contain and snuff out. Photo by Murray McGrath

Wildland Fires, which for discussion here include forest, brush, crop or grassland fires, are defined as "*An uncontrolled burning of woodlands, brush or grasslands."* [54] While relatively uncommon within Vermont and the Town of Andover large **wildland fires** are always a threat particularly for rural communities with large tracts of forested and vegetative land and have the potential to damage structures and utilities and croplands. A major Wildland Fire can leave a large amount of scorched and barren land susceptible to erosion for many years, particularly on steep slopes and ridgelines.

National Weather Service
Criteria for Issuing a
'Red Flag Warning'

- Winds sustained or with frequent gusts > 25 mph
- Day Relative Humidity at or below 30%
- Rainfall for the previous 5 days less than 0.25"
- Lightning after an extended dry period
- Significant dry frontal passage dry thunderstorms
- Keetch-Byram Drought Index values of 300 or greater (in summer)

Wildland Fire hazard can result directly from natural events such as lightning, particularly during periods of extended drought and extreme heat. These conditions provide more surface fuel for combustion and can extend underground along tree root systems following extended periods of drought. More often uncontrolled burns occur from a combination of dry conditions, high winds and human neglect or other human influences. Improperly disposed fire ashes and lit cigarettes are common causes. Unintentional human causes would include sparks from downed power lines, railcars and other vehicles or farm equipment. Continued and consistent enforcement of 'red flag' warnings is used to restrict controlled burning during the dry seasons.

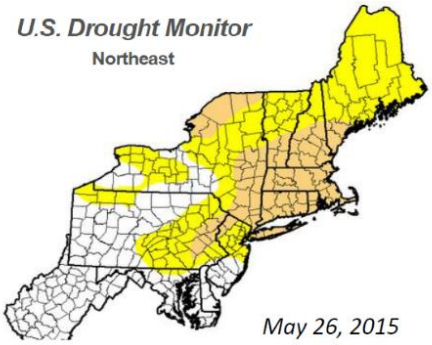
Wildland Fire: History and Extent of Impact

The State Hazard Mitigation Plan's analysis of Wildland Fire threat states that *"Wildland Fire conditions in Vermont are typically at their worst either in spring when dead grass and fallen leaves from the previous year are dry and new leaves and grass have not come out yet, or in late summer and early fall when that year's growth is dry".* [55] Wildland Fires can be ignited by lightning during a thunderstorm; however, this is rare in Vermont. Fire incidents are typically isolated and ignited by brush fires or burning debris, but these can be the major causes for igniting wildland fires, according to the Vermont Department of Forests, Parks, and Recreation. According to the State of Vermont Hazard Mitigation Plan, "There has not been a major

[54] 2018 Vermont State Hazard Mitigation Plan
[55] 2018 Vermont State Hazard Mitigation Plan

Wildland Fire in Vermont in the last 50 years. Vermont has a reliable system of local fire suppression infrastructure coordinated at the state level. Vermont's climate, vegetation type, and landscape discourage major Wildland Fire."[56]

Despite the drought in 2016-2017, Vermont's 2017 Wildland Fire Program Annual Report notes that the 2017 fire season was well below normal at 49 acres burned from 51 fires. The average between 2012 and 2016 was 109 fires and 317 acres per year, according to NOAA.



Source: U.S. Drought Monitor Index

In April 2015, more locally, a state-wide Red Flag Warning was issued for Windsor County. The region was under a D2 drought following a drying trend which began in early May. According to the 2015 Spring Fire Season Summary, on May 4th there were officially verified reports of 14 fires that occurred that day burning over 200 acres, setting off an active fire season. A 26-acre forest fire in Andover started when brush piles that were burned 3 days earlier rekindled from the strong winds. Firefighters from five departments responded. An airplane hangar and the plane inside were damaged and a nearby house was threatened. The fire season during 2015 (March-May) burned 335 acres, thirty percent more than the prior ten-year average. [57]

In addition to a Wildland Fire event reported in NOAA'S Storm Events Database in Windham County, just south of Andover, the following incidents have been locally reported: from nearby regions.

- 47-acre forest fire in Brattleboro, sparked by a downed powerline.
- 137-acre forest fired in Norwich, also caused by a downed powerline.
- 1/3 acre in Killington in 2021 that continued burning underground for three days.

Although Wildland fires are reported in the annual Vermont State Fire Marshal Report, which provides yearly fire statistics from FEMA's Nation Fire Incident Reporting System (NFIRS), they are not displayed here since, as of 2015, the fire statistics no longer breakout data for Wildland Fire separately.

Wildland Fire: Trends and Vulnerability

Wildland and brush fires pose a unique danger to local rural communities and controlling them can be challenging given a small town's limited capacity to respond to a major Wildland Fire. The greater hazard for Andover is the smaller, uncontrolled brush fires which may burn between 1 and 10 acres if uncontrolled. A rural town like Andover would benefit from the installation of additional dry hydrants where feasible in remote areas that could be inaccessible to a larger fire truck. Dry hydrants are non-pressurized pipe systems that draft water from an adjacent body of water such as a pond or stream with one end of the situated in the water source, and the other end available near the roadside. This allows firefighters to connect to the hydrant and pump from the water source.

