

Town of Windsor, Vermont: Local Hazard Mitigation Plan

2021-2026

November 1, 2021

Adopted by the Town of Windsor
November 13, 2021

*Prepared by
Town of Windsor
and
Mount Ascutney Regional Commission*

EXECUTIVE SUMMARY

This 2021-2026 Local Hazard Mitigation Plan is an update from the previous 2016-2020 plan. As with the prior plan, this planning effort recognizes the benefits of taking a proactive approach to reduce the impact of natural hazards on the Windsor community. A town must have a current FEMA approved five-year plan that meets all the required elements in regulation 44 CFR §201.6 in order to be eligible for federal and state disaster recovery funding.

Hazard mitigation planning is a local public process to identify those hazards that not only have historically impacted the town, but can be expected to affect the Windsor community in the future; and to develop and monitor the implementation of specific strategies and actions that will reduce the potential for physical and financial loss from these hazards should a disaster occur.

The **Hazard Profile and Assessment** in **Section 5** provides a basis for the selected strategies and actions listed in **Table 12: 2021-2026 Mitigation/Preparedness Strategies and Actions** on page 72. These action items, identified by the Town's Hazard Mitigation Committee members, are a culmination of an initial assessment and prioritization of hazard trends and their impact on town property, infrastructure, economy, life and the local environment.

Most notable projected hazard trends obtained through review and discussion of current data resources is an increased probability of occurrence for flooding and erosion, extreme temperatures, drought, high wind events, and ice. As a result, a greater potential for wildfire and structure fire is also possible. Newly noted hazards that are briefly discussed in this plan update are Infectious Disease and Plant Infestations.

As in the prior plan, **Flooding** and related **Erosion** continue to be priority events, given the Town's geographical characteristics and historical and projected probability of occurrence and impact. This update identifies **Ice**, **Extreme Cold** and **Heavy Snow** as separate hazards, previously combined in the prior plan. These are now assessed separately due to changes in climate that have increased the impact of ice and extreme cold while the impact from heavy snow remains constant and is not expected to change.

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 now identified separately as a significant hazard from thunderstorms, winter storms, and other severe weather events that are not always accompanied by precipitation. Combined, high winds from these weather events have a high probability of occurrence with higher wind gusts. **Drought** is also newly recognized as a notable and increasing risk to the community with more frequent extended periods of **Extreme Heat** and variability in precipitation events.

The Town's geographic and demographic vulnerability to **Wildland** and **Structure Fire** has kept these hazards as priorities that could potentially worsen with higher frequencies of extreme weather events such as drought, high wind and thunderstorm events. **Infectious Disease Outbreak** and **Plant Infestations** are newly identified hazards given the recent COVID-19 pandemic and the potential impact on town infrastructure from recent tree infestations.

Table 12 identifies and prioritizes a number of preparedness and mitigation actions including infrastructure upgrades, preparedness actions to improve emergency response, outreach efforts to raise community awareness, and potential policy and capability enhancements. Ideas were drawn from Town plans, River Corridor Plans, Road Erosion Inventories, and state and neighboring town hazard mitigation plans, as well as suggestions from FEMA guidance documents. You will find the proposed mitigation ideas in Table 12 to be more specific actions compared to prior plans and consistent with other Town plan policies and recommendations. There are also larger projects that have been broken down into phases for more feasible implementation of important and longer-term mitigation projects.

Particularly important and new this update, is the formal monitoring of plan progress over the five-year planning period. Although the Town is not obligated to implement all the recommended projects in Table 12, it is expected to formally monitor the progress it has 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 planning.

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

Town of Windsor 2021-2026 All Hazard Mitigation Plan
November 13, 2021

CERTIFICATE OF ADOPTION

Town of Windsor, VT
Selectboard
**A Resolution Adopting the
Town of Windsor 2021-2026 All Hazard Mitigation Plan**

WHEREAS, the Town of Windsor 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 Windsor Selectboard on September 28, 2021, to present and receive public comment on the draft Plan; and

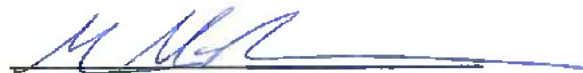
WHEREAS, the updated Town of Windsor 2021-2026 Local Hazard Mitigation Plan demonstrates the community's commitment to implementing the mitigation strategies and authorizes responsible agencies to execute their actions; and

WHEREAS, the updated Town of Windsor 2021-2026 Local Hazard Mitigation Plan was submitted to Vermont Emergency Management and the Federal Emergency Management Agency for review on July 24, 2021; and

NOW, THEREFORE BE IT RESOLVED that the Town of Windsor Selectboard hereby adopts the 2021-2026 Windsor Local Hazard Mitigation Plan for municipal use and implementation.

Duly adopted this 13 day of Nov, 2021.

Selectboard



Chair, Windsor Selectboard

Member

Member

Member

Member

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Map 4: Forest Block Map

Map 5: Downtown Flood Overlay

Appendix B: Agendas, Sign-In Forms, Public Notice

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Appendix E: Future Hazard Mitigation Ideas

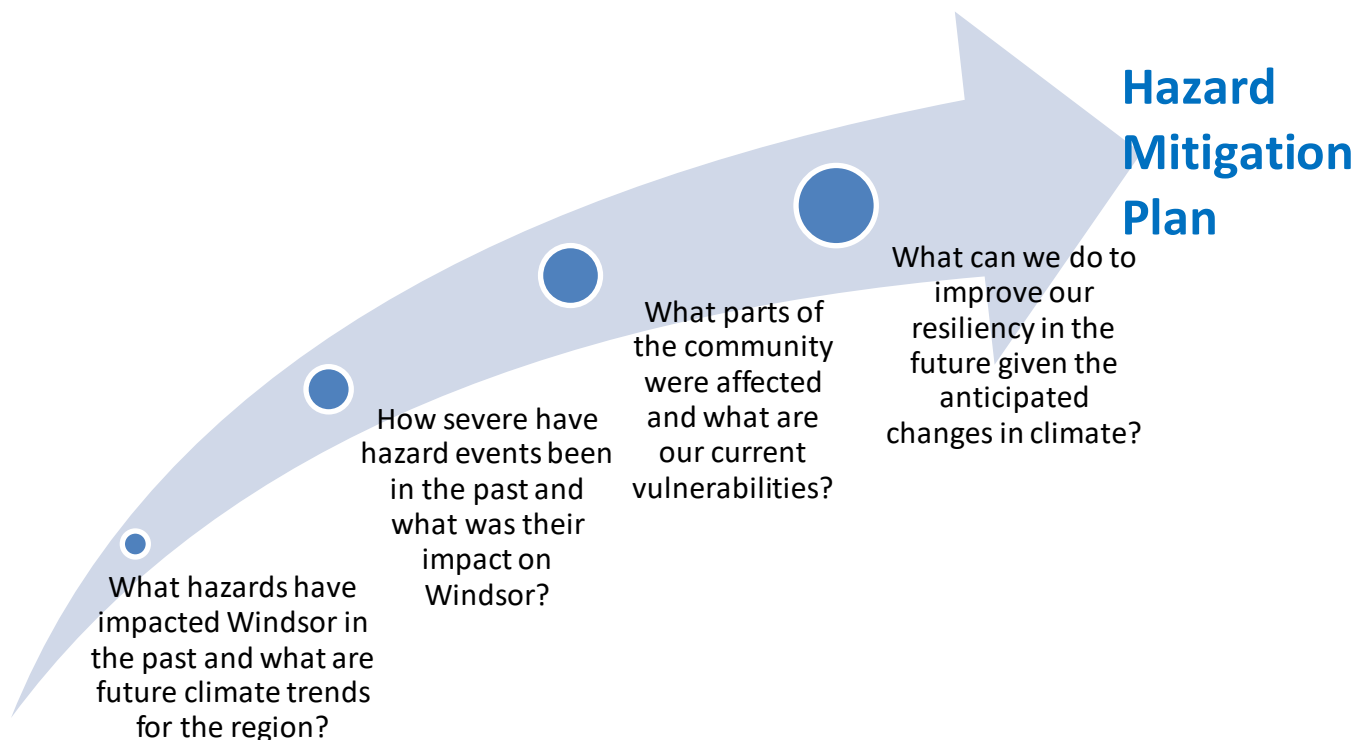
Appendix F: Plan Monitoring Forms

1. INTRODUCTION

This Local Hazard Mitigation Plan is intended to assist the Town of Windsor in identifying and understanding the risks of natural hazard events to the community and developing strategies and actions that can be taken to improve the resiliency of the local community to hazard events.

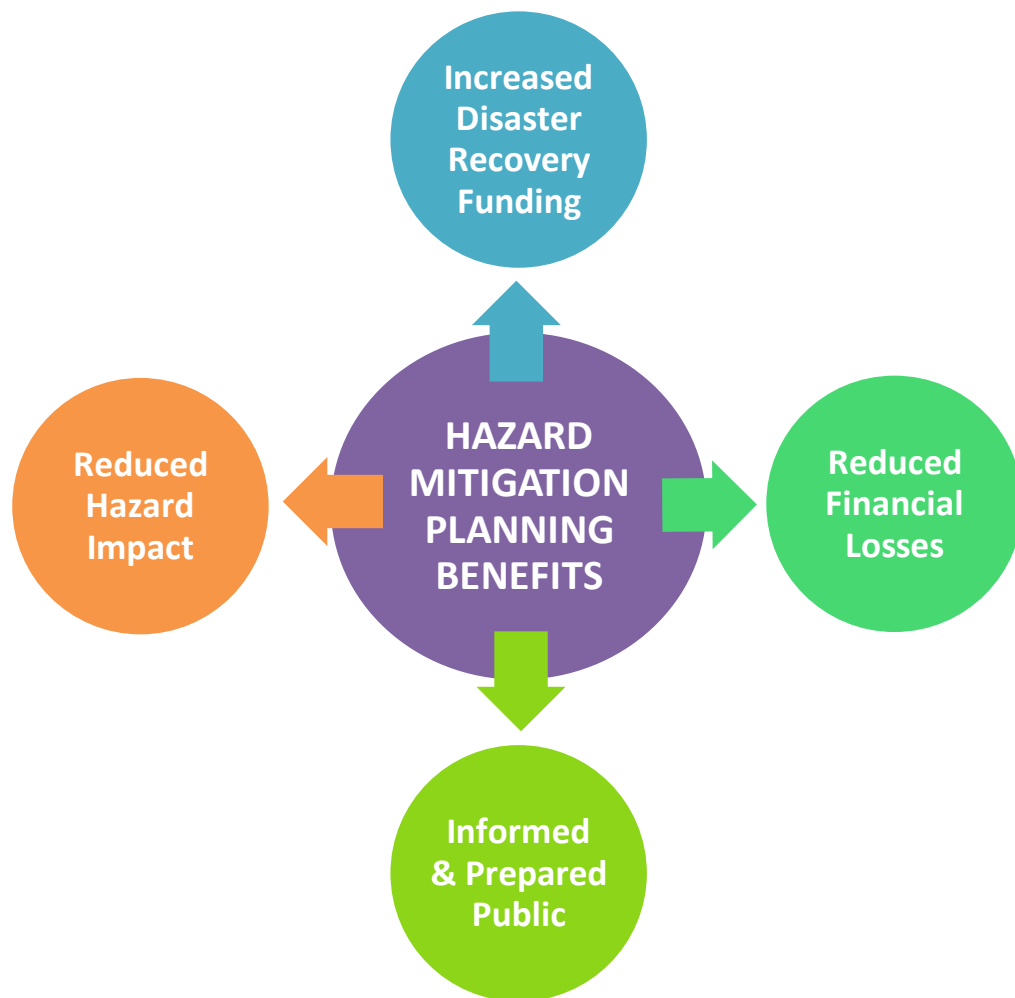
Local Hazard Mitigation Planning is the process of identifying strategies and policies in order to develop a long-term plan of action that will reduce or remove future risk and losses to a community caused by natural or man-made hazard events. This planning effort involved an assessment of local capabilities and resources, an awareness of historical and future hazard occurrences, an understanding of the potential impacts to life, local economy, infrastructure and the environment; and a determination of vulnerable areas and assets within the community. These efforts concluded with a list of actions that can be found in **Table 12** at the end of this plan that are to be monitored for progress over the next five-year period.

This plan will focus on assessing natural hazards and mitigating actions. The Windsor community has provided input to this plan in the form of local and historic knowledge and experience.



2. PURPOSE

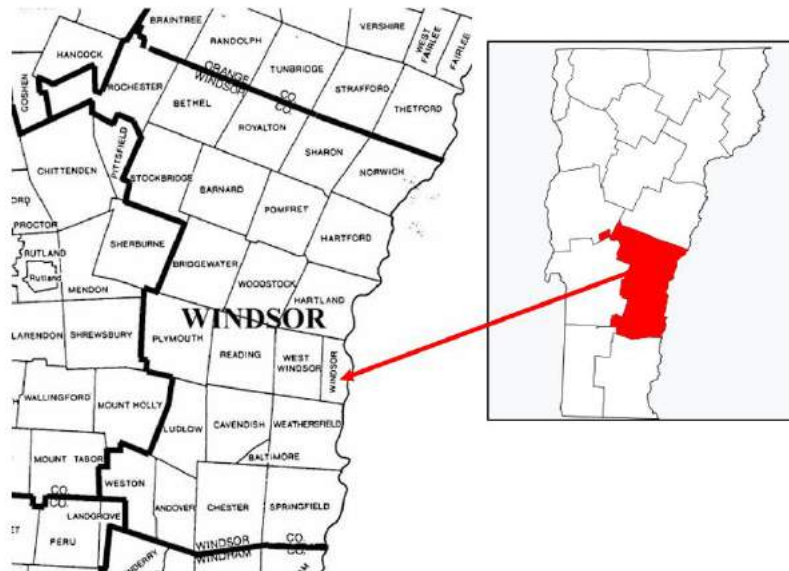
The Federal Emergency Management Agency (FEMA), Vermont Emergency Management (VEM), and local towns have come to recognize that it is less costly to take action to minimize the impact of natural hazards than to repeatedly repair damage after a disaster has struck. Hazards cannot be eliminated, but it is possible to determine what the hazards are and which are more likely to occur and tend to have the greatest impact on a community. With some research and outreach, a local community can determine the extent and impact of these hazards and which assets and areas are most at risk. A culmination of these efforts is a working dynamic list of specific strategies and actions that can be taken to reduce the impact of these hazards on the community. This plan also recognizes and has identified opportunities for mitigation measures during all of the other phases of emergency management: preparedness, response, and recovery.



3. TOWN PROFILE

The Town of Windsor is a small rural New England town located within Windsor County in southeastern Vermont. It is bordered by the Towns of Hartland, Weathersfield, West Windsor, and Cornish, New Hampshire.

The Windsor County region is comprised of 24 towns and is the largest county by area in Vermont, encompassing 977 square miles. It is influenced by both the Connecticut River, which runs along the eastern edge, and the Green Mountains which dictate the physiology of the western edge of the region.



Known as the “Birthplace of Vermont”, the Town of Windsor is a relatively small town in terms of land area, only 20 square miles, with a population of 3,400. The historic buildings in the downtown are surrounded by outstanding natural assets, including the Connecticut River, Mount Ascutney State Park, Mill Pond, Lake Runnemede and Paradise Park. A large infrastructure system, built for the expansive manufacturing industry that thrived in the mid-1900s, serves the more developed parts of Town. Mt. Ascutney Hospital, the Windsor school system and smaller-scale shopping opportunities in Windsor serve the surrounding towns.

The Town’s topography is relatively flat land with rolling hills and it is situated with its entire east border along the high banks of the Connecticut River. The Mill Brook is a tributary of the Connecticut River that runs through Windsor and feeds the Mill Pond, an 80-acre waterbody just south of downtown that services one of the Town’s recreation centers. It is impounded by the historic Ascutney Mill Dam, constructed in 1834. The dam’s stone buttress which had been damaged by Tropical Storm Irene has been repaired since the prior plan. North of downtown, Kimball Brook and Hubbard Brook feed Lake Runnemede, which is managed for wildlife conservation and accessed through Paradise Park in Windsor’s Town forest.

Windsor is served by four state roads which provide a number of alternative evacuation routes. These major thoroughfares also bring of out-of-state travelers through town on their way to other south centrally located tourist destinations. The Green Mountain Railroad runs through Windsor on the route that extends from Bellows Falls to Rutland. Currently the tracks are used mainly for freight traffic, although an excursion train, the Green Mountain Flyer, runs from Bellows Falls to Ludlow during the fall foliage season.

Vermont state highways including Routes 44 and 44a along with US Route 5 and Interstate-91 connect the town with larger population centers to the north and south. In addition, Bridge Street and County Road are classified as Class 2 town highways and serve as important connections to other towns. Bridge Street is notable as it leads to the historic Cornish – Windsor Covered Bridge, originally built in 1976, and reconstructed in 1988. The covered bridge, which spans the Connecticut River, is the only direct connection between Windsor and New Hampshire. The bridge is owned and maintained by the State of New Hampshire.

Land use patterns in Windsor have developed in the classical New England village pattern with a densely developed downtown surrounded by more sparsely developed rural lands. The downtown commercial center is located near the Connecticut River and is concentrated along Route 5 with industrial uses nearby. The downtown is home to many beautiful historic buildings. Immediately outside of the downtown and to the west of Route 5 are high- and medium-density residential neighborhoods, sprinkled heavily with historic structures.



Beyond these neighborhoods are rural residential areas, as well as areas of farmland and forest. All of the high-density residential areas are served by Town water and sewer while areas outside of the downtown are served by private wells and on-site septic systems. The current zoning map designates uses and areas of development which are sufficient to handle current development trends. **(See Appendix A: Map 1 – Existing Land Use)**

Windsor has two sections of town located in the Industrial zoning district, Windsor Industrial Park (i.e. Artisans Park) north of town and the other to the far south occupied by construction enterprises. The former Goodyear 60-acre campus, although not in

the Industrial District, is located in the downtown area east of the railroad tracks. Recreational centers are on the outskirts of the town center and include Lake Runnemedede (also known as Evart's Pond) to the northwest, used primarily for conservation and known for its natural beauty, mountainous views and recreational opportunities. To the southwest of downtown is Mill Pond (also known as Kennedy Pond) impounded by the historic Ascutney Mill Dam (also known as Windsor Upper Dam) or Mill Pond Dam) which is one of the oldest in the country. The impoundment is an important summer recreational area for the town.



Windsor County's population of 46,720 (2010 U.S. Census Bureau) experienced uninterrupted growth since 1950 averaging 7.9%. However, according to the Census, the most recent decade has seen a substantial decrease in the rate of population growth at 0.6% from 2000 to 2010, compared to Vermont State at 2.8%. This was primarily the result of substantial drops in the two highly populated towns of Rockingham and Brattleboro, offset by modest increases in smaller towns. Windsor County population has been decreasing since 2000 from 57,481 to 55,275 in 2019. Conversely, over the same period, the median age and household income for the county have been trending up; now at 47.7 years of age and \$60,987, respectively.

The population of the Town of Windsor has been in decline, falling 18% since 1970, according to the U.S. Census (See **Table 1**). Over the same period, the percent of population under 18 years of age has dropped by more than half while the percent over 65 years of age has almost doubled. Although the population for Vermont and for Windsor County is generally aging, over the past 20 years, the over 65-

years-of-age population in Windsor has remained steady at, approximately, 21%.¹ Median income for Windsor in 2019 was \$49,063, below that of \$60,987 for the County.²

TABLE 1: Windsor Population and Age Distribution – 1970-2019³

Year	1970		1980		1990		2000		2010		2019	
Population	4,158		4,084		3,714		3,756		3,593		3,392	
Age	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total	#	% of total
<5	NA	NA	NA	NA	279	7.5%	189	5.0%	187	5.2%	197	5.8%
<18	1,376	33.1%	NA	NA	876	23.6%	644	17.1%	560	15.6%	573	16.9%
18-64	2,283	54.9%	NA	NA	1,686	45.4%	2,146	57.1%	2,066	57.5%	1,908	56.3%
>65	499	12.0%	NA	NA	873	23.5%	777	20.7%	780	21.7%	714	21.0%
Totals	4,158	100%	4,084	100%	3,714	100%	3,756	100%	3,593	100%	3,392	100%

As in all of Vermont, the climate in Windsor is generally temperate with moderately cool summers and cold winters. Average annual precipitation is around 40 inches, and snowfall generally ranges from a minimum of 70 inches to as much as 200 inches in the mountains. The weather can be unpredictable at times, with large variations in temperature, precipitation, and other conditions occurring both within and between seasons. This variation continues to grow with the effects of climate change.

Development Trends and Impact on Hazard Risk

Development over the previous plan period has not negatively impacted the community's vulnerability to the hazards addressed in this plan. Over the past five years from 2015 to current, there have been 19 permits issued for new houses, and 2 for mobile homes. No real commercial or industrial permits were issued. There have been 2 significant home renovations within the SFHA both of which were existing homes brought up to FEMA standards. It can be surmised that risk of residential flooding and fluvial erosion has been substantially reduced since the prior plan due to actions taken during this period which are listed in **Section 4.3a**.

For future development, the Town is focused on supporting the existing businesses, revitalizing the Downtown, providing the amenities desired by residents, and attracting new businesses in and around the Downtown where infrastructure exists. Lands along the Connecticut River have been designated within the Conservation future land use category and are intended to allow only land uses that preserve the floodplain such as farming and outdoor recreation. All redevelopment in Windsor will be subject to Development Review Board approval and local flood regulations.

¹ [U.S. Census Bureau](#)

² [U.S. Census Bureau](#)

³ [U.S. Census Bureau](#)

4. PLANNING PROCESS

The local planning process used to develop this hazard mitigation plan follows guidance by the Federal Emergency Management Agency (FEMA) and Vermont Emergency Management (VEM). The planning process began in December 2020 with the Windsor Town Manager reaching out to municipal staff and local volunteers to participate as members of a Hazard Mitigation Committee. A four-member Hazard Mitigation Committee (HMC) was formed to direct the activities of the process with guidance from Mount Ascutney Regional Commission's (MARC) Community Development Specialist. All correspondence was via phone or email and meetings were conducted virtually.

MARC staff had initial discussions with the Town Manager of Windsor to review the overall planning process. The discussion included the need for town input, the importance of the public participation and public notice procedure, VEM and FEMA review and approval process, and the timeline to complete the update. This information was forwarded to the also provided to committee members via email in December.

The Hazard Mitigation Committee was tasked with updating the plan and overseeing the public process. Committee members include representation from a cross-section of town departments and Boards. MARC staff conducted the meetings, provided data for the plan update, drafted the plan and presented a review of the draft plan to the Selectboard during a Selectboard public meeting. Committee Members and participants are listed below.

- Windsor Town Manager
- Windsor Highway Foreman
- Fire Chief/Emergency Management
- Zoning Administrator
- Community Development Specialist, Mount Ascutney Regional Commission

The Hazard Mitigation Committee members participated throughout the planning process either by scheduled virtual group meetings or via committee email correspondence and conference calls as outlined below.

The kick-off meeting with the Hazard Mitigation Committee began with an overview of the process with a discussion on the purpose of hazard mitigation planning, the planning process and timeline, and the importance of community outreach and public involvement. Hazard Mitigation Committee members and meeting schedules were determined at that time and a procedure was discussed on how to engage the local community to participate given State Covid restrictions that were in place at the time. The process proceeded with the tasks as depicted in **Appendix C: 2021-2026 Windsor Local Hazard Mitigation Plan Process Flow Chart**. The meeting dates and tasks performed are identified in the flow chart with **Sign-in Sheets and Agendas** in **Appendix B**.

Throughout the process members and the public were encouraged to provide information either during the virtual meetings or through Town website notifications and on the MARC Windsor Hazard Mitigation

Planning webpage. Public input on past hazard events and the impact of those events on the Town as recollected was incorporated into the hazard profile section to provide a local perspective and basis for local data research. Hazard data was updated by MARC staff, presented to the Committee members, and posted for public review.

Early in the process each hazard was assessed for the probability of future occurrence and the potential impact each would have on life, infrastructure, the local economy, and the environment. Vulnerable areas and assets were identified during the hazard assessment as part of the discussion on historical impact (see **Section 5.1: Hazard Probability of Occurrence and Impact Assessment**).

As part of the update process, the Hazard Mitigation Committee conducted a review of the status of prior plan actions and other progress made in mitigation and preparedness (see **Section 4.3a: Previous Plan Period Mitigation Actions**). Municipal capabilities and available resources for hazard mitigation planning and implementation were also discussed and suggestions made for improving effectiveness (see **Section 4.3c: Review of Town Progress, Resources and Capabilities**). A thorough review of the Town Plan policies and recommendations identified common strategies which generated ideas for new mitigation actions (see **Section 4.3b: Review of Windsor Town Plan**).

This update is an extensive update to the previous plan and includes a number of revisions and improvements. The following is a partial list of revisions:

- General updates to Town profile and town maps.
- Inclusion of an easy-to-read Process Flow Chart to depict the planning process.
- Reorganization/restructuring of the plan contents to better reflect required FEMA elements.
- Reevaluation of hazards with a new methodology for scoring similar to that of the Vermont State 2018 Hazard Mitigation Plan to better recognize the integral nature of hazard events and hazard impacts and how hazards can impact a community in different ways.
- Update of hazard data using new data sources and more local data.
- Prioritization of mitigation strategies/actions and correlation to plan goals and incorporation of phasing large projects.
- Recognition of specific prior actions completed but not previously identified in prior plan.
- 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

Due to State Covid restrictions and guidelines, all meetings were held virtually. Three monthly planning meetings were held, and all were publicly noticed (see **Public Notice** in **Appendix B**). The notice was posted on the Town website and included in the Town's weekly newsletter, as is customary for the

Town, and was linked to a dedicated Windsor Hazard Mitigation Planning Update page on the MARC website. A link to participate in the virtual meetings was offered. The MARC webpage posted the meeting schedule, agendas and planning documents and materials for public access throughout the process. The notice and webpage encouraged participation and requested public comment on planning topics with templates to provide information on hazard events and local impact. The Town Manager was tasked with keeping the Town Selectboard and relevant commissions abreast of the planning progress and noticed meetings, and to encourage participation to attending public. Public input received included:

Public Release of First Draft

A first draft was released for public review on September 1, 2021. The Public Review Process included:

- An electronic copy posted on the Town and MARC websites that circulated to individual members of the Board of Selectmen and Planning Commission, requesting comments from the local boards and community.
- An electronic distribution made to adjacent towns (Hartland, Weathersfield, West Windsor) via email to respective Town Clerks with a request to post the draft on their websites and provide a copy to their Planning Commission and Selectboard members.
- All distributions included the following:

"The Town of Windsor is seeking comment on its 2021-2026 Local Hazard Mitigation Plan draft. The purpose of this planning effort is to improve Windsor's resiliency to natural hazards through hazard assessment, recognition of vulnerable assets, and identification of mitigating actions and strategies to reduce the impact of these hazards on the community. The neighboring town communities are also invited to attend the Windsor Selectboard meeting of September 28, 2021 at 7 PM for a review of the draft plan. The meeting will be held virtually. Please feel free to forward any questions or comments to Tom Marsh, Town Manager at tmarsh@windsorvt.org by October 1, 2021. We welcome all input."

During the planning phase, only one public comment was received suggesting that wildfire section acknowledge the occurrence of underground root fires. There were no comments received from the neighboring communities or from the local community via email during the comment period following the public release of the draft.

The draft plan was presented by MARC staff during a scheduled Windsor Selectboard Meeting on September 28th 2021 following public notice three weeks prior. The following comments were received and have been incorporated into the plan draft.

- The Asian Longhorned Beetle should be included along with the Ash Borer as an invasive species that could impact the Town during the plan period. Action strategies should include the proactive removal of ash trees at first sign of infestation.
- A question was asked of the existence of an emergency plan for hazardous spills from transportation incidents and the fire chief provided a response. MARC added that man-made hazards were not required to be covered under a FEMA LHMP but can be added. The plan will note these types of incidents as a secondary hazard under an ice or snow hazard event.

- A board member asked if the Town was obligated to implement the list of strategies in Table 12 over the 5-year plan period. MARC responded that the town is not obligated to implement all these actions and it is made clear in the plan that progress is dependent upon availability of funding, feasibility and cost/benefit as well as community and municipal support and capacity. However, the town should be showing progress towards reducing its vulnerability to the identified hazard risks.

The final plan draft will complete the Vermont State Hazard Mitigation Officer review for referral to FEMA for Approval Pending Adoption (APA). Following APA, the Town may then adopt the Local Hazard Mitigation Plan and forward a copy of the adoption resolution for FEMA to complete the plan approval and adoption process. The final adopted Local Hazard Mitigation Plan will also be posted on the Town and Mount Ascutney Regional Commission websites and made available at the Windsor Town Offices.

4.2 Resources Consulted

A number of plans, studies, reports, and technical information and web data sources 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:

- Local Hazard Mitigation Plan, Town of Windsor, Adopted April, 2016
- Windsor Town Plan, adopted November 12, 2019
- Windsor Zoning Regulations, as amended in March 24, 2015
- 2008 Hubbard Brook Phase I Stream Geomorphic Assessment
- Windsor 2016 Stormwater Report
- Mill Brook River Corridor Plan, 2015
- Tactical Basin Plan for the Black and Ottauquechee Rivers and Connecticut River Tributaries, 2018
- Town of Windsor 2017 Road Erosion Inventory
- MRGP Road Assessment of Hydrologically Connected Segments, 2017-2018
- Windsor Community Flood Study, May 2014
- A Plan for Windsor's Riverfront Community - Connecting The Right Side of the Tracks
- Great River Hydro Plans for Dam Failure: 9/28/2018 Local News reformer.com
- [U.S. Census Bureau](#)
- [NOAA Storms Event Database](#)
- [Vermont Division of Fire Safety](#)
- [U.S. Climate Data](#)
- [USGS WaterWatch](#)
- [FEMA Disaster Declarations](#)
- [Vermont Agency of Natural Resources-Flood Ready](#)
- [State of Vermont 2018 Hazard Mitigation Plan](#)
- [Drought.gov](#)
- Mount Ascutney Regional Commission for GIS mapping data

4.3 Review of Town Progress, Resources, and Capabilities

4.3a Previous Plan Period Mitigation Actions

Table 2 below lists the mitigation and preparedness projects and actions from the previous *2016 Windsor All Hazard Mitigation Plan* and indicate the status of each as determined by the Hazard Mitigation Committee. It can be seen that most of these actions have been completed. Other actions that are ongoing or uncompleted were reevaluated for inclusion in **Table 12: 2021-2026 Mitigation/Preparedness Strategies and Actions** at the end of this document. Others were deemed to be ineffective or not necessary and have been dropped.

TABLE 2: Status of Previous Plan Mitigation Actions

2016 MITIGATION ACTION	2021 STATUS
Maintain Basic Emergency Operations Plan	ongoing
Maintain ICS/NIMS Training	ongoing
Discuss Requirements/ Encourage the installation of adequate fire suppression into new construction	ongoing
Discussion & Upgrades to Mill Pond dam to meet standards	Repairs to Dam Buttress completed
Collect additional hazard vulnerability data for inclusion in next plan update	In progress
Discuss/Identify Options for Bridge enlargement on Bridge Street	Infeasible, dropped
Enhance fire suppression capabilities	ongoing
Make NFIP pamphlets available in town	completed
Review Regional Resources List (shared equipment inventory)	ongoing
Public Outreach: distribute state brochures on fire prevention	Completed – Brochures and Digital material available
Conduct studies to assess vulnerability of critical facilities to earthquake events	completed

2016 MITIGATION ACTION	2021 STATUS
Conduct an engineering study of critical facilities to identify vulnerabilities to high wind	Not completed and removed from list of recommended actions because of low vulnerability and low priority
Public Outreach: distribute FEMA guides and brochures	Completed – Brochures and Digital material available

Additional progress made in reducing hazard risk and improving preparedness since the prior plan:

- In addition to repairs, substantial safety reinforcements were made to further stabilize the stone buttress and spillway of the historic Ascutney Mill Dam following Tropical Storm Irene (TSI) to reduce the risk of a dam breach.
- Juniper Hill upgrades have improved the resiliency of the road.
- Permanent removal of Brook Road Bridge 22 and debris with bank stabilization and a conservation easement through Upper Valley Land Trust to maintain vacant lots for floodplain access and sediment storage.
- Debris cleanup of the Goodyear Industrial Campus concrete slab for a solar array install has reduced the risk of a release of hazardous material debris during future flood events.
- Windsor’s Riverfront Redevelopment Plan highlights the flood hazard risks, includes mapping of 180 structures in Special Flood Hazard Areas and plans for reducing flood risk for neighborhood communities on the Connecticut River.
- Enhancements were made to expand mutual aid agreements and technical training of EMS personnel for increased emergency response capability.

4.3b Review of Town Plan

The Windsor Town Plan was updated in 2019 and adopted November 12, 2019. Compared to earlier plans, the community is making strides in its efforts to address sustainable development, natural resource conservation, flood resiliency, and hazard mitigation. The current Town Plan includes a more comprehensive integration of the local hazard mitigation planning and a commitment to implementing its strategies and actions. Town planning can always benefit from better integration and coordination of hazard mitigation planning goals and strategies in the planning process. To help achieve this, the last Town Plan update included a Flood Resiliency Chapter with description of the hazard, vulnerable areas and recommended goals, policies and strategies.

The Windsor Town Plan has outlined goals, policies and recommendations related to hazard mitigation which can be found in **Appendix D**. Upon review, the Hazard Mitigation Committee has identified mitigation strategies and actions that will meet objectives for both the Town and Hazard Mitigation

Plans. These proposed actions can be found as noted in **Table 12: 2021-2026 Mitigation/Preparedness Strategies and Actions**.

4.3c Status of Community Resources and Capabilities

Table 3 is a compilation of community resources and capabilities including town authorities, policies, and programs, which can be helpful in reducing hazard risk for the community. Each was evaluated for effectiveness in attaining hazard mitigation goals and for opportunities for improvement. These resources and capabilities are useful in regulating development location, building design, environmental conservation, and best management practices to reduce flooding and erosion. They are critical in providing an effective local emergency response.

Windsor currently participates in the **National Flood Insurance Program (NFIP)** and will continue to regulate floodplain use through the Flood Hazard Review which is conducted during the development review as outlined in the Town's Zoning Regulations and Flood Hazard Overlay District Boundaries as shown on the NFIP maps, as amended in March, 2015. These regulations are based on flood elevations and floodway limits and data provided by the NFIP Flood Insurance Study and accompanying maps. Participation status for Windsor can be found on pg. 48.

Continued enforcement of these regulations by the Windsor Administrative Officer will maintain Windsor's compliance with the NFIP. The Zoning Administrator is charged with implementing these regulations and, in concert with the Development Review Board, advising residents on floodplain development.

TABLE 3: Status of Community Resources and Capabilities

Resource	Description	Effectiveness in implementing HM Goals	Opportunities for Improving Effectiveness/Status
2019 Town Plan	Plan for coordinated town-wide planning for land use, municipal facilities, etc. Updated every 8 years.	Effective in addressing development in hazard areas, including floodplains. The last update incorporated a flood resiliency section.	Plan can be strengthened to be more effective by better coordinating with LHMP goals and actions in some Town Plan sections.
2019 Town Plan Addendum on Flood Resiliency	State requirement for Town Plans as of 2015. Identifies flood and fluvial erosion hazard areas and vulnerable structures. Recommends policies and strategies to mitigate risks.	Effective in providing guidance to restrict new development in identified flood hazard, fluvial erosion, and river corridor areas, and encourage floodplain protection and restoration and flood emergency preparedness.	Opportunities to consider actions that meet stated recommendations, policies & goals that reduce flood hazard risk in vulnerable areas identified.

Resource	Description	Effectiveness in implementing HM Goals	Opportunities for Improving Effectiveness/Status
Connecticut Valley Fire Mutual Aid System and the Upper Valley Fire Mutual Aid System	Provides access to dozens of other fire departments, in addition to the equipment and personnel at the local fire station	Effective in providing the capacity for the Town to respond within minutes to a large-scale emergency in Windsor.	Radio communication standardization will improve effectiveness.
Local Emergency Management Plan (LEMP) (adopted 4/2020)	Basic municipal procedures for emergency response Updated annually.	Effectively outlines procedures for call-outs, evacuation, etc.	VEM updated the LEMP process in 2019 to allow towns more planning flexibility and additional planning resources online at VEM/LEMP . No improvements to be made by Town.
Local Emergency Planning Committee 3 (LEPC3)	Volunteer organization involved in regional hazard mitigation efforts	LEPCs create an important partnership between residents, local government, and industries to protect communities from hazardous materials incidents, emergencies, and disasters.	State is in discussion to move forward with a statewide LEPC and transition to (REMC) Regional Emergency Management Committee. The REMCs will act as all-hazards planning committees that are regionally organized and locally controlled. This regional approach will be more effective for HMP in small towns for hazards such as flooding.
LEPC 3 All Hazards Resource Guide	A planning tool and resource to Local Emergency Planning Committee for towns in emergency situations	Effective in providing data and resources to town first responders	Last revised in 2016. No updates are planned at this time but state is considering expanded use by contractors.
School Emergency Response Protocol	School procedures for emergency response	Utilizes template provided by state; provides a checklist of actions for use by administrators and first responders. Effective to reference during emergency situations.	Recently standardized to improve coordination with Municipal Aid Programs. Coordination with the LEOP will improve effectiveness.
State Road & Bridge Standards (last adopted 7/9/2019)	Town complies with State design and construction standards for roads and drainage systems.	Effective through their continued implementation	Continued implementation of State Road standards is critical to effectiveness. No improvements to be made by Town.
Municipal Roads General Permit (MRGP)	State Standards have been updated to include the MRGP to	Effective in controlling road erosion and stormwater run-off from	Work with regional planners to actively pursue available funding opportunities to implement

Resource	Description	Effectiveness in implementing HM Goals	Opportunities for Improving Effectiveness/Status
	control runoff and drainage on hydrologically connected road segments. Compliance is being phased in over time.	roads with implementation of Best Management Practices. Current update requires prioritization and planned implementation schedule of identified road segments. Provides funding source for compliance.	recommended improvements on hydrologically connected road segments. Be proactive in preparing and annually monitoring an implementation plan for compliance.
Infrastructure & Road Maintenance Programs (last updated 2020)	Bridge & Culvert Inventory, updated every 3 years.	Effective at tracking and planning for upgrades to most vulnerable infrastructure	Proactive planning to incorporate identified needed upgrades through available clean water and road improvement grant programs can improve effectiveness.
Subdivision Regulations	Regulates the division of land, standards for site access and utilities	Effective through their continued implementation	Continued updates and enforcement are important for continued effectiveness. No improvements or updates planned at this time.
Windsor Zoning Regulations (amended 3/2015)	Seeks to guide development in conformance with Town Plan.	Effective in standardizing the permitting and review process for development within a flood hazard area.	Continued updates and enforcement are important for continued effectiveness. Update is planned for 2021.
National Flood Insurance Program (NFIP) (enrolled 9/28/1979)	Provides ability for residents in participating communities to acquire flood insurance	Covers damage caused by flooding and informs residents of flood risk and homeowner tools for flood mitigation. Effective in ensuring that future development is safe from flooding.	Continue outreach to flood vulnerable residents and maintain Town compliance.
State Building Code	Regulates building construction standards	Effective in meeting fire and safety standards for residential and commercial buildings	No improvements to be made by Town.
Access Permits	Regulates driveway access along town-maintained roads and in flood hazard areas	Effective in limiting the number of road cuts and in reducing the potential for flooding and erosion with culvert size requirements	Continued enforcement of access permit regulations and incorporating Flood Hazard Area requirements as updated. No improvements planned by Town at this time.

Resource	Description	Effectiveness in implementing HM Goals	Opportunities for Improving Effectiveness/Status
Windsor Zoning Administrator	Ensures compliance with zoning codes and flood hazard regulations	Effective in implementing zoning bylaws to minimize flood hazard risk	Effectiveness determined by periodic Zoning Regulation updates.
Mount Ascutney Regional Commission	Regional organization working to further Emergency Management and Hazard Mitigation goals.	Effective in assisting towns in Hazard Mitigation Planning and other municipal planning efforts and with application assistance for project funding.	The RC can improve the planning process and investigate additional sources of historical and statistical data for identified hazards.
Technical Resources			
Windsor MRGP Road Segment Inventory (2020)	State Program provides an assessment of hydrologically connected road segments for erosion and requires a local plan for achieving compliance.	Effective in identifying road sections that are vulnerable to erosion and suggests Best Practices to improve resiliency and bring segments up to MRGP Standards.	The Inventory report prioritizes assessed segments and can be used to identify the higher priority or most vulnerable sections.
Town of Windsor Road Erosion Inventory Report (2017)	These state funded reports were produced every few years to assess site specific vulnerabilities to erosion.	Identifies and prioritizes road erosion issues and recommended actions with cost estimates	This report is most effective when considered for capital budgeting, infrastructure upgrades and planning. It is no longer produced but some identified sites may still be relevant.
2015 Mill Brook Corridor Plan & Hubbard Brook Stream Geomorphic Study	These reports provide detailed analyses of current conditions and watershed-wide and site-specific recommendations.	Recommended actions are prioritized based on effectiveness for improving flood resiliency and water quality in rivers and streams	Effectiveness can be improved if these documents are consulted for project implementation on a periodic basis and incorporate these projects into other town planning activities
Windsor Community Flood Study (2014)	intended to identify flood and erosion hazard areas, clarify the local flood permit process, and explain complex flood rules for residents to guide redevelopment efforts.	Identifies specific mitigation techniques, explains NFIP, identifies other resources and can serve as an educational outreach document.	Effectiveness can be improved with a more active and expanded distribution effort. May require small updates upon review.
Emergency Action Plans/Maps for Ascutney Mill	Inundation Flood Maps are maintained for the Mill Pond and	Identifies specific areas at risk from inundation flooding from a dam	Effectiveness can be improved if residents are made aware of the existence of these plans and can

Resource	Description	Effectiveness in implementing HM Goals	Opportunities for Improving Effectiveness/Status
Dam (Mill Pond Dam or Windsor Upper Dam) and Wilder Dam (??)	Connecticut River dams which depict extent of inundation in the event of dam failure.	should it breach. If a dam breach is anticipated, this can help with evacuation plans and can be lifesaving.	be better prepared should warnings or evacuation be required.
Vermont Flood Ready	An online-map tool that provides mapping data to identify areas at risk of flood or fluvial erosion. Provides community risk assessment reports and references for reducing flood risk.	Effective at providing a wealth of public information on everything flood related in a community in a very concise and organized interactive web portal.	Effectiveness can be improved if the website can be better promoted through outreach or possibly offer an instructional webinar for the local community.