[56] 2018 Vermont State Hazard Mitigation Plan
[57] 2015 Spring Fire Season Summary, VT Department of Forests, Parks & Recreation

Wildland Fires can threaten people who are living in remote forested areas. Protecting these structures from fire poses special problems, given the longer response time and limited resources. In addition to amount and frequency of precipitation, a particular town's vulnerability to large Wildland Fires is directly related to the proportion and continuity of acreage that is forested, pasture and cropland. In Andover, this represents over 50% of total town land cover (See **Appendix A: Map 1- Current Land Use)**.

According to the State Plan, only five statewide burning bans have been issued over the last 55 years since 1965. Four of those were over the last 22 years in 1999, 2001, 2005-2006, and most recently in 2012, supporting the trend toward drier conditions and increasing the risk of a major Wildland Fire. With a projected increase in the average annual maximum temperature, more frequent extended periods of extreme heat, and the likelihood of drought, it can be anticipated that small brush fires will occur more frequently in coming years and the potential threat of a large wildland remains.

Local education and outreach programs continue to be the most effective way to reduce a community's risk of fire. Firewise, is a community outreach program through the National Fire Protection Association that provides guidance, resources, and training on protecting homes and property from wildland fire. Smokeybear.com provides information for the prevention of Wildland Fire geared towards kids' education, residential home burning tips and campfire safety. The Vermont Annual Fire Marshal Report also offers informational resources for municipalities and property owners regarding fire safety. In addition, the Vermont Division of Fire Safety conducts a number of public educational events throughout the state and provides a toolbox of resources to educate communities which the town takes advantage of continuously and annually.

6. MITIGATION PROGRAM

The **Mitigation Program** is the core of the Hazard Mitigation Plan. The following sections detail the plan **Goals and Objectives**, identified **Mitigation and Preparedness Actions and Strategies** and **Criteria for Prioritization**. The implementation schedule that follows in **Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions** is a comprehensive list of actions identified for potential implementation during the five-year plan period to reduce the impact of the most significant hazards assessed in this plan. New to this update is a formalized process to **Monitor and Evaluate** plan progress on an annual basis.

6.1 Mitigation Goals and Objectives

Following the Hazard Analysis and Hazard Profile and review process as described in **Section 4**, the HMPT then agreed upon the following overarching goals and associated objectives below.

Hazard Mitigation Goals and Objectives

1. Provide protection and reduce risk to the community from the Impact of Hazard Events.
    a. Implement action items that reduce the risk of potential loss of life, injuries, negative health impact, and property damage.
    b. Implement action items to minimize financial losses due to hazard events incurred by the community including residents and business owners.
    c. Implement action items the improve resiliency of our built and natural environment including public infrastructure, and recreational, cultural and historic assets.
    d. Maintain, enhance and raise awareness of the Emergencies Operation Plan.

2. Raise community awareness of the Hazard Risks, Resiliency Resources and Mitigation Planning.
    a. Encourage hazard mitigation planning to be incorporated into other municipal and community planning efforts.
    b. Review progress on implementation of the hazard mitigation plan during publicly noticed meetings (Selectboard, Planning Commission).
    c. Improve and enhance efforts to increase public knowledge of hazards and resources.

3. Improve effectiveness of future Hazard Mitigation Planning efforts.
    a. Develop a process for tracking plan implementation over the plan period and incorporate phased planning for large or complex projects.
    b. Be proactive in seeking funding opportunities for hazard mitigation projects.
    c. Improve local engagement in reporting vulnerabilities and hazard events.

6.2 Hazard Mitigation/Preparedness Strategies and Actions

Throughout the planning process, efforts were made to identify actions that would address the Town's vulnerabilities and achieve the goals and objectives outlined above. Potential ideas were generated following a comprehensive review of technical studies and reports, town and regional planning documents, neighboring town hazard mitigation plans, Vermont State 2023 Hazard Mitigation Plan, and input from the Town, the climate survey and the Hazard Mitigation Planning Team.

The mitigation and preparedness actions in **Table 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions** have been chosen by the Team as the most effective and feasible actions to be taken during this plan period to lessen the impacts of the most impactful natural hazards identified in **Section 5**. They take into account natural systems and protection; local planning, policy and regulatory; structural and implementation; and education and awareness. Some actions from the previous plan that were not completed or are on-going or implemented periodically have been carried over to this update. There is at least one action for each hazard identified in Section 5.1 as most impactful to the Town. Partners and Responsible Parties and Timeframe for each action is identified and potential funding sources are suggested.

Compared to the prior Hazard Mitigation Plan, there are several changes to be noted from this planning effort that are listed below.