5. HAZARD IDENTIFICATION and ASSESSMENT

The following assessment addresses all of the hazards identified during the hazard analysis. The probability of occurrence and impact to the town were used to assess the town's vulnerability to each hazard and can be found in **Section 5.1**. Following this assessment, it was determined that only those hazards that were more likely to occur were further examined for historical occurrence and extent of impact, and trends and community risk as outlined in **Section 5.2**.

5.1 Hazard Probability of Occurrence and Impact Assessment

A hazard vulnerability assessment for Windsor began with identifying all possible natural hazards as addressed in the *2018 Vermont State Hazard Mitigation Plan*. The group performed two assessment exercises, similar to the approach that was used in the State plan. This type of approach was helpful in that it distinguished between hazard events and hazard impacts. For example, **Wind** is a hazard impact from different hazard event types: Hurricanes, Thunderstorms and Winter Storms and **Erosion** can result from Tropical Storms, Ice Jams, Thunderstorms or spring melt. This new approach to the assessment allowed for better focus on the probability and risk of the impact of flooding, for example, rather than on the weather event itself.

The first exercise was to generate a **Hazard Event Probability Score** for each hazard event based on the frequency of historical occurrence and the projected occurrence over the plan period, given expected changes in climate. These scores are shown in **Table 4a: Hazard Events Assessment** along with a listing of possible impacts from each event type.

The second exercise listed all possible hazard impacts and generated a **Potential Hazard Impact Score** by considering the potential severity and extent of damage and disruption to the population, property, public services, the economy and the local natural environment. An overall **Hazard Assessment Score** was calculated by multiplying the Potential Hazard Impact Score times the Hazard Event Probability Score. The results are shown in **Table 4b: Hazard Impact Assessment**. The methodology used for each of these exercises is detailed below each table.

A discussion of each of the hazards is given in the proceeding **Subsections 5.2a through 5.2g**. Only natural hazards were further evaluated for this update. The **Hazard Profile and Assessment** in **Section 5** provided a basis for the selected implementation strategies and actions listed in **Table 12: 2021-2026 Mitigation/Preparedness Strategies and Actions**.

TABLE 4a: Hazard Events Assessment

Hazard Events	Historical Occurrence	Probability of Future Occurrence	Event Probability Score	Types of Potential Hazard Impacts from the Event
Score Range	1 - 4	1 - 4	Avg.	
Rainstorm/Thunderstorm/Microbursts	4	4	4.00	Inundation & Flash Flooding, Erosion & Fluvial Erosion, Slope Failure, High Wind, Lightning, Hail, Wildfire
Hurricane/Tropical Storm	1	2	1.50	Inundation & Flash Flooding, Erosion & Fluvial Erosion, Slope Failure, High Wind
Winter Storm	3	3.5	3.25	Heavy Snow, Ice, High Wind, Transportation Incident, Structure Fire
Drought	2	3	2.50	Increases vulnerability to Wildfire, Erosion, Slope Failure, Invasive Species
Wildfire	1	2	1.50	Increases vulnerability to Erosion and Slope Failure
Ice Jams	2	2.5	2.25	Inundation, Fluvial Erosion
Extreme Cold	3	3	3.00	Increases vulnerability to Structure Fire
Extreme Heat	2	3	2.50	Increases vulnerability to Drought and Wildfire
Earthquake	1	1	1.00	Slope Failure
Tornado	1	1	1.00	Wind, Hail
Dam Failure	1	1	1.00	Inundation, Erosion, Fluvial Erosion, Landslide
Infectious Disease	1	3	2.00	

Historical Occurrence: Relative frequency of occurrence experience in the past 10 years

- | | |
|-------------------------|--|
| 1 = Rarely | 0 to 2 occurrences |
| 2 = Few Occurrences | 2 to 5 occurrences |
| 3 = Several Occurrences | 5 to 9 occurrences |
| 4 = Annual Occurrence | 10 or more occurrences or typically experienced at least once annually |

Probability of Future Occurrence: Probability of occurrence over next 10 years.

- | | |
|-------------------|--|
| 1 = Not Likely | Not expected to occur |
| 2 = Occasionally | Could plausibly occur at least once |
| 3 = Likely | Likely to occur in any one year |
| 4 = Highly Likely | Highly likely to occur at least once in any one year |

Types of Hazard Impacts: Examples of types of impacts should a hazard event occur.

- | | | |
|-------------------------|--------------------------|--------------------------|
| Fluvial Erosion/Erosion | Landslides/Slope Failure | Inundation Flooding |
| Ice/Ice Jam | Heavy Snow | Hail |
| Extreme Heat/cold | Drought | Wildland/Structural Fire |
| High Wind | Lightning | Infectious Disease |
| Invasive Species | Transportation Incidents | |

TABLE 4b: Hazard Impact Assessment

Hazard Impacts	Probability Score*	Potential Hazard Impact (score 1-4)					Hazard Assessment Score**
		Infrastructure	Life	Economy	Environment	Avg.	
Inundation / Flash Flooding	4	2	2	2	2	2.0	8.0
Fluvial Erosion/ Erosion	3	2	1	1	2	1.5	4.5
Slope Failure	1	1	1	1	1	1.0	1.0
Ice	4	3	2	1	1	1.75	7.0
Heavy Snow	3	1	1	2	1	1.25	3.8
High Wind	3	2	2	1	1	1.5	4.5
Hail	1	1	1	1	1	1.00	1.0
Lightning	2	1	1	1	2	1.25	2.5
Extreme Cold	4	1	2	1	1	1.25	5.0
Extreme Heat	4	1	2	1	1	1.25	5.0
Wildfire	4	1	1	1	1	1.00	4.0
Structure Fire	4	1	2	1	1	1.25	5.0
Earthquake	1	1	1	1	1	1.0	1.0
Drought	3	1	2	1	2	1.50	4.5
Dam Failure	1	4	3	4	4	3.75	3.8
Invasive Species	3	1	1	1	2	1.25	3.8
Infectious Disease Outbreak	2	1	2	3	1	1.75	3.5

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

While the assessment scores in **Table 4b** are not intended to prioritize hazard risk, they can be used to get a general sense of which hazards are of greatest concern to the Windsor community. The Hazard Mitigation Committee had decided that only those natural hazards which scored a '4' or greater out of a possible 16 were considered for evaluation and are profiled in this plan. These are highlighted in the **Table 4b** above. For other hazards, the HMC decided that these be excluded given that the likelihood of occurrence is either very low with no account of recent local occurrence or the hazard impact is very isolated or low.

Subsections below provide additional detail of each of the hazards determined to be most relevant to the Town of Windsor. 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; and
- hazard trend and determination of populations and community assets at risk.

The following hazards were determined to be of lower priority for reasons noted below. For more information on these hazards, the reader is directed to the [2018 Vermont State Hazard Mitigation Plan](#).

Hail and **Lightening** do occur but very rarely and have not resulted in reported damage to the Town of Windsor. 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** can be significant hazards, the likelihood of occurring in Windsor over the plan period would be negligible for New England per the Vermont State Hazard Mitigation Plan. Local regional recollection of this type of hazard occurring has been the sensation of minor tremors felt from distant events.

Infectious Disease would likely be addressed at a state or nationwide scale. However, additional evaluations could be done for local opportunities to improve preparedness for emergency response and supplies. This is recognized as a secondary hazard with a new action item in **Table 12**, but the hazard is not profiled in this local plan.

Heavy Snow events are anticipated during the winter season and most small towns, like Windsor, have the equipment and local capacity to clear and manage average annual snow loads of over 85 inches for southern Vermont.

Invasive Species is a recognized hazard and has increased since the ravaging of Tropical Storm Irene in 2011. Japanese Knot Weed has claimed the barren riverbanks and its shallow root system make this invasive prone to wash out during high water flow events causing blockage under bridges and in

culverts. However, removal from barren sections of riverbed is not permitted and berm removal and restoration to improve floodplain access would also include removal and revegetation with native species. Infestations of local plant species can be considered here in future planning as the impacts of the Emerald Ash Borer and White Pine Needle Disease progress with regional mitigation efforts. This is recognized as a secondary hazard with risk to town infrastructure and residents. A new action item for this is included in **Table 12**, but the hazard is not profiled in this local plan.

Slope Failure is a real threat along the banks of the Williams River as a result of the severe erosion caused by Irene. Should they fail and block an underpass, significant isolated flooding could occur. The scope to mitigate this hazard is beyond the jurisdiction and capability of the Town and is not covered here. Flood mitigation efforts upstream may help to reduce this risk.

Dam Failure was assessed as having a low probability of occurrence since repairs were made to the Mill Pond Dam buttress in 2018. However, this hazard continues to be profiled in hazard mitigation planning due to the potential for a catastrophic impact on the community (**See Section 5.2g**).

Windsor 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 Windsor has been provided where available. However, 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. Windsor will strive to improve the recording and maintenance of local hazard data and has included this as part of the monitoring process for this plan.

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.

- Flooding and related erosion continue to be a priority given the Town's geographical characteristics and historical and projected probability of occurrence and impact. However, these hazards were assessed as one in the prior plan. They are now assessed separately to better differentiate the risk of erosion due to river or inundation flooding or stormwater flow.
- Winter Storm related hazards were combined in the prior plan. This update identifies ice, extreme cold and heavy snow as separate hazards. This is due to changes in climate that have increased the impact of ice and extreme cold while the impact from heavy snow has been a low priority and is not expected to change.
- Ice from winter storm events has become a more frequent occurrence, due to a trend towards more extreme variations in temperature during the winter season, and is identified separately from other winter snow events (extreme cold and heavy snow) in this update. This in turn

increases the risk of transportation incidents on major throughfares through town and of downed powerlines and structure fire incidents.

- Extreme Heat and Extreme Cold have increased in priority primarily due to an increase in probability of occurrence and duration of events with climate change. The aging of Windsor’s residents, a more vulnerable population, was also a consideration.
- High Wind is now identified separately as a significant hazard impact from thunderstorms, winter storms, other severe weather events, and winds without precipitation. Together these events have a high probability of occurrence and prevalence of higher wind gusts.
- Drought is now recognized as a notable and increasing risk to the community with more frequent extended periods of extreme heat and variability in precipitation events.
- Infectious Disease Outbreak has been identified as a hazard risk due to the recent COVID-19 pandemic experience. Impact to the community from this type of hazard is widespread and recovery is long. The potential of a new pandemic or likelihood of the continuation of COVID-19 during the plan period exists but was determined to be low.
- Plant Infestations due to climate change is beginning to gain recognition. While more information is needed, the Town recognizes that this could become a hazard for town roads and infrastructure.

The types of hazards having the greatest impact on a regional basis can be gleaned from **Table 5**, 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. Severe Winter Storms also occur; however, harsh winters are a ‘way-of-life’ in Vermont and the Windsor Town Highway Department is accustomed to operating in heavy snows and low temperatures. Other hazards such as flooding, wildfires, ice jams and landslides are more localized and characteristic of a town’s topography, roadways, infrastructure, location of critical facilities, and land use and less likely to result in a federally declared disaster.

TABLE 5: Federal Disaster Declarations for Windsor County VT⁴

Federal Disaster Declarations: Windsor County 1970 – 2020(current)			
FEMA Disaster Number	Date of Declaration	Description	Date Occurred
3567-EM-VT	August 22, 2021	Tropical Storm Henri	August 22, 2021
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, 2012

⁴ [FEMA Disasters Declaration Website](#)

4207	February 3, 2015	Severe Winter Storm	December 9-12, 2014
4140	August 2, 2013	Severe Storms and Flooding	June 25-July 11, 2013
4022	September 1, 2011	Tropical Storm Irene	August 27-September 2,
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,
938	March 18, 1992	Flooding, Heavy Rain, Ice	March 11, 1992

5.2a. Wildfire

Probability of Occurrence: 4.0
 Average Hazard Impact: 1.0
 Hazard Assessment Score: 4.0

Wildfire was identified as a notable hazard for the Town primarily because of the high probability of occurrence, although the impact of fire incidents is typically isolated.



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

Wildfires, which for discussion here include forest, brush, crop or grassland fires, are defined as ‘An *uncontrolled burning of woodlands, brush or grasslands.*’⁵ While relatively uncommon within Vermont and the Town of Windsor, large **wildland fires** are always a threat particularly for rural communities with large tracts of forested and vegetative land and

⁵ 2020 Vermont State Hazard Mitigation Plan

have the potential to damage structures and utilities and croplands. A major wildfire can leave a large amount of scorched and barren land susceptible to erosion for many years, particularly on steep slopes and ridgelines.

Wildfire 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.

Wildfire History and Extent of Impact

The State Hazard Mitigation Plan's analysis of wildfire threat states that *"Wildfire 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"*.⁶ Wildfires can be ignited by lightning during a thunderstorm; however, this is rare in Vermont. More typically, brush fires or burning debris are the major causes for 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 wildfire 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 wildfire.'⁷

National Weather Service Criteria for Issuing a Red Flag Warning'

- Winds sustained or with frequent gusts > 25 mph
- Relative Humidity at or below 30% anytime during the day
- Rainfall amounts for the previous 5 days < 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)

In addition to a wildfire event reported in NOAA'S Storm Events Database, just south and west of Windsor, the following incidents have been locally reported:

- 26-acre forest fire in Andover, a neighboring town, caused by a re-kindled brush fire;
- 47-acre forest fire in Brattleboro, sparked by a downed powerline;
- 137-acre forest fire in Norwich, also caused by a downed powerline; and
- 1/3 acre in Killington last summer that continued burning underground for three days.

⁶ 2018 Vermont State Hazard Mitigation Plan

⁷ 2018 Vermont State Hazard Mitigation Plan



Both structural and wildland fires have historically been reported in the annual Vermont State Fire Marshal Report, which provides yearly fire statistics from FEMA's Nation Fire Incident Reporting System (NFIRS). **Table 6: Fire Statistics for Vermont, Windsor County and Town of Windsor** shows historical fire reporting data (where available) for Vermont, Windsor County and the Town of Windsor as reported to NFIRS.

The fire statistics reported by the State Fire Marshal no longer breakout data for wildfire and structure fire separately. Instead, the NFIRS Series 100 reporting has been used since 2015 and includes both structure and wildfire type incidents, as well as vehicle fires. It can be estimated from Table 5 that the average annual fire

incidents reported for Windsor is 6 wildfires and 10 structure fires. Average annual fire incidents reported in Windsor is 19 and has trended up since 2010 and is discussed below.

The average wildfire impact in Vermont between 2012 and 2016 was 109 fires and 317 acres per year, or 2.9 acres per wildfire incident. Using this average to estimate the potential extent of wildfire hazard for Windsor gives an estimated annual loss of, approximately, 17 acres.

Wildfire 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 wildfire. The risk and impact of a wildfire event in Windsor, however, is generally less than other Windsor County towns which are geographically larger and tend to have greater forest coverage and more rural communities and economies, such logging which rely on brush burns.

Forest management could also be a factor, as noted by local fire officials. In addition to lack of precipitation, a particular town's vulnerability to large wildfires is directly related to the proportion and continuity of acreage that is forested, pasture and cropland. In Windsor, forested areas within Paradise Park and Ascutney State Park are valuable natural resources and support the local economy and recreation tourism. Wildfires can also 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. Windsor's town forests are particularly vulnerable to wildfire fire as these tracks are maintained to be contiguous for the preservation of wildlife crossings and recreational purposes. (See **Appendix A: Map 4 - Forest Block**).

Community structures are not particularly vulnerable to wildfires because they are typically located in town centers and away from large tracts of forested and vegetative land, though their close proximity to

each other increases vulnerability if a structure fire is triggered by accident. The Town continues to encourage new development in or near downtown areas in order to preserve these natural resources and conserve municipal infrastructure resources. This policy also helps to reduce the risk of structure damage losses to wildfire.

Though wildfires may not be a high hazard, the HMC identified smaller, brush fires as a high hazard due to their frequency of occurrence and lack of warning time. Drier conditions combined with higher winds may be the reason for more frequent fire incidents (or responses) as reported to the State Fire Marshall over the past 10 years, although the reports are now based on response to both structure and wildland fires and does not distinguish between them.

Vermont is seeing an increase in the average annual maximum temperature and likelihood of drought (See **Section 5.2f**). These trends are also recognized by the Windsor HMC. 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 wildfire.

It can be anticipated that small brushfires will continue to occur at a steady rate throughout Windsor on a yearly basis given the topography, climate, and land uses within the town. However, given the appropriate seasonal conditions, the threat of a large-scale wildfire remains present. While the number of responses is known by year, the size, in acres, of the events was not captured.

The Town has recently expanded their Mutual Aid Emergency Services Network as noted in **Table 3** which will improve response capability to address large. With expectations of more frequent drought conditions and increased wildfire risk, the town will plan to use available resources and outreach programs to educate the community on how to minimize the risk of brush and wildfires and to issue and enforce dry weather alerts when the risk wildfire is high.

5.2b. Structure Fire

Probability of Occurrence:	4.0
Average Hazard Impact:	1.25
Hazard Assessment Score:	5.0

Structure Fire was identified as a notable hazard for the Town primarily because of the high probability of occurrence. Although the impact of structure fire incidents is typically isolated with a low impact for infrastructure, economy, and environment, the risk of catastrophic loss of life and private property is high.

Structural Fire is not a natural hazard but an important secondary hazard from natural events with a high probability of occurrence and potential for catastrophic loss. Structure fires are common throughout Vermont during the winter months as residents heat their homes with wood or wood pellet burning stoves and other open flame methods. For this reason, structure fire can be considered a

secondary hazard to severe winter weather and extreme cold temperatures together with other state risk factors noted below.

With little or no warning, these fires can affect a single residential structure or spread to other homes, businesses or apartment complexes and can result in loss of property and life. Residential structure fires are common in Vermont. The National Fire Protection Association reports that 25% of all structure fires nationwide are in residential construction. In Vermont, residential-related fires accounted for 74% of total structure fires statewide in 2020, according to the State Fire Marshall report, with home heating as the leading cause followed by cooking and electrical.

Over the past 10 years, the top cause for residential fires in Vermont has consistently been related to home heating. While the fire problem varies across the country, there are several other common contributing factors such as poverty, climate, education, code enforcement, demographics, rural communities that influence the statistics.

Fires can be caused by improperly disposing of ashes with live coals from wood stoves, misuse of space heaters, failure to clean creosote from solid-fuel heating equipment chimneys, as well as faulty electrical wiring and lit smoking materials. The most significant common factor in fire fatalities in Vermont continues to be the absence of a functioning smoke detector in the sleeping area of residential structures.



Structure Fire History and Extent of Impact

Historically, Vermont has had a disproportionately high per capita fire fatality rate due to risk factors contributing to home heating fire related incidents, as compared to other states.⁸

- Age of Housing Structures - 44% of Vermont homes were built before 1950, 2nd oldest in the nation behind Maine.
- Vermont is the second least populated state- remote rural communities can be difficult to reach with firefighting equipment in a timely manner.
- Extreme Winter Temperatures – Vermont is the 7th coldest state.
- Higher Risk Population -3rd oldest median age where the elderly is at higher risk. Over the past 5 years, 51% of Vermont's fire deaths have been seniors over the age of 65.

⁸ 2020 Vermont Fire Marshal Annual Report

- Home Heating Methods - 1st for per capita use of wood for heating.

Local fire officials in Windsor have identified that emergency response calls related to residential fires constitute the majority of responses, reporting 10 per year on average.

Structure fires are, typically, more frequent during winter months with wood burning and other heating methods using flammable fuels. Local incidents can also occur through-out the year. This could be due to the higher frequency of brushfires which can be close to barns and other outbuildings.

As shown in **Table 6: Fire Statistics for Vermont, Windsor County and Town of Windsor**, statistics from the State Fire Marshal Annual Reports indicate a peak in NFIRS Series 100 fire responses in 2015 for the State followed by lower-than-average number of annual responses over the past 5 years. The Town of Windsor, however, has seen a jump in the number of fire responses in the last 2 years. The local Fire Chief attributes this, in part, to the inclusion of all types of smaller fire responses in the Series 100 reporting.

Estimated Dollar Loss compiled for **structure fires** in Vermont is shown here.⁹ Reported dollar loss by insurance companies is trending up with \$101,700 per claim in 2019, up from \$48,535 in 2015. Applying the data provided by insurance company claims, the potential annual loss due to structure fire for the Town is estimated to be \$1,20,000 based on an estimated average of 10 structure fires per year.