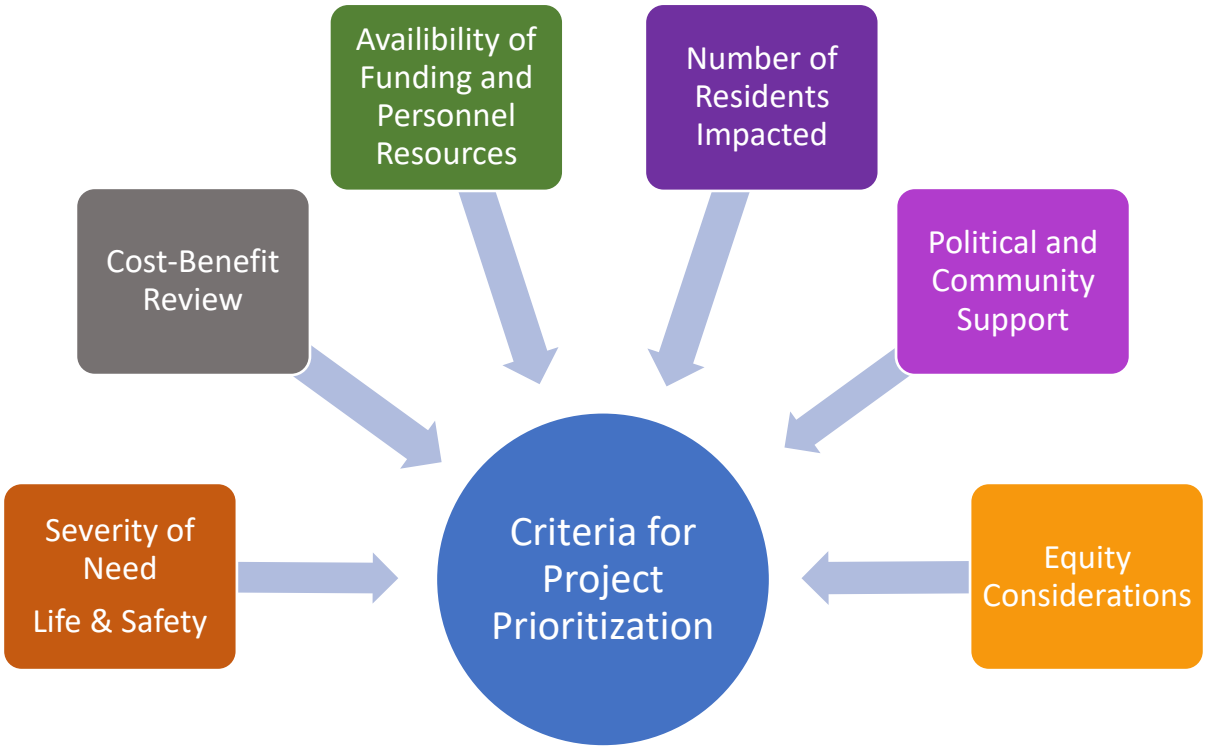
6.2a Changes from Prior Plan

- The Town's **method of hazard assessment** was modified from the previous plan to resemble that used by the State. The hazard impact assessment categories were expanded to differentiate between the probability of a weather hazard event and the probability of the hazard impact which can be common to other weather events. Community impact was broken down into four categories (life, economy, infrastructure, and environment) and assessed individually.
- **Flooding, Fluvial Erosion and Erosion** continue to be of greatest concern. The major flood event of July 2023 occurred during the writing of this plan. Based on the damage experienced during this event and Tropical Storm Irene, **Erosion** from **Flash Flooding** is recognized apart from fluvial erosion with Andover's susceptibility to stormwater runoff from upland areas in town.
- **Ice and High Wind** are profiled for the first time as new hazards to be addressed. This is, in part, a result of the way these hazards are assessed, but there is also greater concern about the higher probability of occurrence of these hazards given recent and trending climate extremes in wind, temperature variations and precipitation events.
- **Invasive Species** is now recognized as a priority with Emerald Ash Borer (EAB) tree infestations confirmed in neighboring towns threatening the Town's extensive ash tree inventory and is expected to have financial and economic impacts over the next 5 years.

- **Slope Failure** is identified as a higher priority hazard in this plan because of the continued deterioration of unstable river bluff slopes from repeated heavy precipitation and flooding threatening road infrastructure and private properties.
- Development of specific **mitigation goals and objectives** and a revised **methodology for prioritizing** actions to ensure goals are addressed to improve plan effectiveness.
- Greater focus on addressing specific **vulnerabilities**.
- A formalized process for **plan monitoring** was developed to improve plan effectiveness and an effort was made to better **correlate mitigation actions** to the Town Plan goals and recommendations.