Year	Fire Departments Reporting	Fires Reported	Estimated Dollar Loss by Fire Departments	Insurance Companies Reporting/ Total	Fire Claims Reported	Reported Dollar Loss by Insurance Companies
2012	194	2,233	\$ 17,840,192	860	839	\$ 44,510,095
2013	194	2,116	\$ 26,485,951	615	878	\$ 50,911,724
2014	228	2,114	\$ 30,412,139	615	1,130	\$ 50,589,356
2015	230	2,198	\$ 25,112,224	606	939	\$ 45,574,673
2016	228	3,138	\$16,919,906	644	706	\$ 57,098,292
2017	172	2,458	\$ 21,029,493	615	1,104	\$ 54,359,205
2018	170	1,708	\$ 22,628,798	611	844	\$ 57,204,711
2019	157	2,302	\$ 21,511,729	557	669	\$ 68,006,719
2020	168	2,678	\$17,889,976	Data not currently available		

⁹ NFIRS and Insurance Company Data, 2020 Vermont Report of the State Fire Marshal

TABLE 6: Fire Statistics for Vermont, Windsor County and Town of Windsor¹⁰

	Vermont State				Windsor County			Windsor			
YEAR	Fire-NFIRS Series 100 ¹	Structure Fire Responses	Wildland Fire Responses	Total	Structure Fire Responses	Wildland Fire Responses	Total	Fire-NFIRS Series 100	Structure Fire Responses	Wildland Fire Responses	Total
2010	-	1956	475	2431	181	70	251	-	12	2	14
2011	-	2366	1144	3369	181	70	251	-	6	7	13
2012	-	2225	667	2892	201	101	302	-	10	5	15
2013	-	2114	625	2739	229	86	315	-	10	11	21
2014	-	2232	470	2702	205	61	266	-	11	5	16
2015	3575	-	-	3575	239	89	328	NA	NA	NA	-
2016 ³	3269	-	-	3269	-	-	-	21	-	-	21
2017	2458	-	-	2458	-	-	-	17	-	-	17
2018	2660	-	-	2660	-	-	-	20	-	-	20
2019	2274	-	-	2274	-	-	-	30	-	-	30
2020	2693	-	-	2693	-	-	-	27	-	-	27
Annual Average ²					206	80	286	23	10	6	19

NA – Not Available / Did not report

¹ As of 2016, the Vermont Fire Marshall Report no longer reports fire statistics by county nor by fire type (structure and wildland). Active Fire departments reporting vary from 68% (2019) to 74% (2017)

² Annual Averages are based on available data shown in table.

¹⁰ Vermont Annual Report of the State Fire Marshal, for years 2010 through 2020.

Structure Fire Trends and Vulnerability

Structure fires are influenced by many factors independent from climate change and can fluctuate from year to year. However, community structures are not particularly vulnerable to wildfires because they are typically located in town centers and away from large tracts of forested and vegetative land, though their close proximity to each other increases vulnerability if a structure fire is triggered by accident.

Windsor has not had a major structure fire with most incidents involving single residential homes. The photo below is from a two-alarm fire event in September caused by a chimney fire where a 75-year-old woman was rescued. The probability of this occurrence remains high, although it is difficult to project trends over time. However, it may be reasonable to expect an increase in incidents, as seen over the past few years, if the Town population increases, housing and the population continue to age, and extended periods of extreme cold and drought become more frequent. A growth in tourism and bed and breakfast accommodations can also increase the likelihood of structure fires from improper operation and maintenance of solid-fuel heating systems and campfires during the dry seasons due to lack of knowledge on the part of residents and renters. The number of log homes in the region, which are more vulnerable, may also be a factor.

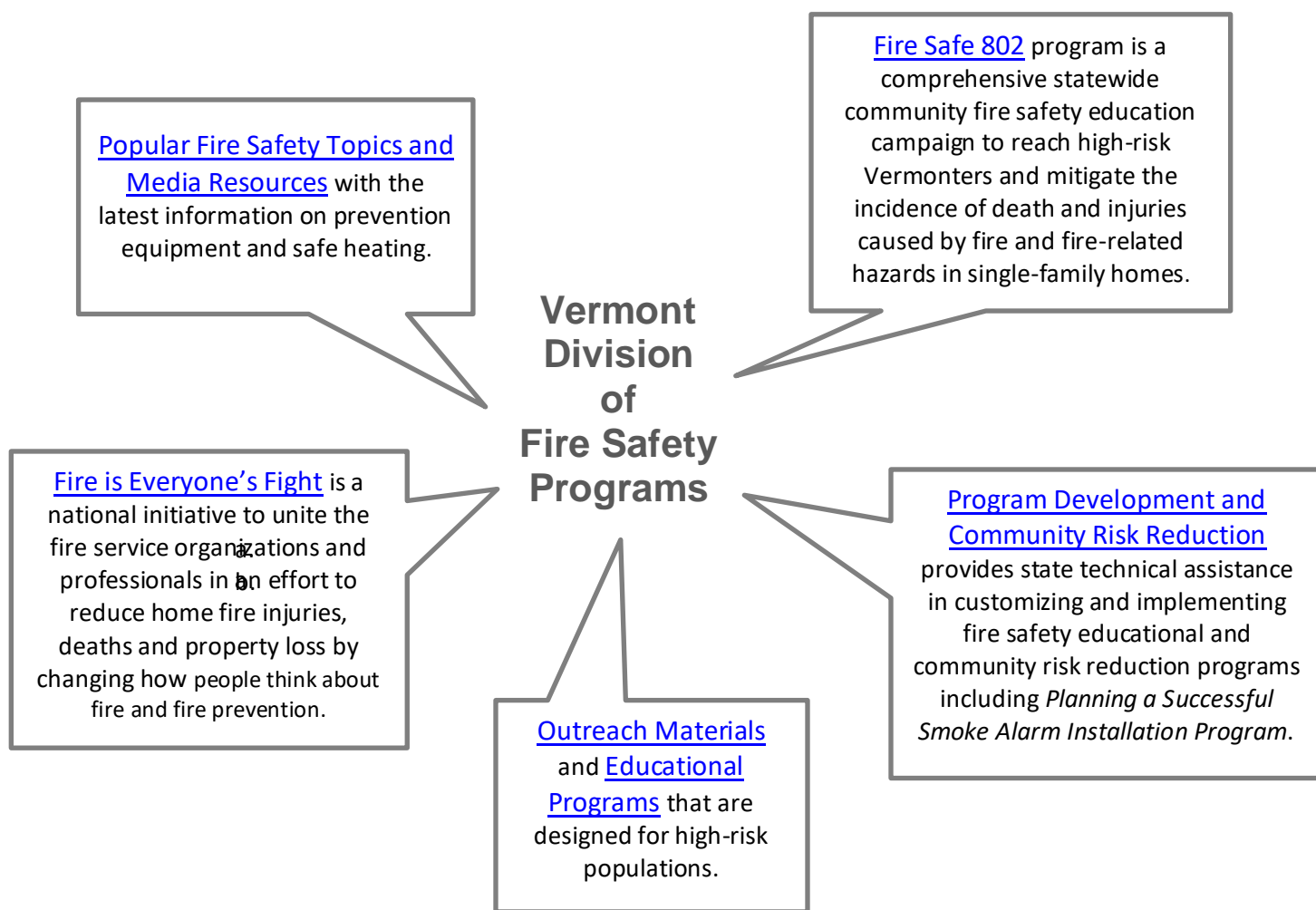


An assessment of town assets vulnerable to **structural fire** would be based on age and proximate location to other high-risk structures. Windsor is home to many historic structures and some have been renovated to proper building codes which has reduced their vulnerability to fire. A discussion of historic resources at risk for structure fire was had, however, more needs to be done in conjunction with the Windsor Historical Society to identify those most at risk and whether mitigation is possible.

The blighted and deteriorating Brownfields structures throughout the downtown area are also at higher risk for fire due to the potential presence of hazardous substances and loiterers. Remediation and/or removal of blighted structures and redevelopment of Brownfield sites to eliminate these hazards has been a focused effort by the town.

Windsor residents remain particularly vulnerable to **structure fires**, which are more likely to cause physical harm and damage to homes, as many of the residents heat their homes using open flame options, such as wood or pellet burning stoves. The elderly living alone are also more at risk, according to statistics, and the average age of Windsor's population has been rising.

Local education and outreach programs continue to be the most effective way to reduce a community's risk to fire. The National Fire Protection Association provides guidance, resources, and training on protecting homes and property from wildland fire. 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 can take advantage of



5.2c. Inundation & Flash Flooding

Probability of Occurrence:	4.0
Average Hazard Impact:	2.0
Hazard Assessment Score:	8.0

Fluvial & Other Erosion

Probability of Occurrence:	3.0
Average Hazard Impact:	1.5
Hazard Assessment Score:	4.5

Flooding, including **flash flooding** and overbank or **inundation flooding**, and **Fluvial 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 call 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 flash flooding.

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 a bridge underpass exacerbating flooding. Inundation flooding caused by a high hazard dam failure can be catastrophic for town located downstream and can occur suddenly with little or warning.

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. Both the Floodway and Floodplain typically lie within the River Corridor.

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 <i>National Flood Insurance Program</i> (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.



River corridors and **floodplains** are different, but related. The river corridor is the area that provides the physical space that the *river* needs to express its energy and meander without causing it to dig down. A floodplain is the area where water flowing out over the *river* bank spreads out.¹¹

Vermont Agency of Natural Resources has mapped river corridors for the Mill Brook and a stream geomorphic study has been completed for Hubbard Brook along with SFHA which are shown in **Appendix A: Map 3 – Water Resource** and can be found on-line.¹² River Corridors are currently being modified to more closely reflect the valley topography and will allow for improved identification of elevated fluvial erosion hazard areas. Inundation mapping is available for the Mill Dam in Windsor and the Wilder Dam on the Connecticut River which indicate those areas at risk of flooding if these dams are breached or should fail.

Fluvial Erosion, which often accompanies flood events, is the predominant form of flood damage in Vermont and in most mountain valley towns. 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, deep snows, destructive ice jams and intense rainstorms. Centers of commerce in villages and towns became concentrated along river banks, forests were cleared and, over time, many rivers moved or were channelized to accommodate this development rendering them unstable and prone to fluvial erosion.¹³ Fluvial erosion can severely threaten mountain communities as most of rural town development lies in valley areas along rivers and streams.

Ice Jams can also cause a secondary event of flooding and threaten many of the same properties located within the FEMA Special Flood Hazard Area. Common in New England, and in Windsor along the Connecticut River, 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



¹¹ The ANR FLOOD READY link shows river corridors overlays and FEH zones, http://floodready.vermont.gov/assessment/vt_floodready_atlas.

¹² The ANR FLOOD READY link shows river corridors overlays and FEH zones, http://floodready.vermont.gov/assessment/vt_floodready_atlas.

¹³ Municipal Guide to Fluvial Erosion Hazard Mitigation, Vermont Agency of Natural Resources

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.

Flooding and Fluvial Erosion: History and Extent of Impact

Flooding and fluvial 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, microbursts, ice jams, severe thunderstorms or heavy rain events**. These events can also cause dam failure as a secondary hazard which can have catastrophic impact.

Although **hurricanes and tropical storms** rarely impact Vermont, they have historically caused the greatest state natural disasters. Prior to Tropical Storm Irene in August, 2011, Vermont was impacted by Tropical Storm Floyd in November, 1999, causing major flooding and power outages. However, the Hurricane of 1938 may have been the most powerful tropical storm to hit Vermont in modern times, with sustained winds of 74mph which was claimed to have changed the landscape of the state with the extensive tree damage.

The Flood of 1927 termed ‘the greatest natural disaster’ was a 500-year flood event caused by a tropical system in Vermont 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. Widespread flooding more recently occurred in June, 1973, when up to 6 inches of rain fell resulting in a Disaster Declaration for all 14 counties and \$64 million in damage. In 2011, four regional disaster declarations were issued in Vermont due to flooding and fluvial erosion. The fourth was Tropical Storm Irene in late August when up to 11 inches of rain fell in some areas of the State. The most significant state-wide historical flooding events and their impact on the region are detailed in **Table 7: Vermont Historic Flood Events**.

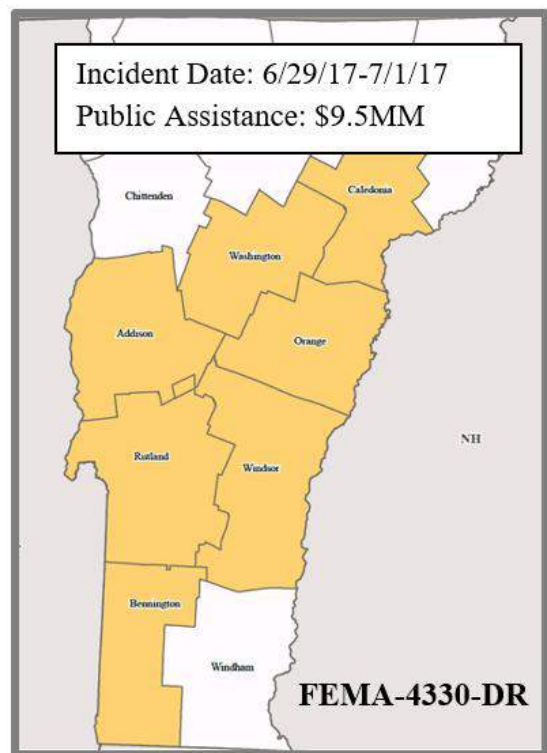
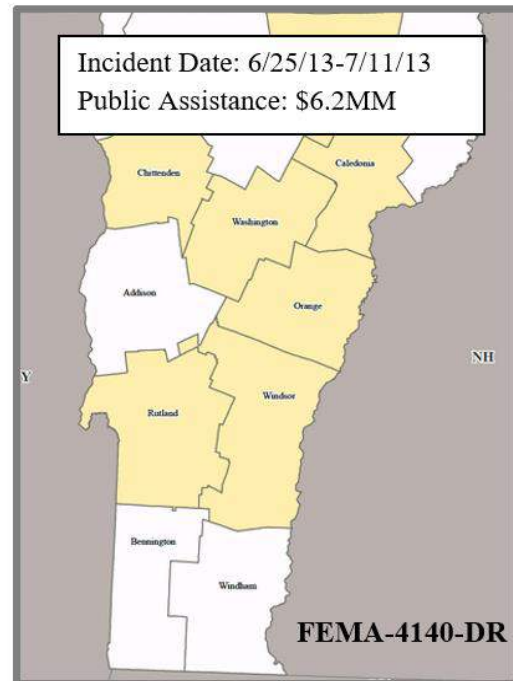
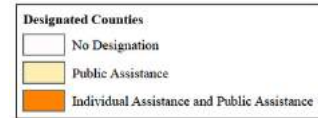
On a regional level, of the 16 FEMA Disaster Declarations for Windsor County since 1992, 13 were related to flooding, one to a winter storm and the most recent two to COVID-19. Two of the flood related disasters were the result of Tropical Storms; Floyd in 1999 and Irene in 2011. FEMA assistance for the most recent of these Declared Disasters impacting Windsor County is shown in **Figure 1: Regional Impact of Federally Declared Disasters**. These flood damages are associated with inundation flooding and fluvial erosion; however, data indicate that greater than 75% of flood damages are associated with fluvial erosion.

Flooding in Vermont is primarily the result of **Severe Storm** events. Over the past several years 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. 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 which closed Route 11 in Windsor.

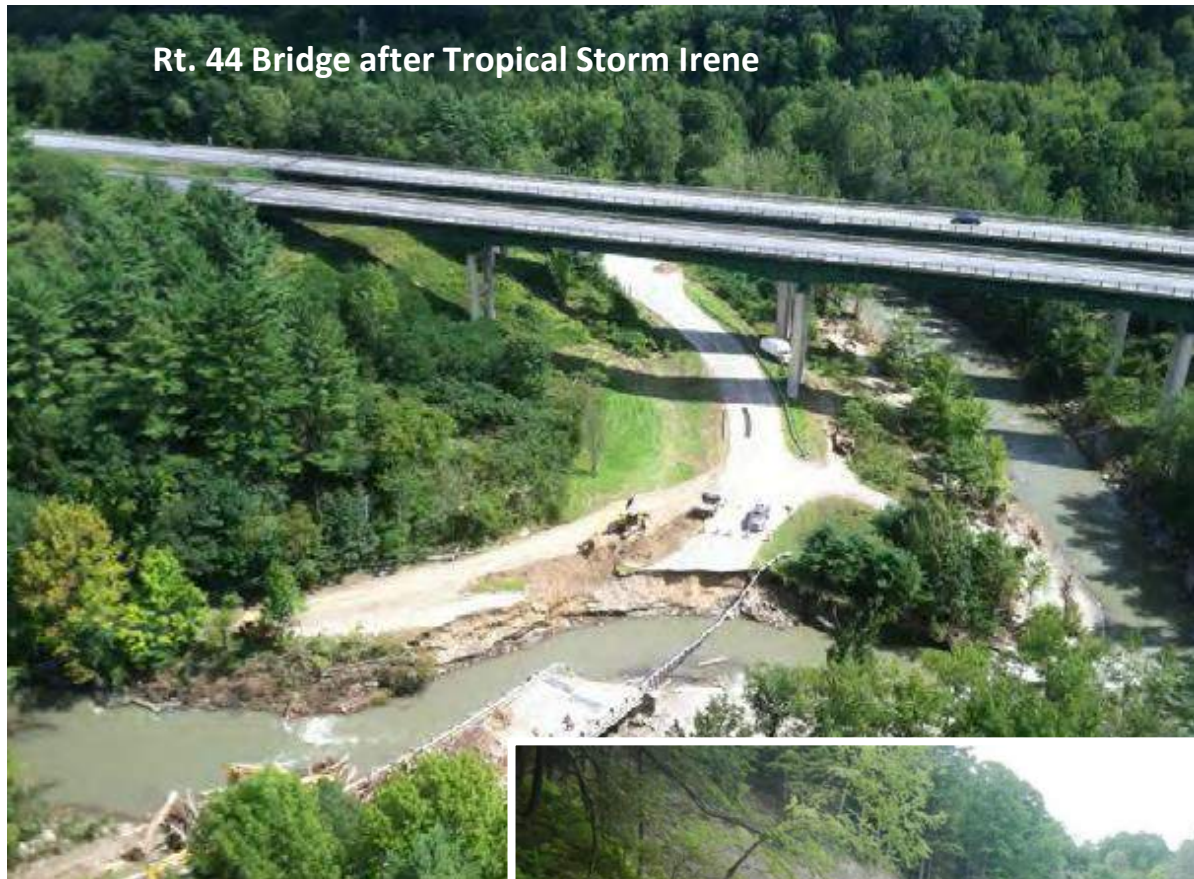
TABLE 7: Vermont Historical Flood Events.

Event	Date	Description	Impact or Extent of Damage
Great Flood of 1927	November 3, 1927	After a wet October, rivers were swollen and the ground was saturated. Nine inches of rain fell in a 36-hour period triggering disastrous flooding. The month of October saw 150% greater rainfall than normal and lack of vegetation due to de-forestation may have reduced the ground's ability to absorb water. Though all of New England was affected, Vermont was devastated. The state flooded from Newport to Bennington, with the Winooski River Valley the hardest hit. Deadliest disaster in Vermont history.	<ul style="list-style-type: none"> ➤ 84 people perished ➤ 9,000 left homeless ➤ Many roads, countless homes and over 1,200 bridges washed away ➤ Over \$28 MM in damages (\$404 million in current \$s)
The Great New England Hurricane of 1938	September 21, 1938	One of the most powerful and destructive hurricanes to hit southern New England and the region of Southeast Vermont with winds over 100 mph. Authorities were unaware of the magnitude so no evacuation procedures were instituted and very few precautions were taken. The only tropical cyclone to make a direct hit on Vermont in recorded history. Hurricane-force winds caused extensive damage to trees, buildings, and power lines.	<ul style="list-style-type: none"> ➤ 600 people perished in southern New England, only 5 in Vermont ➤ Over 2,000 miles of roads were blocked taking months to reopen ➤ Vermont maple and sugar groves were damaged ➤ Over \$300 MM in damages (\$5 Billion in current \$'s)
Tropical Storm Irene	September 1, 2011	Tropical Storm Irene tracked north northeast across eastern New York and western New England producing widespread flooding, and damaging winds across the region. The greatest impact across central and southern Vermont was due to catastrophic flash flooding as a result of 4 to 7+ inches of rainfall which occurred across all of Windham and Windsor County, especially in the foothills of the Green Mountains. Several dozen roads (state and local), including Routes 4, 12, 12A, 100, 103, 107 and 131, as well as several bridges were washed out or suffered severe damage. Several communities within Windsor County were isolated due to loss infrastructure. Dozens of homes and businesses experienced severe flooding as well as major losses to farms and livestock.	<ul style="list-style-type: none"> ➤ Frequent wind gusts of 55-60 mph, peak gusts at 85 mph. ➤ 18,000 customers in Windham County lost power. ➤ Greatest single-day rainfall in Vermont's recorded history. ➤ Rainfall averaged 4 to 8 inches, and up to 11 inches in some areas over a 12-hour period. ➤ There were nearly 2400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene. ➤ \$18.7M estimated in Public and Individual FEMA Assistance.