6.2b Prioritization of Strategies and Actions

For this update, the Team selected a method for prioritization of strategies and actions based on three categories – High, Moderate, and Low. It was decided that this methodology would improve overall progress on implementation with a focus on higher priority actions. Compared to a specific scoring process, this methodology for prioritization offers the following benefits:



- Provides needed flexibility as priorities can change over time.
- Allows the Town to take advantage of all funding opportunities as they arise.
- Implies that several actions can progress simultaneously.
- Works well for larger or complex phased projects.
- Encourages the Town to keep all proposed actions in mind.

To assign an action priority, the Hazard Analysis Score in **Section 5.1** and the criteria listed below were considered together but weighted subjectively with greater weight placed on **Severity or Immediacy of Need**, **Feasibility and Capacity to Implement**, and **Project Benefit**.

- Severity or Immediacy of Need. This subjective assessment would consider the potential extent of risk in terms of property and structural damage repair costs, safety risk to residents, probability of the hazard occurrence and number of residents impacted that would benefit from the mitigation action.
- Community and Municipal Support: Level of support within the community based on public meetings and survey results and level of municipal support with minimal or no political objections or reduction in tax revenues.
- Feasibility and Capacity to Implement: Availability of funding and personnel resources to implement the project. Availability of town, state or federal funds, and availability of town personnel and MARC staff.
- Project Cost: Cost is generally assessed as High for projects over $100,000, Medium for projects from $20,000 to $100,000 and Low for projects under $20,000.
- Project Benefit: Considers extent of benefit or positive impact of the action to the community and disproportionate populations, to the local economy, local environment and town infrastructure and a subjective assessment of the cost-benefit of the project.

TABLE 6.2-1: 2024-2029 Mitigation/Preparedness Strategies and Actions

High Priority
Moderate Priority
Low Priority

MITIGATION ACTION OR STRATEGY[1]	HAZARD/ ACTION CATEGORY	CRITERIA[2]					PARTNERS & REPONSIBLE PARTY[3]	TIME FRAME[4]	FUNDING SOURCE[5]
		NEED	SUPPORT	FEASIBILITY	PROJECT COST	PROJECT BENEFIT			
On Going:									
Prioritize Culvert replacement based on VTculvert data, Road and Bridge standards, geomorphic assessments, damaged or known undersized.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Highway Department,** MARC	Ongoing, Annually	TOB
Maintain updated culvert/bridge inventory.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Highway Department,** MARC	Ongoing, 3yrs	TOB, VTRANS
Develop schedule to Replace and Upgrade known undersized culverts based on above and recent flood damage.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Highway Department,** MARC	Short-Term, Annual Updates	TOB
Update Local Emergency Management Plan	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Emergency Management Coordinator**	Annually	TOB, MARC/EMPG
Maintain current ERAF status at a minimum.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Selectboard,** MARC, HMPT	Ongoing	TOB
From Town Input, Survey, Town Planning Documents, MARC Recommendations and Technical Document Review									
Develop and implement a process to a) record and document town infrastructure at risk for flood damage prior to next	Flood, Fluvial Erosion, Erosion	H	H	M	M	H	**Town Clerk,** Highway Department,	Mid-Term	FRCF, VWG, VCF

flood event to facilitate the FEMA public assistance process and b) have a written procedure for assessing damage immediately following an event before any reparations are made and a process for documenting reparations and recovery efforts.							MARC		
Complete a Road Erosion Inventory Reassessment by October 31, 2027, for MRGP compliance.	Flood, Fluvial Erosion, Erosion	H	H	H	M	H	**Highway Department,** MARC	Long-Term	BRGP
Work with MARC to bring MRGP Implementation Table Portal up to date with completed road work.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Highway Department,** MARC	Short-Term	TOB, MRGIA
Review Progress Report on MRPG compliance and develop a plan to achieve compliance threshold by December 31, 2036.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Highway Department,** MARC	Short-Term	TOB
Replace Culvert (#40) on East Hill Rd. in phases: Phase I – Preliminary Engineering/hydraulic study Phase II – Engineering Design Phase III – Implementation	Flood, Fluvial Erosion, Erosion	M	H	H	M	M	**Highway Department,** Selectboard, MARC	Short-Term Mid-Term Mid-Term	FRCF, DR4720, HMGP, BRIC, THSGP
Replace Culvert (#B24) on Middletown Road: Phase I – Preliminary Engineering/hydraulic study Phase II – Engineering Design Phase III – Implementation	Flood, Fluvial Erosion, Erosion	H	H	M	H	H	**Highway Department,** Selectboard, MARC	Short-Term Mid-Term Mid-Term	FRCF, DR4720, HMGP, BRIC, THSGP
Replace damaged Culvert (#C25) on Pettengill Rd. and increase to bakfull width: Phase I – Preliminary Engineering/hydraulic study Phase II – Engineering Design Phase III – Implementation	Flood, Fluvial Erosion, Erosion	M	M	M	H	M	**Highway Department,** Selectboard, MARC	Mid-Term Long-Term Long-Term	FRCF, DR4720, HMGP, BRIC, THSGP
Horseshoe Acres area bridge (#B5) deck repair work needed.	Flood, Fluvial	H	H	H	M	H	**Highway**	Mid-Term	FRCF, DR4720, HMGP,

	Erosion, Erosion						**Department,** Selectboard, MARC		BRIC, THSGP
Replace deteriorated and damaged Culvert (#3) on Love Joy Brook Rd.	Flood, Fluvial Erosion, Erosion	H	H	H	M	H	**Highway Department,** Selectboard, MARC	Short-Term	FRCF, DR4720, HMGP, BRIC, THSGP, BRGP
Boynton Hill area bridge (#B6) deck repair work	Flood, Fluvial Erosion, Erosion	H	H	H	M	H	**Highway Department,** Selectboard, MARC	Mid-Term	FRCF, DR4720, HMGP, BRIC, THSGP
Develop an inventory of residential ponds and beaver ponds and determine level of flood risk and potential strategies to mitigate.	Flood, Fluvial Erosion, Erosion	L	M	L	L	M	**HMPT**, Highway Department	Long-Term	TOB, VWG
Review location needs and map ponds as emergency water source for potential dry hydrants and develop program to incentivize pond owners.	Wildfire	L	L	M	L	M	**HMPT**, Highway Department	Long-Term	TOB, FPSG, RFP
Determine practicality of implementing a pond permitting process and/or provide pond construction guidance to minimize flood risk of a pond breach.	Flood, Fluvial Erosion, Erosion	M	M	L	L	M	**HMPT**, Selectboard, Planning Commission, MARC	Mid-Term	TOB
Put in place a process for residents of higher elevations to report to the Highway Department on road conditions during high wind and winter events.	Ice, High Wind, Heavy Snow	M	L	L	L	M	**HMPT,** Highway Department	Long-Term	TOB
Commission a review and update of site-specific projects as identified in the Williams River Corridor Plan of 2016.	Flood, Fluvial Erosion, Erosion	M	M	M	M	H	**MARC,** HMPT, Selectboard	Short-Term	EDDIBG, FRCF
Fitzgerald Associates to identify current floodplain areas identified in the RCP and work with VRC or VLT and landowners to develop a plan for conservation easement.	Flood, Fluvial Erosion, Erosion	L	L	M	M	L	**MARC,** HMPT, Selectboard	Long-Term	VRC, VLT, RCCEG, RCCEG, FRCF

(WPD ID#4736)									
Commission study to evaluate active bank erosion on Middle Branch, a main tributary of the Williams River, which is threatening homes around Castaldo Road on Route 11 and develop mitigation options, Phase I: Commission study Phase II: Develop mitigation plan	Flood, Fluvial Erosion, Erosion, Slope Failure	M	M	M	L	M	**HMPT,** Selectboard, MARC	Mid-Term Long-Term	FRCF, HMGP, BRIC, EDDIBG
Commission a Preliminary Assessment of active bank erosion and failing armor threatening a house and quarry access Road on Route 11 and design options to prevent future erosion including new placed rock armor and slope modification to establish stable grade (T5.S3.01, T5.S3.03) (WPD ID#4708) (RCP AB-1a-c)	Flood, Fluvial Erosion, Erosion, Slope Failure	M	M	M	L	M	**MARC,** HMPT, Selectboard	Long-Term	FRCF, HMGP, BRIC, EDDIBG
Work with residents of 995 Simonsville Rd. on a FEMA buyout. Exposed garage foundation due to erosion of toe slope continues to worsen. (WPD ID#11562)	Flood, Fluvial Erosion, Erosion, Slope Failure	H	H	H	H	H	**Selectboard**	Short-Term	HMGP, FPA, FRCF
Work with GMP to determine relocation of utility pole on Pettengill Rd. which is threatened by an active mass failure. (WPD ID#4709)	Flood, Fluvial Erosion, Erosion, Slope Failure	M	H	M	M	M	Selectboard, MARC	Mid-Term	TOB
Put in place a schedule to Identify and remove high hazard trees to reduce power outages*	High Wind, Ice, Heavy Snow	M	H	M	L	M	**Highway Department,** Selectboard	Long-Term	TOB
Proactively reach out to GMP with identified trees that are susceptible to causing downed power lines.	High Wind, Ice, Heavy Snow	M	M	M	L	M	**Highway Department,** Selectboard, GMP	Long-Term	TOB
Update Flood Damage Prevention Regulations from 2007.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**Planning Commission,** Selectboard,	Mid-Term	TOB, MPG