FIGURE 1
Regional Impact of
FEMA Declared Disasters
Severe Storms and Flooding



More locally, in the Town of Windsor, floods are the most probable natural hazard event and may include inundation flooding events, flash floods, ice jams, and erosion hazard flooding. Estimated at over a 100-year flood event, Tropical Storm Irene brought much devastation with many roads damaged or completely washed away. Although a quantitative measure of the extent of fluvial erosion is not available, it can be gleaned from the photos below.



Bridge failures and roadway washouts occurred in numerous locations, including severe damage to an approach bridge on Route 44 under Interstate 91. Significant damage was incurred to infrastructure along the Mill Brook, including the pedestrian bridge connecting Union Street to the school athletic fields, and Brook Road which has since remained impassible to through traffic.

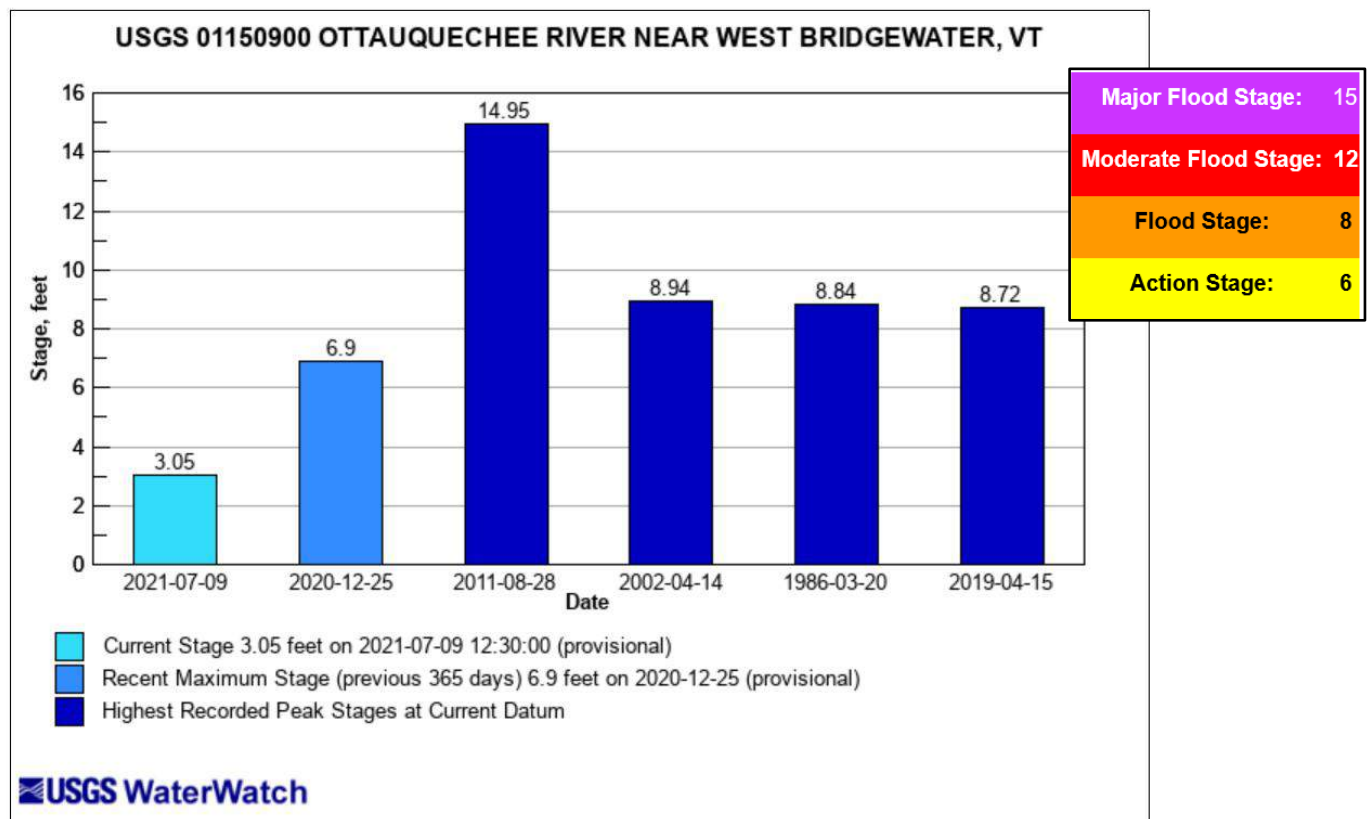


The American Precision Museum and school athletic fields incurred damage and the historic Ascutney Mill Dam was also impacted causing further and accelerated deterioration of the stone buttress and spillway. The total damage sustained by the Town of Windsor is estimated at \$3.5 million. In 2013, heavy rain dropping two to three inches in two hours resulted in flash flooding causing damage in Windsor in a number of locations, including but not limited to County Road and Hunt Road.



The United States Geological Survey (USGS) maintains a streamgage on the Ottauquechee River near West Bridgewater, VT, which regularly monitors the river height and streamflow. This gage is located northwest of Windsor and is best representative of streamflow unimpeded by dams for the Windsor region. The USGS streamgage data in **Figure 2** displays recorded recent and historic peak data on gage height. During Tropical Storm Irene, gage height approached major flood level at almost 15ft. Other highest recorded peak stages from current datum show gage height exceeded the 6ft. action flood stage in the early winter of 2020, compared to other flood stage events which occurred during early spring melt or summer.

FIGURE 2: Gage Heights for the Ottauquechee River Near West Bridgewater, VT¹⁴



**Note the gage height approached 'Major Flood Stage' of 15 feet during Tropical Storm Irene.*

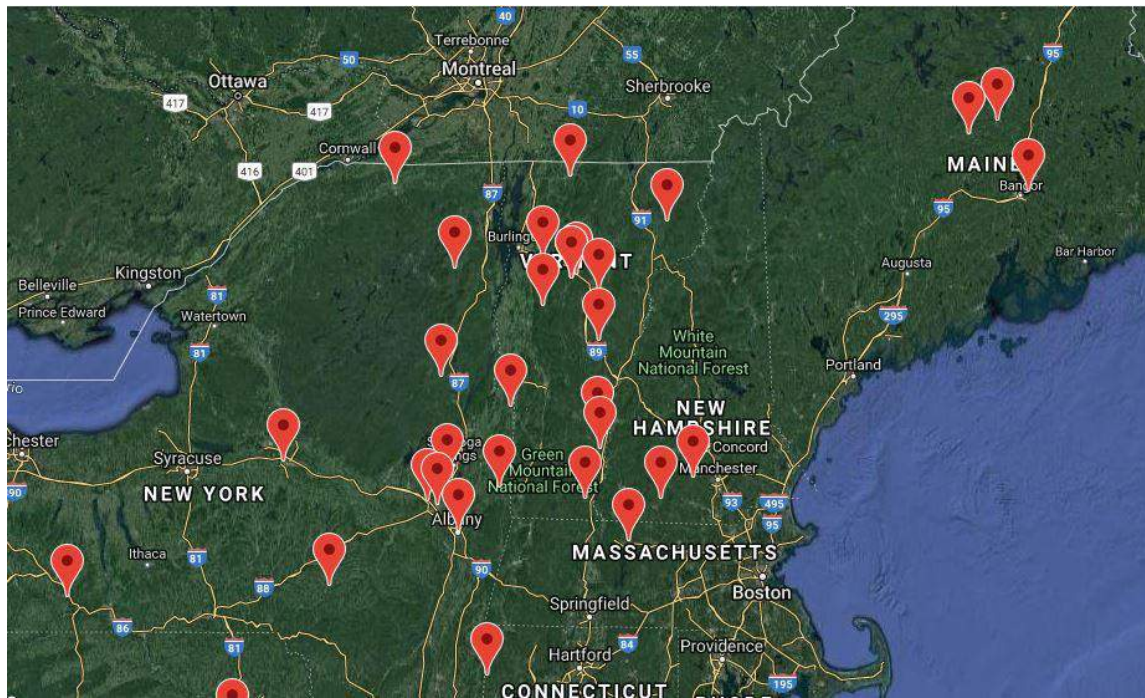
The most devastating winter floods have been associated with a combination of heavy rainfall, warm temperatures, and rapid snowmelt. Winter weather with less than average snowfall can result in greater ice buildup on streams and rivers, potentially resulting in greater ice jam damage.

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 US Army Corps of Engineers, Ice Jam Database CRREL State Summary Report. **Figure 3** below identifies the location of ice jam events in the region during 2019.¹⁵ It can be seen that Vermont had experienced more ice jams in 2019 than other New England states.

¹⁴ <http://waterwatch.usgs.gov> accessed in May 2020, Toolkit, Flood-Tracking Chart

¹⁵ [CRREL Ice Jam Database](#)

FIGURE 3 : 2019 Ice Jam Locations, CRREL Database



Windsor, VT Ice Jam History	
River	Date
Connecticut	1/13/2018
Connecticut	1/10/2001
Connecticut	12/17/2000
Connecticut	3/11/1992
Mill River	3/11/1992
Connecticut	3/1/1979
Connecticut	2/1/1973
Connecticut	3/21/1968
Connecticut	3/6/1964
Connecticut	3/9/1946
Connecticut	3/27/1928

There are several ice jam events in Windsor on record in the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL) database shown below. As can be seen in this data, most historic ice jams had occurred in March during normal spring thaw.

However, the most recent events occurred in January, the coldest month of the year, which is unusual and likely due temperature extremes from climate change.

Most recently, in 2018, a January thaw occurred when temperatures rose above 50 degrees initiating an ice flow on the Connecticut River and extensive flooding resulting in evacuations, road closures and damage to farm land along the river. Windsor officials decided to close the Cornish-Windsor Bridge that spans the Connecticut River for fear of collapse as the floating slabs of ice had risen close to the bottom of the bridge.

“As the parking lot of a retail plaza along Route 5 in Windsor was inundated with rising water levels from a small stream that connects the Connecticut River to Lake Runnemedede, the Price Chopper there made an early afternoon decision to temporarily close its doors.”¹⁶



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. Since Irene, Vermont has experienced nine FEMA declared disasters from severe storms and flooding, three of which have impacted Windsor County. In recent years, flood intensity and severity appear to be increasing. According to prior *State of Vermont Hazard Mitigation Plans*, studies show that areas of the State can

¹⁶ [Valley News, 1-15-2018](#)

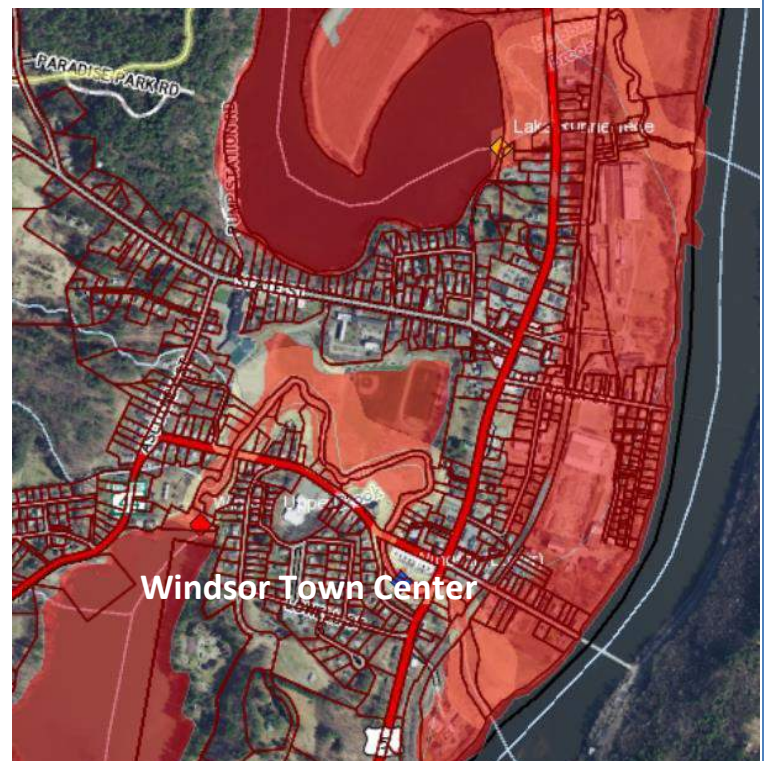
expect a greater frequency of flooding with an increase in extreme rainfall amounts.¹⁷ Extreme changes in temperature during winter months with late winter rain storms is also a factor causing more frequent ice jams and can be expected to increase in frequency with climate change.

The local streamgage data in **Figure 2** also supports this trend. Current datum shows gage height exceeded flood stage five times over the past 34 years, since 1986, four of which occurred over the past 10 years. The impact of temperature extremes and its impact on flooding can also be seen in this data. Streamgage height exceeded the 6ft. Action Flood Stage in the early winter of 2020, compared to other all other recorded flood stage events since 1986 which occurred during early spring melt or summer.

A region's **vulnerability** to flooding and erosion depends on topography, as well as meteorological events. The Town is particularly susceptible to inundation flooding in lower lying areas of the town center, residential neighborhoods along the Connecticut River, and also to flash flooding in higher elevation areas along the Mill Brook.

Windsor's risk for catastrophic flooding and erosion, though low, is augmented by its proximity to the Connecticut River and inundation from failure of high hazard dams.

The Water Resources and Downtown /Historic District Maps show the areas in town that are part of the currently mapped FEMA Floodways and Floodplains, as well as River Corridor Protection areas which correlate with fluvial erosion hazards. These flood hazard areas are mapped along the Connecticut River and the Mill Brook.



Conservation of the broad floodplains along the Connecticut River, including extensive farmland north and south of downtown, will maintain flood storage capacity, which will help mitigate flooding in the lower elevations of the downtown area. However, given the location of the thickly settled area along the Mill Brook, flooding events have the potential to cause significant damage to infrastructure and structures within Windsor.

Table 8 lists the number and types of vulnerable structures in Windsor that lie within the Special Flood Hazard Area or SFHA (Floodway and Floodway Fringe) and the River Corridor.

According to Vermont's Flood Ready- Flood Hazard Summary Community, there are 249 structures that lie within the SFHA, of which 79% are residential structures. Nine of these are critical public structures.

¹⁷ 2013 State of Vermont Hazard Mitigation Plan, p 4-9

Most of these structures are within the Connecticut River floodplain which was thickly developed with industrial buildings and residential dwellings constructed for workers during the height of the Town's manufacturing enterprises. Seventeen percent (17%) of all structures in Windsor are located within the special flood hazard area – this is the highest proportion of all Vermont towns. Furthermore, Windsor has the second highest number of structures within the floodway – second only to Barre City¹⁸.

In Windsor, all proposed development within the FEMA special flood hazard areas is subject to flood hazard review in accordance with the Windsor Zoning Ordinance. Since the prior plan, there has been no new development within the special flood hazard areas that would have increased the Town's flood hazard risk.

TABLE 8: Summary of Structures within Flood Hazard Zones and River Corridor ¹⁹

Flood Zone	Building Type	# Units	%
River Corridor	Single-Family	25	68%
	Multi-Family	2	5%
	Mobile Homes	1	3%
	Commercial	2	5%
	Other	7	19%
Total RC		37	100%
Floodway (SFHA)	Single-Family	49	67%
	Multi-Family	11	15%
	Mobile Homes	0	0%
	Commercial	7	10%
	Other	6	8%
Total Floodway		73	100%
Floodway Fringe (SFHA)	Single-Family	76	43%
	Multi-Family	39	22%
	Mobile Homes	25	14%
	Commercial	21	12%
	Other	15	9%
Total Floodway Fringe		176	100%

National Flood Insurance Program (NFIP)

Windsor has been a participatory, non-sanctioned member of the National Flood Insurance Program since September 28, 1979 and regulates development in the floodplain through the enforcement of NFIP policies. Program statistics are summarized in **Table 9**²⁰. The Town of Windsor has the second highest number of repetitive losses in Windsor County. The number of properties and percent of properties with

¹⁸ 2014 Community Flood Study

¹⁹ GIS analysis using E911 building points (2021), FEMA-mapped floodplains (2015), and ANR-mapped River Corridors (2015). Some structures may have been removed from SFHA or RC since this data was compiled.

²⁰ Vermont Flood Ready [FEMA NFIP Insurance Report & FEMA Repetitive Losses and BCX Claims](#) Information by Town, 6-26-2018

NFIP insurance are down from five years prior. The number of repetitive losses is up slightly from 4 to 6. Additional detail on these changes is not available the Town has included a strategy to improve outreach to properties in flood risk areas.

TABLE 9: Windsor National Flood Insurance Program Statistics (Report Date 6/26/2018)

# of Policies	Total Premium	Total Coverage	# LOMCS	% SFHA Structures Insured	# of Claims Since 1978	Claims Paid Since 1978	# of Repetitive Losses
61	\$84,576	\$7,422,600	10	21%	23	\$189,106	6

NFIP Standards for Historic Structures

NFIP rules allow two options to modify flood standards in order to maintain the historic integrity of designated historic structures. Windsor’s Zoning Regulations include both options for historic structures.

- Seven buildings, the Cornish-Windsor Covered Bridge and the Mt. Ascutney State Park are individually listed on the National Register;
- There are currently two historic districts listed on the National Register: Ascutney Mill Dam Historic District and Windsor Village Historic District.
- Twenty-one buildings and one bridge are individually listed on the Vermont State Register;
- Four historic districts are also listed on the Vermont State Register: Ascutney Mill Dam Historic District, Court Square Historic District, Main Street Historic District, and Upper Main Street Historic District.

Non-contributing structures and vacant lands within Historic Districts do not meet the “historic structure” definition. Therefore, they must meet all applicable flood hazard provisions. FEMA publication “Integrating Historic Property & Cultural Resource Consideration into Hazard Mitigation Planning” provides guidance and concepts on identifying and integrating historic structures located in flood hazard areas.

The community assets areas most at risk of flooding and erosion became apparent following Irene and more recent storm events. Many of the roads impacted by the Tropical Storm Irene remain vulnerable areas of town although repairs made at that time have reduced the Town’s flooding and erosion risk with upgraded culverts and other best management practices to control stormwater runoff. The following areas continue to be problem areas vulnerable to reoccurring minor flooding during a hard rain.

Public Structures within the Special Flood Hazard Area

- Water Treatment Facility on Pasco Way.
- Town Garage structures on Central St.
- Windsor Welcome Center on River St.
- Windsor-Cornish Covered Bridge on Bridge St.

Historic Structures within Special Flood Hazard Area

- Old Constitution House on North Main St.
- American Precision Museum on Main St.
- Windsor-Cornish Covered Bridge on Bridge St.

Problem areas vulnerable to reoccurring minor flooding during a hard rain or spring melt

- Areas around **VT Route 44** in low lying areas out past the armory and sections of Rt. 44 that run within or along the fringe of SFHA or river corridors of the Mill Brook near I-95.
- **Retail Plaza on Route 5** which lies east of Lake Runnemede and within a floodplain just south of Hubbard Brook.
- Remaining sections and infrastructure on **Brook Rd.** that lie within or near the Mill Brook SFHA or river corridor.
- **Hewett Road** is a critical connector and emergency access corridor due to the washouts on Brook Road. The bridge is in fair condition but an eventual upgrade and replacement is recommended to reduce risk of debris or sediment accumulation.
- Sections of **County Rd.** that run within or close to the Hubbard Brook corridor. **Hunt Rd.** overpass to Kimball Brook.
- Sections of **Sunset Lane** that run along the floodway fringe of the Mill Brook near Rt 44 intersection.
- Agricultural farm land east of Rt. 5 and sections of **Rt. 5 along the Connecticut River** which lie in the floodway and are vulnerable to ice jam flooding.
- **Johnson Rd. bridge** and sections of **Juniper Hill Rd., Weeden Hill Rd.** which run along or through the Hubbard Brook river corridor.
- Gully formation on steep slopes leading to **Paradise Park** from stormwater flow which threaten recreational assets.

Other areas of lower risk

- SFHA below the Mill Pond Dam including the **athletic fields**.
- Areas of potential flood risk below the **Lake Runnemede North Dike**, an earthen dam.
- Residential properties on **Jarvis, Central and National Streets** that lie within the floodway of the Connecticut River, as well as sections of **Bridge and River Street**.
- **Brownfields** including the Goodyear Industrial Campus, that lie within the floodway of the Connecticut River.

Bridges and culverts are also vulnerable to flood and fluvial erosion damage, as much of this infrastructure remains undersized constricting flow or is poorly aligned. Blocked culverts compromise the structural integrity and safety of the road crossing resulting in damage to adjacent properties. In addition, the Corridor Plan identifies culvert and bridge upgrades or removal projects for reducing flood and erosion hazard risk. Some of these recommended actions have been implemented and other considered as actions items in **Table 12: 2021-2026 Mitigation/ Preparedness Strategies and Actions** at the end of this document.

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. A new road inventory, completed in 2019 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. Windsor has made significant progress in bringing high priority segments into compliance. These assessments help guide the Town’s annual work on infrastructure improvements and are critical to reducing the Town’s risk to flooding and erosion.