							MARC		
Consider River Corridor Bylaws during update to flood regulations to restrict further development in river corridors and increase ERAF reimbursement rate. In conjunction with update of Flood Regulations.	Flood, Fluvial Erosion, Erosion	M	L	L	L	M	**Planning Commission,** Selectboard, MARC	Mid-Term	TOB, MPG
Review and amend zoning regulations to better protect rivers and streams and areas at high risk for erosion or slope failure from flooding or heavy rain events.	Flood, Fluvial Erosion, Erosion, Slope Failure	M	L	L	L	M	**Planning Commission,** Selectboard, MARC	Long-Term	TOB, MPG
Consider flood and erosion hazard mitigation in permitting subdivisions and driveway access permitting to improve flood resiliency and reduce erosion.	Flood, Erosion	M	M	M	L	M	**Planning Commission,** Selectboard, MARC	Long-Term	TOB, MPG
Develop a list of properties (911 addresses) within the Special Flood Hazard Areas, River Corridor, and Fluvial Erosion Hazard Areas for public reference and outreach.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**HMPT,** MARC	Short-Term	FRCF, VWG, VCF
Design and have printed a wall size map for display at Town Hall with flood hazard and river corridor overlays for public viewing so residents can identify their properties in relation to these high-risk areas.	Flood, Fluvial Erosion, Erosion	H	H	M	L	H	**MARC,** HMPT, Selectboard	Short-term	FRCF, VWG, VCF
Develop and conduct a public outreach process to provide information to current residents and potential new buyers on flood hazard and fluvial erosion risk and NFIP to raise awareness.	Flood, Fluvial Erosion, Erosion	H	H	M	L	H	**MARC,** HMPT, Selectboard	Short-term	TOB, VCF, FRCF
Implement the formal process for monitoring the implementation of Mitigation Actions described in Section 6.3.	Flood, Fluvial Erosion, Erosion	H	H	H	L	H	**HMPT**, MARC, Selectboard	Short-term Annually	TOB
Access and evaluate the Municipal Vulnerability Index Tool, to assess Town preparedness for and resilience to the impacts of climate change for helpful guidance on local	All	L	M	H	L	H	**MARC**, Highway Department	Long-Term	TOB

hazard mitigation planning.									
Annually seek funding and plan for implementation for MRGP compliance on high slope, High Priority hydrologically connected road segments as identified in the MRGP road assessment inventory and experience during July 2023 flood event	Flood, Fluvial Erosion, Erosion	H	H	H	M	H	**Selectboard**, Highway Department, MARC	Annually	TOB, TCB, MRGIA, BRGB
Correlate Road Erosion Inventory Assessments with Transportation Resiliency Planning Tool to identify and help prioritize culvert and bridge replacement and stormwater management planning projects	Flood, Fluvial Erosion, Erosion	M	M	H	L	M	**MARC,** Highway Department	Mid-Term	TOB
Work with the State for permission to remove fallen trees and river debris at high risk for blocking underpass during flood events.	Flood, Fluvial Erosion, Erosion	M	M	M	L	M	**Highway Department**	Mid-Term	TOB
Review inventory of ash trees, identify active Emerald Ash Borer (EAB) or other infestation areas and seek funding for removal.	Invasive Species	M	M	M	L	M	**HMPT**, MARC, Selectboard	Mid-Term	EABG, CCFC
Develop and implement an outreach project based on 'Slow the Spread' on the EAB infestation to bring awareness to residents with ash trees on their properties and how to assess and mitigate.	Invasive Species	H	M	M	L	H	**Town Volunteer,** VT F&W	Mid-Term	EABG, CCFC, TOB
Register with Vermont Alert used by the state and local responders to notify the public of emergency situations.	Event Related Hazards	H	H	H	L	H	**Emergency Management,** Town Clerk	Short-Term	TOB
Include review of the LHMP in all Town planning efforts to identify ways to incorporate hazard mitigation to improve plan effectiveness.	All	H	M	H	L	H	**MARC,** town staff & representatives	On-going	TOB, MPG
Consider/incorporate, if applicable, Hazard Mitigation Actions into each section of the Town Plan goals, policies, and recommendations during the next town plan update.	All	H	M	H	L	H	**Selectboard**, MARC, HMPT	Next Update for Town Plan 2025	TOB, MPG

[1] Action Item carried over from prior plan noted by '**'

[2] For **Criteria** see Section 6.2b

[3] **Responsible Party**: Responsible Party is shown in **Bold** and others listed are support entities

HMPT- Andover's Hazard Mitigation Planning Team
MARC- Mount Ascutney Regional Commission
GMP – Green Mountain Power

[4] **Timeline** is identified as Short-Term, Mid-Term or Long-Term within the five-year planning period and can be generally referenced as follows: Short-term 2024-2025, Mid-Term 2026-2027, Long-Term 2028-2029.