Dam Failure is a rare flooding event and can be expected to result in loss of life and also cause significant economic losses, including damages to downstream property or critical infrastructure, environmental damage, or disruption of lifeline facilities. Inundation area for the **Wilder Dam** on the Connecticut River and the **Ascutney Mill Dam** is shown in **Appendix A: Map 5 - Windsor Downtown Flood Hazards**. More information on this hazard risk can be found in **Section 5.2G**.

For Windsor, flood risk is best managed by maintaining and increasing floodplain access, minimizing further development within the river corridor, and improving sustained outreach to property owners within the SFHA and river corridor on flood and erosion hazard risk and mitigation information. MARC continues to work with local communities within the region providing information on fluvial erosion hazard and river corridor bylaws, to further limit development and minimize risks.

5.2d. Ice Storm/Ice

Probability of Occurrence:	4.0
Average Hazard Impact:	1.75
Hazard Assessment Score:	7.0

Extreme Cold

Probability of Occurrence:	4.0
Average Hazard Impact:	1.25
Hazard Assessment Score:	5.0

Ice and **Heavy Snow**, are significant natural hazard events for Vermont and Windsor County. Both have a high probability of occurrence and can impact town infrastructure and isolate some vulnerable residents. Heavy Snow is less of a priority for a valley town like Windsor, compared to more mountainous communities in Windsor County, with its relatively flat topography, apart from the Mt. Ascutney. Impacts from ice are considered to be more significant on town infrastructure than those

associated with snow. Both hazards are covered here as heavy snow accumulations can result in ice buildup or flash freezing during extreme temperature fluctuations during the winter months.

Winter storms and **blizzards**, with **snow**, **ice**, **wind** and **extreme cold** in varying combinations, are fairly commonplace in Vermont, Windsor County and occur town wide in Windsor. Heavy accumulation of snow can be accompanied by strong winds, cold and low wind chills. Drifting of snow from high winds cause low visibility and make it difficult to keep roads cleared. 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.

Significant accumulations of ice can cause hazardous conditions for travel, weigh down trees and power lines, and cause power outages. Freezing rain can also be combined with snowfall, hiding ice accumulation and further hindering travel, or with mixed precipitation and potentially ice jams or flooding.²¹

Winter weather related Warnings, Watches and Advisories are issued by the local National Weather Service office based on local criteria. NOAA's Weather Predictions Center is in the process of developing a new prediction tool, the Winter Storm Severity Index (WSSI).

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 more²²."

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 1/4" or greater."²³ Multiple sources state that a 1/4 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.

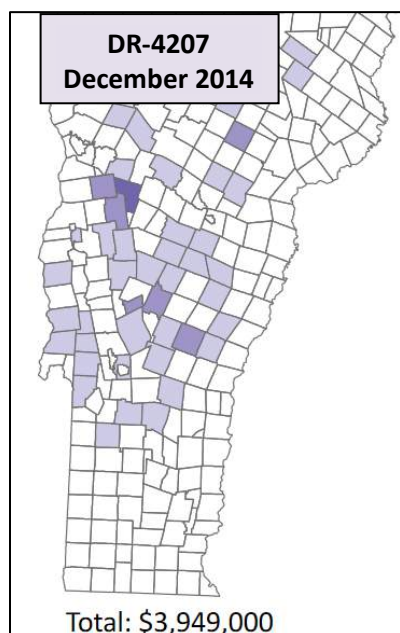
²¹ 2018 State of Vermont Hazard Mitigation Plan

²² National Weather Service Glossary

²³ National Weather Service Glossary

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 snow melt on the roadways has a chance to refreeze over night when the temperature drops below freezing. Black ice can also form when roadways are slick from rain and temperatures drop below freezing overnight.

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



There are no standard models or methodologies for estimating loss from winter storm hazards such as ice. Extreme winter weather is considered a way of life in Vermont and many rural Towns are accustomed and prepared for these events. However, Vermont is less accustomed to **Ice** events which have become a frequent occurrence.

Of the more memorable winter storm events in the twentieth century in Vermont, one of the worst blizzards occurred in December, 1962, with gale force winds and up to 30 inches of snow impacting highways and rail transportation. 'The high winds and bitter cold led to a number of frostbite reports and froze water pipes around the state. Stores, offices, schools, and even ski operations closed in some cases all week.'²⁴

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.²⁵ The damage assessment for Windsor County was estimated to be over \$200,000 and impacted the northwest corner of the county.

A brief 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 and less often in Windsor. 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 most impactful events occurring in the month of March. **Table 10** below is a sampling of historical winter storm events and the extent of their impact since the previous plan.

²⁴ Climate Variability and Socioeconomic Consequences of Vermont's Natural Hazards: A Historical Perspective, [UVM Edu](#)

²⁵ 2018 Vermont State Hazard Mitigation Plan

TABLE 10: Notable Winter Storm Events in Windsor County, Jan/2016 – Jan/2021²⁶

Occurrence Date	Estimated Property Damage	Event Description
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 a 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.



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 neighboring towns of Springfield and Ludlow the hardest hit with recorded totals of 41 inches. The National

²⁶ [NOAA, National Centers for Environmental Information](https://www.noaa.gov/data/monitoring-assessments/national-climate-data-center)

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.²⁷

The Great Ice Storm of January 1998 is the only Federally Declared ice storm (DR-1201) to impact Windsor County. Ice accumulations in many locations reached 3" closing roads, downing power lines and damaging thousands of trees and 700,000 acres of forest. Power was out for 10 days in some areas. While there were no fatalities in Vermont, further north in Quebec, 3 million people lost power and 28 were killed. Property damage was estimated to be over \$6 million for Vermont.²⁸

There is no specific region in Vermont that is more vulnerable to ice storms, according to the 2018 Vermont State Hazard Mitigation Plan. 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." ²⁹

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. What constitutes 'extreme cold' can vary and is based on what a population is accustomed to and prepared for. . The secondary hazard of Structure Fire, which can be the result of extended periods of extreme cold is addressed in this plan. Cold temperatures can also be a hazard for local farmers and their crops if it occurs during the growing season, but the trend for this region has been more variability towards higher temperatures and extended growing seasons during these months.

The National Weather Service will issue advisories to inform the public and agricultural industries:³⁰

Wind Chill Warning: Dangerously cold wind chill values are expected or occurring

Wind Chill Watch: Dangerously cold wind chill values are possible

Wind Chill Advisory: Seasonably cold wind chill values but not extremely cold values are expected or occurring

Hard Freeze Warning: Temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants

Freeze Warning: Temperatures are forecasted to go below 32°F for a long period of time, killing some types of commercial crops and residential plants

Freeze Watch: Potential for significant, widespread freezing temperatures within the next 24-36 hours

Frost Advisory: Areas of frost are expected or occurring, posing a threat to sensitive vegetation

²⁷ <https://snowbrains.com/peru-vermont-record-snowfall/> (December 21, 2020)

²⁸ 2018 Vermont State Hazard Mitigation Plan

²⁹ 2018 Vermont State Hazard Mitigation Plan

³⁰ 2018 Vermont State Hazard Mitigation Plan

The coldest temperature ever recorded for Vermont was -50°F in December 1933. The winter of 1997 holds the record for longest streak of consecutive days below freezing, without a thaw, at 51 days. More recently, the winter of 2015 maintained below freezing temperatures for 27 days. NOAA storm event history for Vermont recorded 10 extreme cold/wind chill events since 2000, primarily during the month of January, where windchill temperatures dropped to -40°F to -60°F. Of these, the January 8, 2015, event impacted Windsor County with windchills colder than -25°F to -40°F overnight and as low as -70°F in the southern Green Mountains. These dangerously cold wind chills lead to the opening of warming shelters, school cancellations, damaged infrastructure and frozen water lines. The winter of 2015 resulted in record cold for many areas.

Local historical data temperatures available for the neighboring Town of Springfield, southwest of Windsor, was obtained from U.S. Climate Data from 2008 to current.³¹ **Table 11** shows the lowest and average low temperature data for the month of January, which is typically the coldest winter month in Vermont. It can be seen that temperature trends reflect a general winter warming with the average low temperature during the month of January above the normal average low of 7°F for eight of the last eleven years.

It is also worth noting that the area is seeing a greater range in temperature extremes which make for more hazardous conditions for flooding and icing. In the current 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.

TABLE 11:
Winter Temperatures for
Springfield, VT

	January Low Temperature °F	
	<u>Lowest</u>	<u>Avg Low</u>
2008	-11	10.8
2009	-18	-0.8
2010	-4	11
2011	-20.9	7.4
2012	-11.9	14.1
2013	0	8.6
2014	-18	5.4
2015	-13	1.2
2016	0	15
2017	-5	19.2
2018	-20.9	8.6
2019	-20.0	10.0

Heavy Snow, Ice and 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.”³²

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.

³¹ [US Climate Data](#), accessed May 2021

³² 2018 Vermont State Hazard Mitigation Plan

Residents can expect at least 60 pounds of weight per square foot on their infrastructure during winter months. Older residents need to be vigilant when clearing snow from walkways and driveways.

Vermont communities are well prepared to handle heavy snowfall. However, it is typically the secondary hazards from impact to town infrastructure that are most concerning to the town. Depending on the event, particularly with heavy, wet snow or ice, electricity may be down for a few hours or days due to downed powerlines from falling trees. This is a time when residents are most vulnerable to structure fire or carbon monoxide poisoning. Many residents heat their homes with open flame heating sources including fireplace, wood or pellet stoves, and will supplement with electric or kerosene space heaters. Extended periods of extreme cold or loss of power during the winter months require continued vigilance on the safety of heating to reduce these risks.



Green Mountain Power, the utility company that currently serves Windsor, follows a regular tree-trimming schedule in coordination with the Tree Warden. Town officials believe this to be satisfactory to mitigate damages and power outages caused by downed trees and tree limbs during events. However, with major state thoroughfares, Rt. 44 and Rt. 5, also serving as local emergency access roads in Windsor, keeping surfaces clear of snow and ice is critical to the safety of residents.

Extreme weather conditions such as snow, ice and rain can also lower the distribution of cellular signals from a cell tower to the receiving device such as a smartphone whether you are outdoors or indoors. Reliability of these communications for reporting an emergency can be compromised during extreme winter weather events. This can become a greater concern as a trend to eliminate home landlines to save utility costs is growing.

According to the State Plan, NOAA Climate Center, coupled with EPA data, suggests that both the number of extreme cold days and record lows are decreasing in the northeastern United States. Climate data confirm that the contiguous United State is warming at a rate 50% greater than the global average, with the most significant warming observed in New England in the winter months. However, Vermont and Windsor remain vulnerable to extreme cold with an aging population, older poorly insulated homes, and high-risk home heating methods. In addition, Vermont is also experiencing a decline in the level of snow cover, which acts as a protective, insulating layer between the cold air and the ground. This variability with extreme cold air and prolonged winter warming trends can negatively impact soil frost and road infrastructure causing frost heaves, burst water lines, and damaged perennial crops that rely on the snow for protection from cold temperatures and winds.³³

³³ 2018 Vermont State Hazard Mitigation Plan

5.2e. High Wind

Probability of Occurrence:	3.0
Average Hazard Impact:	1.5
Hazard Assessment Score:	4.5

High Winds can be generated from a thunderstorm, hurricane or tropical depression, a localized microburst, Nor'easter, or simply just a wind storm. 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 and threat to property. The National Weather Service (NWS) issues a wind advisory when winds are sustained at 31 to 39 mph for at least one hour or any gusts 46 to 57 mph. Sustained winds of 40 to 73 mph or gusts of 58 mph or higher cause the NWS to issue a High Wind Warning.³⁴ Damaging high winds can occur without precipitation but are typically more dangerous during a storm event.

Severe thunderstorms are a relatively common hazard in Vermont, particularly in the spring and summer months. Although typically short in duration, they are capable of producing 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 have most impacted the town.

The downward draft from these storms can produce **microbursts** which are not uncommon in Vermont. These events can come with wind speeds in excess of 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 **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.³⁵

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 or 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.

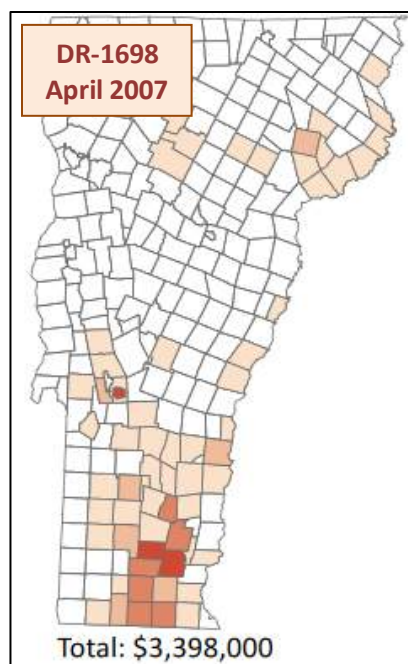
³⁴ 2018 State of Vermont Hazard Mitigation Plan

³⁵ 2018 State of Vermont Hazard Mitigation Plan

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 off 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

*For the purposes of the Hazard Mitigation Plan, the scale is only shown above wind force 5; Data from NOAA

High Wind: History and Extent of Impact



Since 2000, there have been six Federal Disaster Declarations for high wind events in Vermont, excluding those related to Tropical Storm Irene and Hurricane Sandy. One example 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."³⁶ Total Public Assistance for this event was close to \$4 million with the costliest damages in neighboring Windham County. The Town of Windsor received assistance for this declaration.

Since 2000, **NOAA National Centers for Environmental Information's Storm Events Database** recorded 30 High/Strong Wind events and 103 Thunderstorm Wind events that impacted Windsor County causing tree damage 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

Isaiahs 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 wide spread causing power outages up to 25,000 countywide.

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

³⁶ 2018 State of Vermont Hazard Mitigation Plan

in July 2003. A strong storm with heavy rain, lightening and severe winds ravaged the Town of Cavendish and portions of Windsor.

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 Windsor, a number of trees were uprooted with some structural damage.” ³¹

High Wind: Trends and Vulnerability

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. ³⁷

The frequency of high wind events has increased. It is anticipated that extreme weather conditions, due to climate change, will continue to impact the community in the form of high winds in Windsor County during the Windsor 2021-2026 Plan cycle. This is supported by the NOAA data which shows that of the 103 reported Thunderstorm Wind events since 2000, 66 have occurred over the past 10 years.

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 Windsor typically last only a few hours but can last for days if the outage is regional. 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.

Town assets are located in developed downtown areas with less trees and are not particularly vulnerable to this hazard. 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.

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 Windsor in managing and removing trees that threaten lines utility lines.

³⁷ 2018 State of Vermont Hazard Mitigation Plan

5.2f. Extreme Heat

Probability of Occurrence: 4.0
Average Hazard Impact: 1.25
Hazard Assessment Score: 5.0

Drought

Probability of Occurrence: 3.0
Average Hazard Impact: 1.5
Hazard Assessment Score: 4.5

Extreme Heat and prolonged hot weather and resulting **Drought** have not been of concern to Vermonters, historically. Only recently have these potential hazards captured the concern of Windsor County communities. They are profiled here for the first time in Windsor's hazard mitigation planning. The probability of occurrence scored relatively high with a low hazard impact on life, infrastructure and the environment.

Extremely high temperatures can occur when a high-pressure system (under which air is descending toward the Earth's surface) 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, wildfire, invasive species, and infectious disease.³⁸

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 have developed ways to cope with heat and humidity as a way of life.

The Heat Index is a measure of how hot it actually feels when relative humidity is considered in 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.

³⁸ 2018 State of Vermont Hazard Mitigation Plan

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 classification categories 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.

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 wildfires while small town fire departments that rely on river water will have limited capacity for fighting fires.

Extreme Heat and Drought: History and Extent of Impact

The following notable **historic heat events** were gleaned from the 2018 Vermont Hazard Mitigation Plan:

- c. 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.
- d. 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.
- e. 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.

A review of summer temperature data over the past 10 years (2010 to 2019) for the Town of Springfield, which lies directly east of Windsor, suggests no identifiable warming trend between 2010 and 2019. 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 five consecutive days of >90°F occurred in 2011, 2013, 2015 and 2019. In 2018, there were six consecutive days of >90°F in July and three in August.

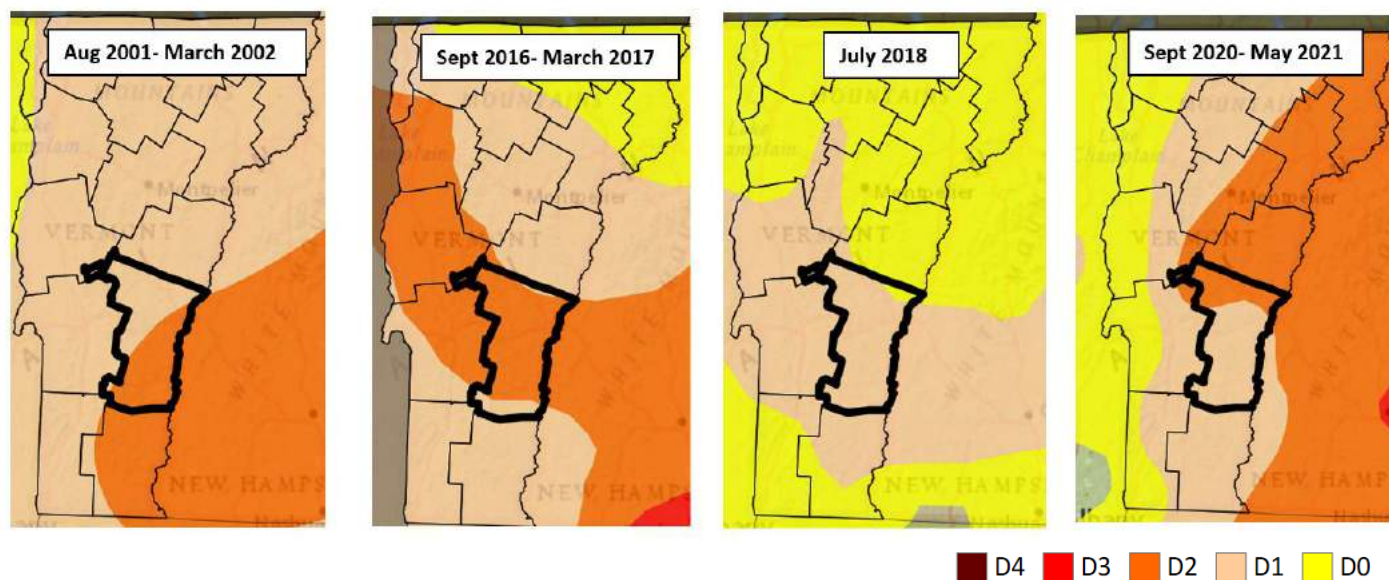
For Windsor County, in the summer of 2018, high temperatures in the upper 80s to upper 90s with dewpoints in the 60s and 70s created dangerous heat indices in the 95-to-110-degree range between June 30th and July 5th. A substantial increase in hospitalizations occurred due to the excessive heat and duration and at least 3 deaths were contributed to the heat. Burlington VT witnessed the warmest 5- and 6-day consecutive stretch since records have been kept in 1892. Also, the ALL-TIME warmest minimum daily temperature was recorded on July 2nd of 80°F, breaking the old record of 78°F.

The 2nd longest heatwave in modern history (1900-onward) occurred across portions of NY and VT in 2020 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. Daily High temperature records were set at Burlington on June 22nd and June 23rd with high temperatures of 96°F for both days.

Vermont droughts are infrequent as precipitation in the northeast is fairly reliable. According to the State plan, there were two declared statewide droughts in the summer of 1995 resulting in water usage restrictions and loss of crops in some areas. A third, more severe drought affected Southern Vermont late summer of that year.

Figure 4 shows historical occurrences since 2000 and 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. Windsor County was affected by all of these recent droughts as shown in **Figure 4** below.