[5] Funding Sources:

Town Funding
TOB - Town Operating Budget
TCB – Town Capital Budget

FEMA and Vermont State Department of Emergency Management (VEM)
DR-4720 HMG – Additional hazard mitigation grant funding under Disaster Declaration for July 2023 flood event
HMA - Hazard Mitigation Assistance Grant Program (VT State Department of Emergency Management)
HMGP – Hazard Mitigation Grant Program (acquisition, infrastructure, planning, outreach)
BRIC – Building Resilient Infrastructure and Communities Grant Program
FMA - FEMA Flood Mitigation Assistance Program
FRCF – Flood Resilient Communities Fund
EMPG – Emergency Management Performance Grant (VT State Department of Emergency Management)
FPSG – FEMA Fire Prevention & Safety Grant

Vermont Agency of Natural Resources (ANR)
DIBG – Design/Implementation (Clean Water) Block Grant Program
EDDIBG- Enhancement Development, Design and Implementation Block Grant
RCCEG – River Corridor Conservation Easement Grant (ERPG)

Vermont Agency of Commerce and Community Development (ACCD)
CDBG – VT ACCD Community Development Block Program
HPG – Historic Preservation Grant Programs
MPG- Municipal Planning Grant

Vermont Department of Fire Safety Programs (VDFS)
FP&S – Fire Prevention and Safety

Vermont Association of Conservation Districts
RFP – Rural Fire Protection/Dry Hydrant Grant Funding

Vermont League of Cities and Towns (VLCT)
FFG&E – Fire Fighting Gear & Equipment and other funding opportunities
FSC – Fire Station Construction

Vermont Transportation Agency (VTrans)
MRGIA – Municipal Roads Grants-In-Aid Program
BRGP – Better Roads Grant Program
THSGP – Town Highway Structures Grant Program
THC2RP – Town Highway Class 2 Road Program
MHSMP – Municipal Highway Stormwater Mitigation Program
TAP – Transportation Alternatives Program

Conservation Programs (CP)
VWG – Vermont Watershed Grant
VLT – Vermont Land Trust
CRC – Connecticut River Conservancy
VRC – Vermont River Conservancy

American Rescue Plan Act (ARPA) - Coronavirus State and Local Fiscal Recovery Funds & related future funding opportunities

MARC Brownflields Reuse Program Grants (MBRP) – EPA Brownfields Grants through MARC

Vermont Urban & Community Forestry (UCF)
EABG - Emerald Ash Borer Grant Program
CCFC-Community Caring for Canopy Grants

Other

VCF-Vermont Community Foundation
VCC-Vermont Conservation Commission
SGSG- Vermont Natural Resources Council Small Grants for Smart Growth

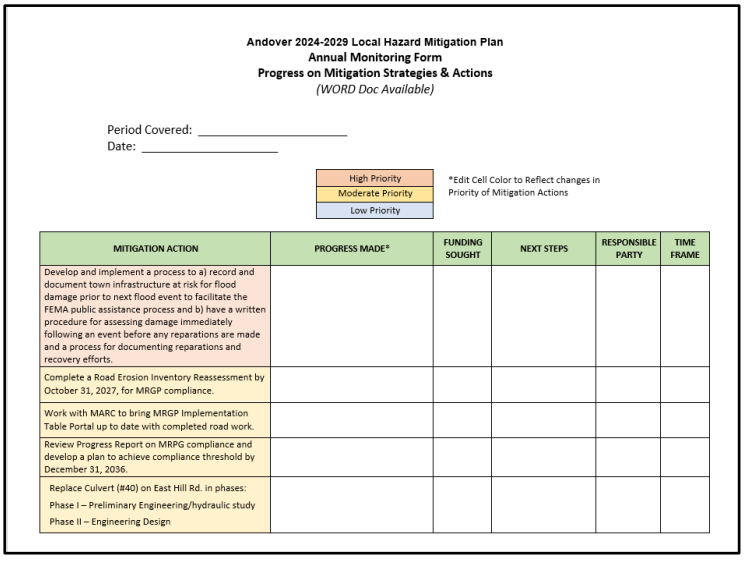
6.3 Plan Monitoring and Evaluation Process

FEMA requires that a Hazard Mitigation Plan includes a monitoring and evaluation process to periodically review the Plan to track the progress/status of the mitigation actions identified in **Table 6.2-1: Mitigation/Preparedness Strategies and Actions** and to evaluate the plan's effectiveness in meeting the plan goals and objectives in **Section 6.1**. With the Selectboard Chair as lead responsible party, the HMPT will be monitoring this plan within the five-year plan period as outlined below, to ensure that progress is made and identified mitigation actions are implemented as resources or opportunities become available. The plan will be evaluated for effectiveness based on criteria to be determined by the HMPT expected to include explicit incorporation of hazard mitigation in other Town planning efforts, increased public interest and participation in the monitoring process, improved local hazard data collection, and reduced financial loses for the Town and its residents from future disasters.