FIGURE 4: Extent of Historical Drought in Windsor County (2000 – 2020)



Extreme Heat and Drought: Trends and Vulnerability

Heat-related events are, historically, less likely to occur compared to other areas of the country. However, they are beginning to occur in much greater frequency. Both state annual minimum and maximum averages show a steady increase from 1960 (**Figure 5**³⁹), with a greater rise in the minimum

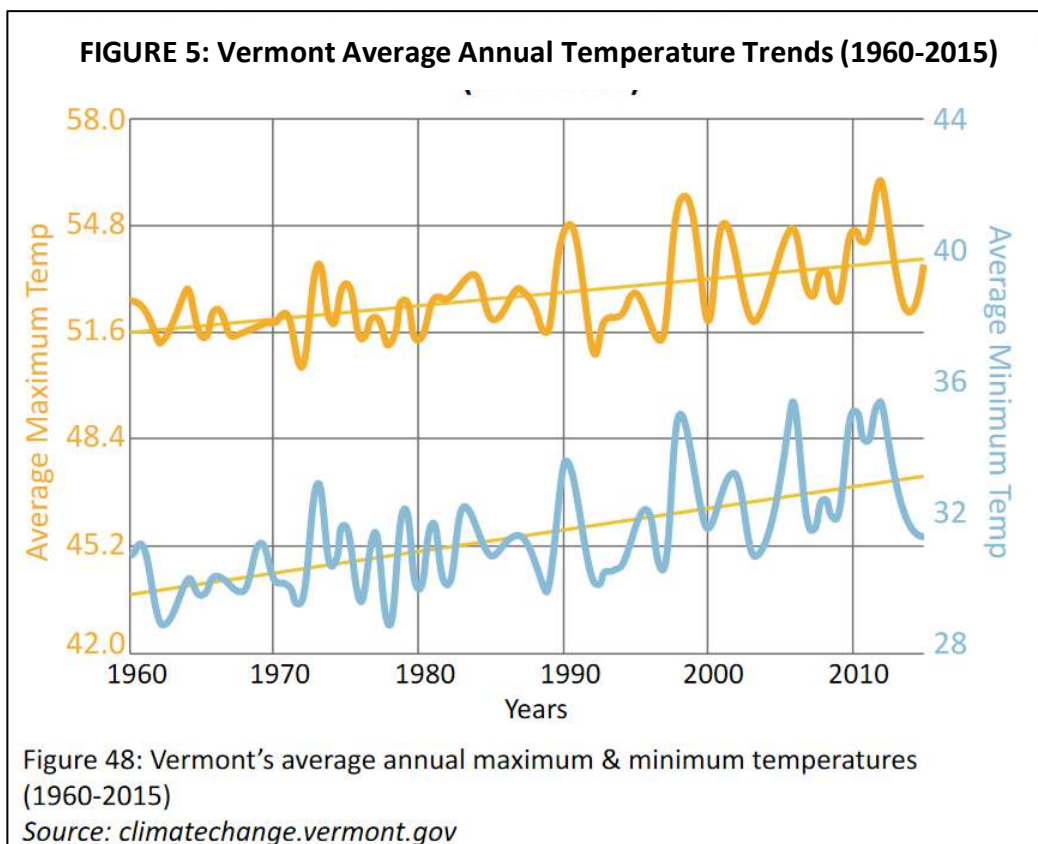
³⁹ 2018 State of Vermont Hazard Mitigation Plan

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.⁴⁰

The primary impact of extreme heat or prolonged periods of hot weather is to 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 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.⁴¹

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.



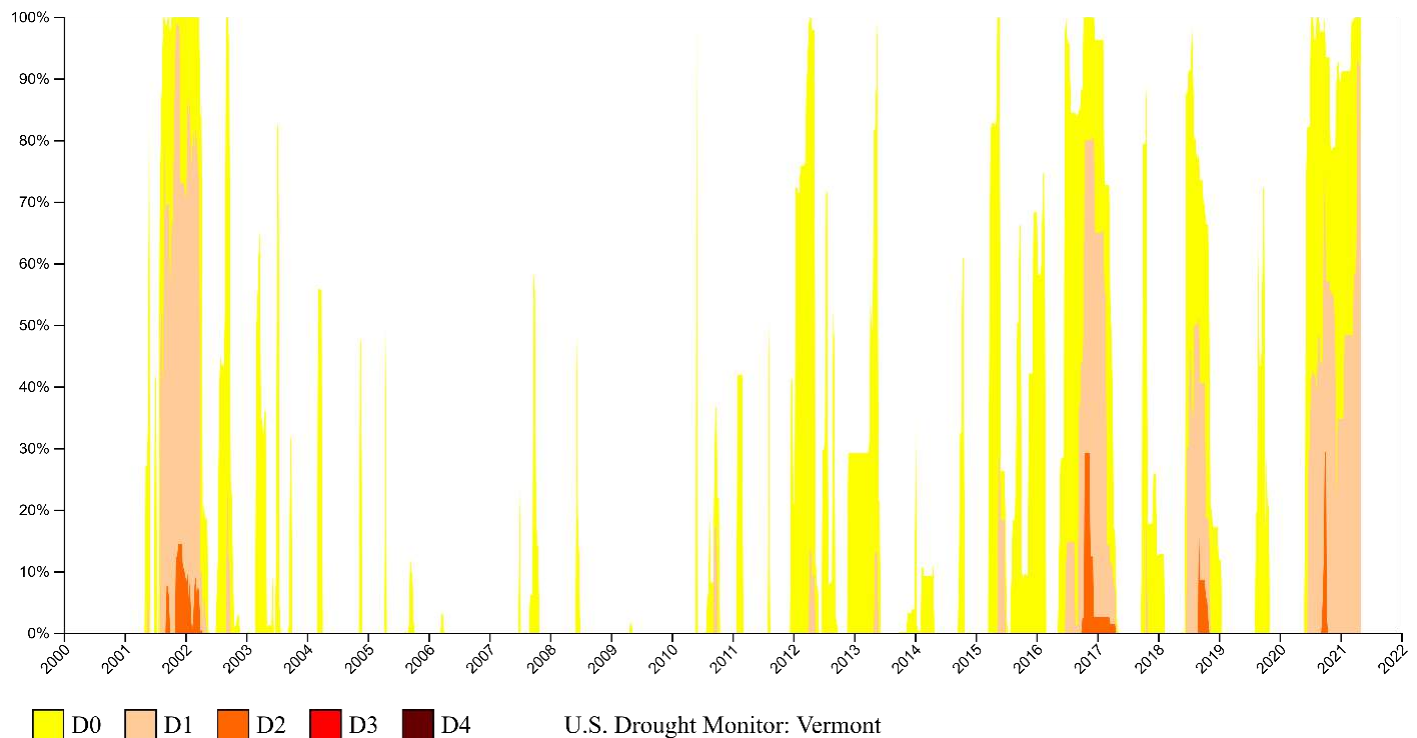
⁴⁰ <https://www.usgs.gov/center-news/northeast-warming-faster-rest-us>

⁴¹ 2018 State of Vermont Hazard Mitigation Plan

Periods of drought for Vermont and Windsor County are also expected to occur with more frequency as can be surmised from the timeline above in **Figure 5** obtained from NOAA’s National Integrated Drought Information Systems (NIDIS) at drought.gov.

Critical Vermont economic sectors such as logging, farming, maple sugaring and dairy farming can be disrupted by impacts from a warming climate. Windsor has experienced only isolated issues with extreme heat and drought but specific data is not available. The Town anticipates this trend continuing and has included these hazards for the first time in their local Hazard Mitigation Plan. Effort will be made to better monitoring local incidents of extreme heat and drought.

FIGURE 6: Vermont Drought Monitor (accessed 6-9-2021)



5.2g. Dam Failure

Probability of Occurrence:	1.0
Average Hazard Impact:	3.75
Hazard Assessment Score:	3.8

Dam Failure was assessed as having a lower probability of occurrence at 1.0 since the repair of the Ascutney Mill Dam was completed in 2018. While dam failure is more likely considered a man-made hazard and can as a result of poor maintenance mismanagement, an extreme flood event could push a dam’s capacity beyond its limit causing the dam to suddenly burst resulting in disastrous flooding and potential loss of life. Dams are manmade structures built to impound water. Dams are built for many and multiple purposes including water storage for potable or livestock water supply, irrigation, or fire

suppression. Dams can also be built for recreation, flood control and hydroelectric power. In Vermont, many of the dams that remain today were originally constructed to supply hydro power to the many mill industries. Dam failure occurs when the structure is breeched and potentially can cause inundation of downstream areas and property. Such an uncontrolled release is rare but can occur with little warning and can cause massive damage and loss of life.

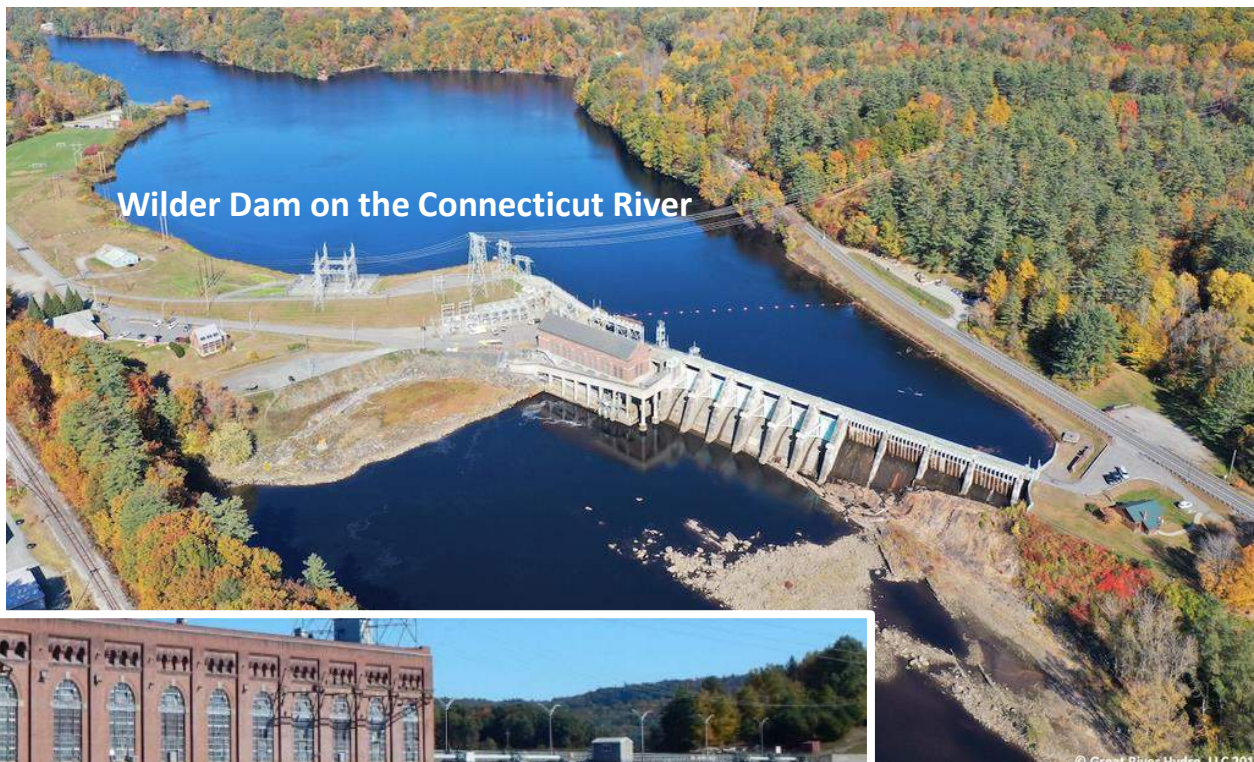
Dam failures can occur at any time in a dam's life; however, failures are most common when water storage for the dam is at or near design capacity. At high water levels, the water force on the dam is higher and several of the most common failure modes are more likely to occur. Correspondingly, for any dam, the probability of failure is much lower when water levels are substantially below the design capacity for the reservoir. Dam failures can occur at any time in a dam's life; however, failures are most common when water storage for the dam is at or near design capacity. At high water levels, the water force on the dam is higher and several of the most common failure modes are more likely to occur. Correspondingly, for any dam, the probability of failure is much lower when water levels are substantially below the design capacity for the reservoir.



Although it is not identified as a high priority hazard, the Committee does recognize the potential catastrophic impact on the community of a dam failure. Windsor lies within the inundation area of two high hazard dams - Wilder Dam which is, approximately 16 miles upstream on the Connecticut River,

and Ascutney Mill Dam (Windsor Upper Dam or Mill Pond Dam) southwest of downtown on the Mill Brook River.

In 2017, Great River Hydro, LLC purchased the network of Connecticut River hydro dams and has been working with towns in the region on an emergency management plan as part of their relicensing with the Federal Energy Regulatory Commission. The Wilder Dam is on the Vermont Agency of Natural Resources Dam Safety Program's as a **High Hazard Potential dam**, a classification standard for any dam whose failure or mis-operation will cause loss of human life and significant property destruction. The dams on this list are typically inspected by a state representative on a rotating basis and are not considered to be in danger of failure. The Town has very recently begun to review and discuss implications of potential Wilder Dam failure. Information on the extent and trend of this hazard is not available.



6. MITIGATION PROGRAM

The following sections detail the mitigation goals and potential mitigation strategies identified by the Town and compiled and organized by the Hazard Mitigation Committee to reduce the impact of the hazards assessed in this plan. The implementation schedule that follows in **Table 12: 2021-2026 Mitigation/Preparedness Strategies and Actions** is a comprehensive list of actions that the town has targeted for implementation during the five-year cycle of this plan.

6.1 Mitigation Goals and Objectives

Following the Hazard Analysis and Hazard Profile and review process as described in **Section 4**, the Hazard Mitigation Committee then agreed upon the following overarching goals and associated objectives below. Note that the numbers do not indicate goal priority but are used to identify actions that support it.

Hazard Mitigation Goals and Objectives

1. Provide protection and Reduce Risk to the community from the Impact of Hazard Events.
 - a. Reduce the risk of potential loss of life, injuries, negative health impact, and property damage.
 - b. Maintain and enhance Emergencies Operation Plan.
 - c. Minimize financial losses due to hazard events incurred by the community including residents and business owners.
 - d. Improve resiliency of our built and natural environment including public infrastructure, and recreational, cultural and historic assets.
 - e. Protect, restore and enhance local natural resources to promote healthy, resilient ecosystems.
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.

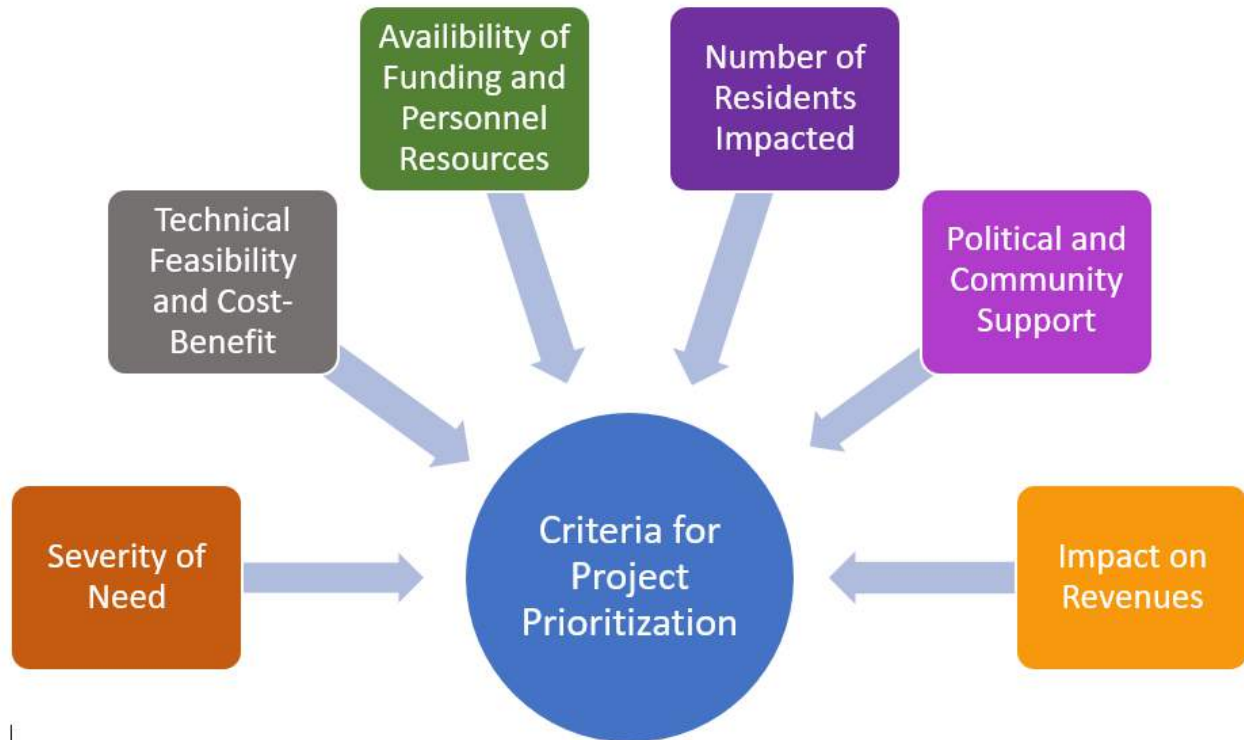
6.2 Hazard Mitigation/Preparedness Strategies and Actions

Throughout the planning process as described efforts were made to identify actions that would address the town's vulnerabilities and achieve the goals and objectives outlined above. These mitigation actions have been identified by the Committee as the most effective and feasible actions to be taken during this plan period to lessen the impacts of the hazards identified in **Section 5**. Some of the actions from the previous plan have been carried-over or modified either because they have been expanded or because of their on-going cyclical nature. Compared to the previous Hazard Mitigation Plan, below are changes in the selection of hazards addressed and changes in the approach on formulating goals and actions:

6.2a Changes from Prior Plan

- The Town's **method of hazard assessment** was modified to resemble that used by the State. The hazard impact assessment was 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.
- **Flood, Erosion, Wildfire and Structure Fire** were again assessed as high priority hazards but with an expanded number of flood and erosion related strategies and actions than in previous years to incorporate recommendations from the Flood Resiliency section of the Town Plan, new stormwater, road erosion and river corridor reports and plans.
- **Infectious Disease** and **Invasive Species** are new hazards identified in this plan update given recent experiences from the COVID Pandemic and tree infestations. General action items have been identified for these hazards although they did not score high enough to be profiled.
- **More local hazard data** has been obtained and presented in support of high priority profiled hazards.
- Efforts were made to **better identify goals and more specific actions** to improve plan effectiveness and clarity in tracking progress. The **method of prioritizing strategies and actions** to be sure they address these goals to improve plan effectiveness.
- Efforts were made to improve plan effectiveness by **correlating mitigation strategies and actions to the Town Plan** goals and recommendations and to recommendations from other technical reports.
- Recognizing the high percent of seasonal residents and new influx of people that have settled either as second home owners or as permanent residents over the course of the pandemic, this plan will focus on enhancing efforts to reach this population through **targeted outreach** to raise awareness.

6.2b Prioritization of Strategies and Actions



For this update, the Committee selected a method for prioritization of strategies and actions based on three categories – High, Moderate, and Low compared to a more ad-hoc basis in the prior plan. 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 action priority, a number of criteria were considered together and weighted subjectively. These criteria are depicted in the diagram above and are listed below.

- Severity or immediacy of need. This subjective assessment would consider the potential extent of risk in terms of structural damage repair costs, level of safety risk to residents, and probability of occurrence.
- Number of residents impacted that would benefit from mitigation.
- 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.
- Strong community support and little or no political opposition or reduction in revenue.
- Project feasibility and cost-benefit. Note that Windsor is a small town and does not currently have the capacity to determine the cost/benefit of each proposed action. However, prior to pursuing any mitigation project, the Town would consider the costs and benefits of the project using FEMA methodology.

As an example, a “High” priority action would typically score higher in the Hazard Analysis and have greater weight for the first two criteria listed above than those with a “Moderate” priority. A high priority action may also be one that is low cost or organizational in nature and, once implemented, will improve the likelihood and feasibility of other actions.