The monitoring process is identified as an action item to be conducted annually (at a minimum) over the plan period, prior to other municipal plan updates, and after a major disaster occurs to determine if the current plan is still consistent with other Town Plan goals, policies, and recommendations. The process will include a noticed annual meeting of the HMPT, to review and track the following:

- progress on implementing **Mitigation/Preparedness Strategies and Actions** (**Table 6.2-1)**
- updates to **Community Capabilities and Resources (Table 4.3-2)**
- updates to local, regional or State hazard data occurrences and extent
- new mitigation actions or revisions to existing actions
- changes in assessment or prioritization of identified natural hazards
- changes in vulnerability of community assets
- consideration and incorporation of hazard mitigation in other town plans and regulations
- effectiveness in meeting stated goals and objectives
- identification of barriers to progress
- release of a brief survey to gather input from the community on their perception of plan progress

This method for monitoring plan progress will be implemented gradually over the plan period. Once fully established, it will include an annual review to be conducted by the HMPT prior to the Town's annual budgeting process each fall with the completion of the **Hazard Mitigation Plan Monitoring Form** in **Appendix I.** Monitoring forms will be completed identifying any progress made for each action and anticipated progress for the coming year. Anticipated progress shall consider applicable funding source opportunities and projected updates to the Town Municipal Plan, zoning or flood regulations, or other town planning.



Andover 2024-2029 Local Hazard Mitigation Plan
Annual Monitoring Form
Progress on Mitigation Strategies & Actions
(WORD Doc Available)

Period Covered: _____
Date: _____

High Priority
Moderate Priority
Low Priority

*Edit Cell Color to Reflect changes in Priority of Mitigation Actions

MITIGATION ACTION	PROGRESS MADE*	FUNDING SOUGHT	NEXT STEPS	RESPONSIBLE PARTY	TIME FRAME
Develop and implement a process to a) record and document town infrastructure at risk for flood damage prior to next flood event to facilitate the FEMA public assistance process and b) have a written procedure for assessing damage immediately following an event before any reparations are made and a process for documenting reparations and recovery efforts.					
Complete a Road Erosion Inventory Reassessment by October 31, 2027, for MRGP compliance.					
Work with MARC to bring MRGP Implementation Table Portal up to date with completed road work.					
Review Progress Report on MRPG compliance and develop a plan to achieve compliance threshold by December 31, 2036.					
Replace Culvert (#40) on East Hill Rd. in phases: Phase I – Preliminary Engineering/hydraulic study Phase II – Engineering Design					

Completed forms will become part of this plan under **Appendix I** and will be distributed along with a narrative to the appropriate boards and commissions and made available for public viewing at the Town Office and on the Town website. Following the HMPT review meeting and reporting, an update on plan progress is to be reported annually at a publicly noticed Selectboard meeting during the 4th quarter.

For these scheduled public meetings, representatives of Town commissions and departments, and interested members of the public will be encouraged to attend. Participants will be asked during these review periods to express their concerns and experiences with hazard events, identify new vulnerabilities and suggest additional mitigating measures. All public input during the annual plan monitoring process will be noted and included as part of this plan in **Appendix I.**

During the monitoring process, the Town will consider and incorporate appropriate hazard mitigation actions from **Table 6.2-1** as part of the budgeting process each year in the fall and as part of the planning process for updates to the Town Plan, Planning and Zoning, Flood Damage Prevention Regulations, Access Permits and any other related planning, such as future community development projects, as appropriate. The HMPT will also be responsible for ensuring proposed mitigation actions remain in line with current town goals, strategies, and policies.

6.4 Plan Maintenance Process

FEMA requires a HMP to be updated every five years. The update will begin during the third year of this plan period with a request for funding by the Selectboard Chair. Upon securing resources, the update process will be conducted as followed in Appendix C beginning no later than fourth quarter 2027 and conducted within a timeline to ensure it is completed before the expiration of the current plan.

The Town will apply for grant funding to update the LHMP in 2026 and reconvene the Hazard Mitigation Planning Team at the direction of the Selectboard Chair by the 4th quarter of 2027 to kick-off the update process and secure consultant services for assistance in the planning process. The Selectboard Chair will again reach out to the community for additional volunteers to participate as members of the Hazard Mitigation Planning Team for the new plan period.

The Team will conduct a new survey and planning activities as outlined in the Process Flow Chart **(Appendix C**). Plan monitoring information gathered during the annual reviews of this update will be consulted along with updated hazard data, town and regional plans, and new relevant reports and studies. All public meetings will be warned following town protocols.

A preliminary draft plan will be made available for public comment on the town and regional websites, and Andover's listserve with a hard copy made available at the town office. A publicly warned meeting will be held in the 3rd quarter 2028, during which any substantial revisions gathered during the public input period will be discussed. A final draft will be provided to the Hazard Mitigation Planning Team, neighboring towns and Andover Boards and Commissions and concurrently to Vermont Emergency Management for review and comment in the 4th quarter 2028. VEM approval and referral to FEMA for Approval Pending Adoption (APA) to be completed by the 1st quarter 2029 for Town adoption. A copy of the final plan with adoption resolution will be sent to FEMA to complete the plan approval and adoption process before this plan expires in the 2nd quarter 2029.