TABLE 12: 2021-2026 Mitigation/Preparedness Strategies and Actions

High Priority
Moderate Priority
Low Priority

MITIGATION ACTION OR STRATEGY	TYPE ¹	HAZARD ADDRESSED	DESIGNATED RESPONSIBLE PARTY ²	TIME FRAME	FUNDING SOURCE ³
Assess County Road drainage issues and seek funding to implement needed stormwater or other practices to reduce erosion.	M	All	Selectboard, Town Administration, Highway Dept, MARC	2022-2023	TCB MRGIA BRGP
Participate in The National Fire Protection Association (NFPA) Community Risk Reduction Resources for improved ISO rating.	P	Wildfire Structure Fire	Town Administration, FD/EMD	2021-2026	TOB
Address Freezing Water Pipes Phase I: Assess issue with freezing water pipes (Day Street) and evaluate permanent solutions. Phase II: Seek funding for conceptual engineering design.	M	Extreme Cold, Drought	Selectboard, Town Administration, Water/Sewer Plant Dept, MARC	2023-2026	TCB HMA ARPA
Address risk to infrastructure and public and private property from Emerald Ash Borer Phase I: Form a project committee and conduct inventory assessment of ash trees in the municipal ROW for emerald ash borer and provide public outreach to community on emerald ash borer information and mitigation. Phase II: Determine risk to Town infrastructure and develop a	M	Invasive Species	Highway Dept, Tree Warden	Phase I: 2021-2021 Phase II: 2022-2023	ANR, Conservation Programs EABG

plan to address these risks.					
Work with Green Mountain Power to prioritize tree maintenance on County Road to minimize power loss to Ascutney Hospital	M	High Wind Ice Storm	Town Administration, Highway Dept, Tree Warden , GMP	Annually 2021- 2026	TOB Other
Increase NFIP Participation Phase I: Develop a plan to increase NFIP participation of residents within high flood risk areas. Phase II: Implement plan and evaluate results or feedback.	M	Flood, Erosion	Zoning Administrator , HMC, MARC	Phase I: 2022- 2024 Phase II: 2024-2026	HMA TOB FMA
Work with MARC to determine feasibility and benefit of having MARC assist with annual monitoring of plan	M, P	All	HMC Town Administration MARC	2022-2022	TOB
Continue progress to upgrade all technical level emergency responders to EMT or higher level to provide more capacity for emergency response. Maintain ER equipment and upgrade to better address climate and hazard trends.	P	All	FD/EMD	Ongoing, Annually, 2021- 2026	TOB HMA EMPG ARPA PACIF
Seek funding to conduct an engineering study to evaluate Lake Runnemede North Dike/Levee	M	Flood, Dam Failure	Town Administration , EMD Selectboard MARC	2023-2024	TCB ANR (ERPG, DIBG) HMA ACCD
Evaluate the feasibility of the remaining proposed solutions from the 2017 Road Erosion Inventory Report to improve flood resiliency of Weeden Hill Rd. (bank stabilization (Site E), Culvert outlet stabilization (Site F), and drainage improvements (Site G) and develop timeline to seek funding for implementation.	M	Flood, Erosion	Town Administration, Highway Dept , Selectboard, MARC	2022-2026	TCB MRGIA, BRGP HMA ANR (ERPG, DIBG)
Focus efforts for MRGP compliance on the gravel road segments at the highest risk for erosion assessed as very high priority (Chellis, Hunt, Marton, Weeden Hill)	M	Flood, Erosion	Town Administration, Highway Dept , Selectboard MARC	Annually, 2022-2026	TCB MRGIA, BRGP

Mill Brook River Corridor project W11-Windsor High School Sewer Line. Seek funding to conduct an alternatives analysis to assess options to re-route the sewer line or replace the existing structure to improve flood capacity and reduce the risk of debris jamming. Damage to the sewer line in a future storm event would interrupt sewer service to the High School.	M	Flood, Erosion	Town Administration, Water/Sewer Plant Operator, Selectboard MARC	2023-2026	TCB ARPA HMA FMA
Work with Wilder Dam owner, Great River Hydro, LLC to learn how to access and use their new online interactive emergency management system to enhance current emergency response and evacuation plans.	M	Flood, Erosion Dam Failure	Town Administration, FD/EMD, MARC	2021-2021	TOB
Work with the Windsor Historical Society to compile and prioritize a list of historic sites at risk of flood and fire hazard and potential mitigation options	M	Structure Fire	Windsor Historical Society FD/EMD Zoning Administrator	2022-2024	TOB
Address deteriorating brownfield sites near downtown area including the burnt structure on 11 River and the former dry cleaners on 7 Maple which are in or near SFHA or River Corridors.	M	Flood, Structure Fire, High Wind	Town Administration, Selectboard, MARC	2021-2022 for 11 River & 7 Maple, ongoing 2023-2026	TCB MBRP
Work with MARC to develop a digital Library of Resiliency Resources to better organize information on local hazards to include a glossary of HM terms and a description of each document rather than just links. Include FEMA and other mitigation guide materials, flood mapping and NFIP information.	M, P	Various	HMC, Town Administration, FD/EMD, MARC	2022-2025	TOB HMA FMA Other
Recommend a more watershed-based approach to address flood risk along the Mill Brook. Work with MARC and other watershed towns up stream of Windsor on projects to reduce flooding and fluvial erosion.	M	Flood, Erosion	Town Administration, MARC	2022-2026	TOB
Work with GMP on enhancing tree maintenance to better assess	M	High Wind,	Town Administration,	2023, then	TOB

and mitigate the potential impact of heavy snow, ice and wind to protect vulnerable utility infrastructure.		Ice	FD/EMD	annually 2024-2026	
Update and provide public access to a plan to address evacuation and sheltering for flood events and shelters for extreme cold and extreme heat.	M, P	Extreme Cold, Extreme Heat, Flood, Dam Failure	Town Administration FD/EMD	2023-2025	TOB, TCB HMA
Make continued progress on Municipal Roads General Permit (MRGP) standards for implementing best management practices on hydrologically-connected road segments and participate each year in the Grants-In-Aid Program for funding.	M	Flood, Erosion	Town Administration, Highway Dept, Selectboard, MARC	Ongoing, Annually, 2021-2026	MRGIA BRGP ANR (DIBG, ERP) HMA
Prepare and maintain, a 3-year road plan to address high priority town roadways that are susceptible to erosion that can be addressed with GIA, BR and other state funding programs.	M	Erosion	Town Administration, Highway Dept, MARC	2022, then ongoing	TOB, TCB
Mitigate ongoing soil erosion in Paradise Park to improve the management of stormwater flowing into the park which has begun to undermine the recreational trails creating an erosion hazard that is exacerbated during heavy rain. <u>Phase I:</u> Determine best solution, finalize conceptual engineering design. <u>Phase II:</u> Determine funding sources to implement project .	M	Erosion	Town Administration, Selectboard, Recreation Commission, MARC	Phase I: 2022- 2024 Phase II: 2024-2026	TCB ANR (DIBG, ERP) HMA ACCD
Continue to promote Windsor Emergency Response program resources on a periodic basis to be determined, for public awareness, particularly for new residents and businesses.	P	All	FD/EM Town Administration	Annually (minimum), 2021-2026	TOB
Consider participation in FEMA's Community Rating System (CRS)- a voluntary incentive program that recognizes and encourages community floodplain management practices.	M	Flood, Erosion	Town Administration, Selectboard, Zoning Administrator MARC	Phase I: 2021-2022 Phase II: 2022-2023	TOB

Phase I: Evaluate the benefits (financial and other) of the FEMA CRS program to the community. Phase II: Determine the feasibility and personnel resources for participation.					
Update bridge and culvert inventories and maintain a priority list for upgrades and repairs to reduce risk of damage and infrastructure failure from flooding and erosion	M	Flood, Erosion	Town Administration, Highway Dept, MARC	Every 3 yrs. priority list annually 2021-2026	TOB TAP BRGP
Maintain and enhance seasonal fire safety awareness program and periodic outreach for schools, residents, landowners, rental properties and town recreational areas.	M, P	Wildfire, Structure Fire	FD/EMD, Recreational Dept., Paradise Park Commission, Windsor Schools	Annually, 2021-2026	TOB FPSG VDFS FEMA Publications
Conduct annual review of Hazard Mitigation Plan progress as noted in Section 6.3 prior to capital budgeting process and recommend incorporating projects selected from this plan, if feasible and funding is available.	M	All	HMC, Town Administration	Annually, 2021-2026	TOB
Work with MARC to encourage hazard mitigation awareness and incorporate mitigation/preparedness actions into other town planning efforts providing specific examples and language to be discussed and considered.	M	All	Selectboard, Planning Commission, Town Administration MARC	During various plan cycles, ongoing	TOB
Encourage, where feasible, turnoffs and water retention or infiltration practices when addressing road drainage issues.	M	Erosion	Town Administration, Highway Dept, MARC	Annually for MRGP, 2022-2026	TOB, MRGIA, BRGP
Work with MARC to provide a concise and comprehensive list of available funding sources to include a description/examples of eligible project types and application schedules to better coordinate efforts in implementing mitigation projects.	M, P	All	Town Administration MARC	2021	TOB HMA

¹ M – Mitigation, P – Preparedness

² Responsible Party is shown in **Bold** and others listed are support entities

HMC – Hazard Mitigation Committee

FD/EMD - Fire Dept./Emergency Management Dept.

MARC- Mount Ascutney Regional Commission

³ Funding Sources:

Town Funding

TOB - Town Operating Budget

TCB – Town Capital Budget

FEMA and Vermont State Department of Emergency Management (VEM)

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

EMPG – Emergency Management Performance Grant (VT State Department of Emergency Management)

FPSG – FEMA Fire Prevention & Safety Grant

Vermont Agency of Natural Resources (ANR)

ERGP - Ecosystem Restoration Grant Program

DIBG – Design/Implementation (Clean Water) Block Grant Program

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

Vermont Department of Fire Safety Programs (VDFS)

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)

VMG – 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 Brownfields 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
New England Grass Roots Environmental Fund
VLCT PACIF Grant Program

6.3 Plan Monitoring and Maintenance Process

Plan Monitoring Process

The Windsor Town Manager will be responsible for monitoring this plan as outlined below, to ensure that progress is made and identified mitigation actions are implemented as resources or opportunities become available. The Town will work with its regional partners, including MARC, to identify funding opportunities and associated open application periods for implementing actions in **Table 12** and to seek assistance with funding applications.

New to this plan update is an effort to formalize a method for monitoring and evaluating the Town's progress on action items and to improve local hazard data collection. The monitoring process has been identified as an action item to be implemented annually (at a minimum) over the plan period and will include a noticed annual meeting of the Hazard Mitigation Committee, to review and track the following:

- progress on **Mitigation/Preparedness Strategies and Actions** listed in **Table 12**;
- changes or improvements in effectiveness of **Community Capabilities and Resources** in **Table 3**;
- updates to local, regional or State hazard data occurrences and extent;
- changes in prioritization of identified hazards;
- consistency with other Town Plan goals, policies, and recommendations, and
- whether stated goals and objectives are being met

This new method for monitoring plan progress will be implemented gradually over the plan period. Once fully established, the Town Manager will assign a staff position to conduct an annual review prior to the Town's annual budgeting process each fall with the completion of **Hazard Mitigation Plan Monitoring Forms** in **Appendix F** to document the status of tasks listed above. Monitoring forms will be completed identifying any progress made for each action and plans for the coming year, change in actions or priorities, and documentation of prior year's hazard events. Completed forms will become part of this plan, distributed to the appropriate boards and commissions, and made available for public viewing on the Town website and in the Town newsletter. Following the review meeting by the Committee, an update on plan progress is to be reported, annually, at a scheduled Selectboard meeting which is publicly noticed with agenda.

For these scheduled public meetings, representatives of the Planning Commission, Emergency Management, Fire and Highway Departments, and interested members of the public will be encouraged to attend. Participants will be asked during these review periods to identify new hazards, new vulnerabilities and suggest new potential mitigating measures. All public input during the annual plan monitoring process will be noted.

During the monitoring process, the Town will consider and incorporate appropriate hazard mitigation actions from **Table 12** as part of the budgeting process each year and as part of the planning process for updates to the Town Plan and Zoning Regulations (includes Flood Hazard Review), as well as for future community development projects, as appropriate.

Plan Maintenance Process

The Town will reconvene the Hazard Mitigation Committee at the direction of the Town Manager in the latter half of 2024 to kick-off the update process with an initial meeting to discuss grant funding and contracting services for assistance in the planning process. The Town Manager will again reach out to the community for additional volunteers to participate as members of the Hazard Mitigation Committee for the new plan period.

The Town will review the prior plan progress and monitoring forms. The Committee will conduct the planning activities as outlined in the Process Flow Chart (**Appendix C**) and incorporate the plan monitoring information, 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 which will be made available for public comment. The plan will be available on the town and regional websites, and hard copies will be available at the town office. A second publicly warned meeting will be held in the 3rd quarter 2025, during which any substantial revisions gathered during the public input period will be discussed. All final edits and revisions will be made and a final draft will be provided to the Hazard Mitigation Committee for final review by end of 2025.

Subsequently, the plan will be sent to Vermont Emergency Management for review, approval and referral to FEMA for Approval Pending Adoption (APA) to be completed in 1st quarter 2026. Following the receipt of APA, the Chester Town Selectboard may then adopt the updated Local Hazard Mitigation Plan and forward a copy of the adoption resolution to FEMA to complete the plan approval and adoption process before this plan expires in 2nd quarter 2026.

Appendix A

Maps

Current Land Use and Facilities Map
Town Plan 2019
Town of Windsor, VT
Adopted November 12, 2019

Land Use and Points of Interest

- Residential
- Commercial
- Farm
- Industrial
- Government and community

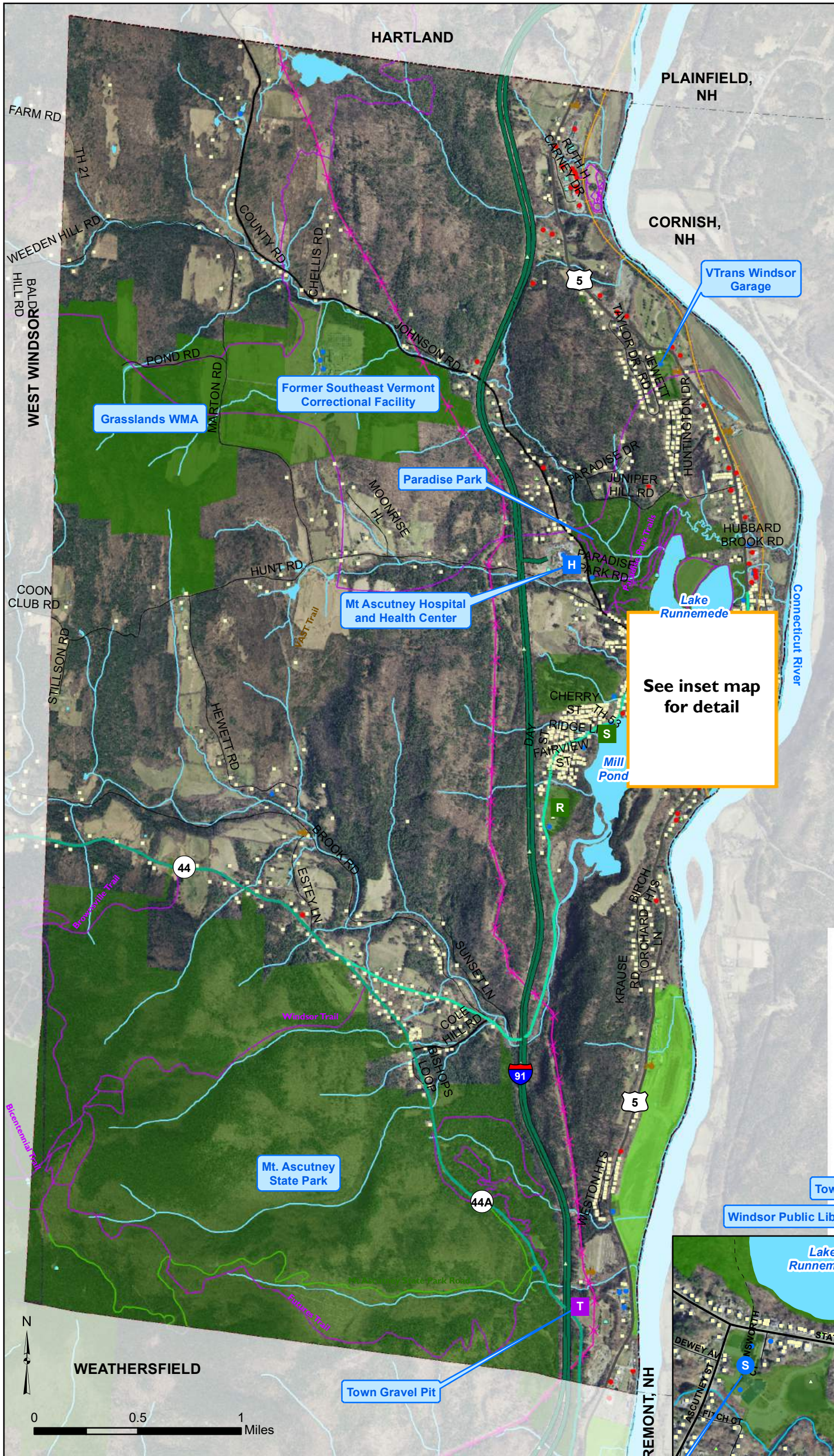
- Town Facility
- Windsor Welcome Center
- Windsor Public Library
- School
- Hospital
- Recreation Fields
- Town Swimming Area
- Train Station

- Public Ownership
- Private Ownership

- Interstate Highway
- US Highway
- VT State Highway
- Class 1 Town Highway
- Class 2 Town Highway
- Class 3 Town Highway
- Class 4 Town Highway
- Forest Road (Windsor only)
- Legal Trail (Windsor only)
- Private Road (Windsor only)
- Town Boundary

- Transmission Line

- Lake or Pond
- River or Stream



See inset map for detail



VT State Plane, Meters, NAD 83
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.

Data Sources:
Facilities in town (RPC 2013), Buildings E911 2018), Public Lands (RPC 2013), Protected Lands (VCGI 2017), Waterbodies (VHD 2010), Road centerline (VTrans 2018), VAST Snowmobile Trails (E911 2013), Hiking Trails (E911 2018) Railroad (VTrans 2017), Transmission Line (ANR 2003 and RPC 2013), Town Boundary (VCGI 2016), Aerial (NAIP 2016)



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For planning purposes only
Not for regulatory interpretation
Drawn June 17, 2019

Future Land Use Map
Town Plan 2019
Town of Windsor, VT
Adopted November 12, 2019

HARTLAND

PLAINFIELD,
NH

CORNISH,
NH

WEST WINDSOR

Draft Future Land Use Catagories

- Conservation
- Industrial
- Institutional
- Residential
- Rural
- Roadside
- Downtown District

Downtown Neighborhoods

- Bridge Street Neighborhood
- Central Business District
- Industrial Heritage Area
- Riverfront Neighborhood
- North Main Street
- South Main Street

Overlays

- Forest Blocks & Habitat Connectors
- Agriculture and Open Land

See
Downtown
Inset

WEATHERSFIELD

CLAREMONT,
NH



0 0.5 1 Miles

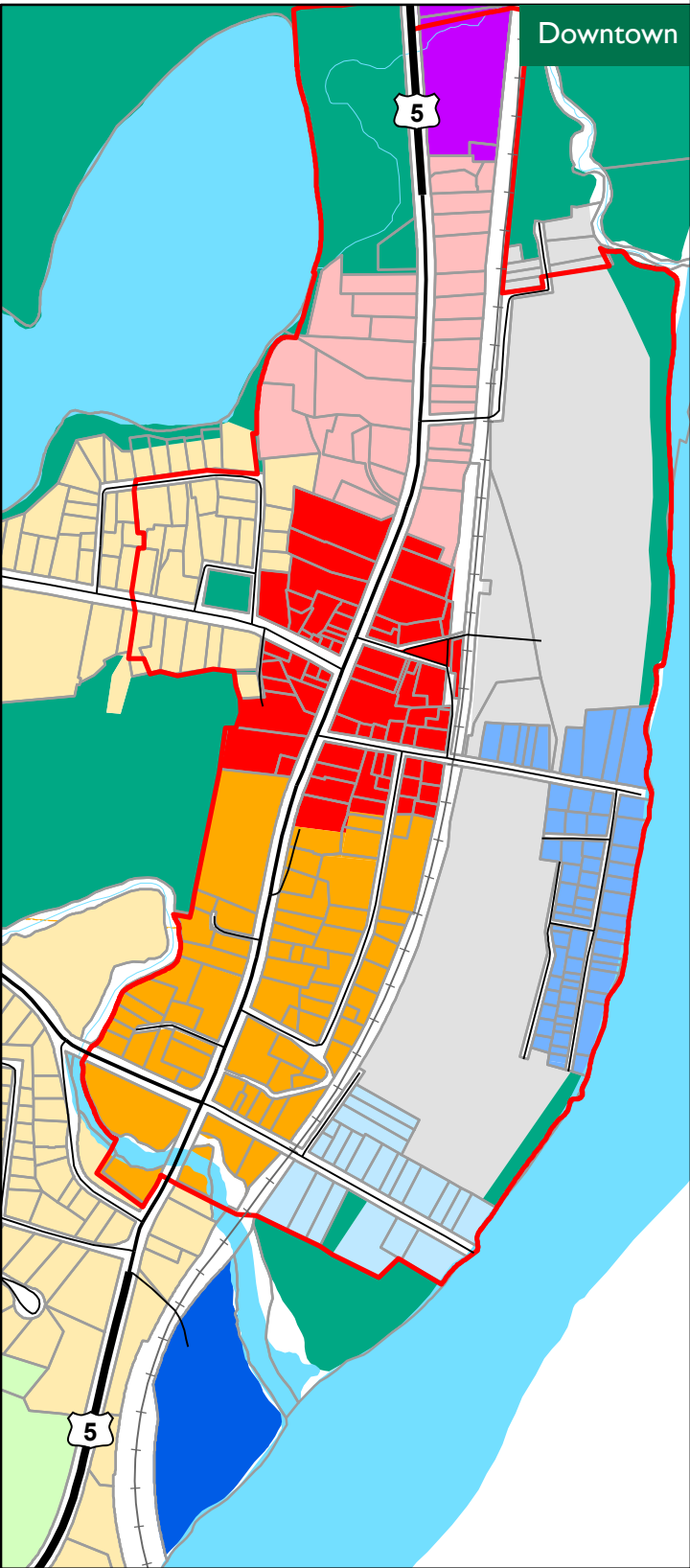
VT State Plane, Meters, NAD 83
Data depicted on this map are for
planning purposes only and are
based on best available information.
Some of the data do not line up.

Data Sources:
Road centerline (VTrans 2018), Parcels
(VCGI 2018), Railroad (VTrans
2017 and NHGranit 1993), Waterbodies
(VHD 2010), Future Land Use and
Overlays (RPC 2019 draft), Forest
Blocks and Habitat Connectors
(RPC 2019 draft).

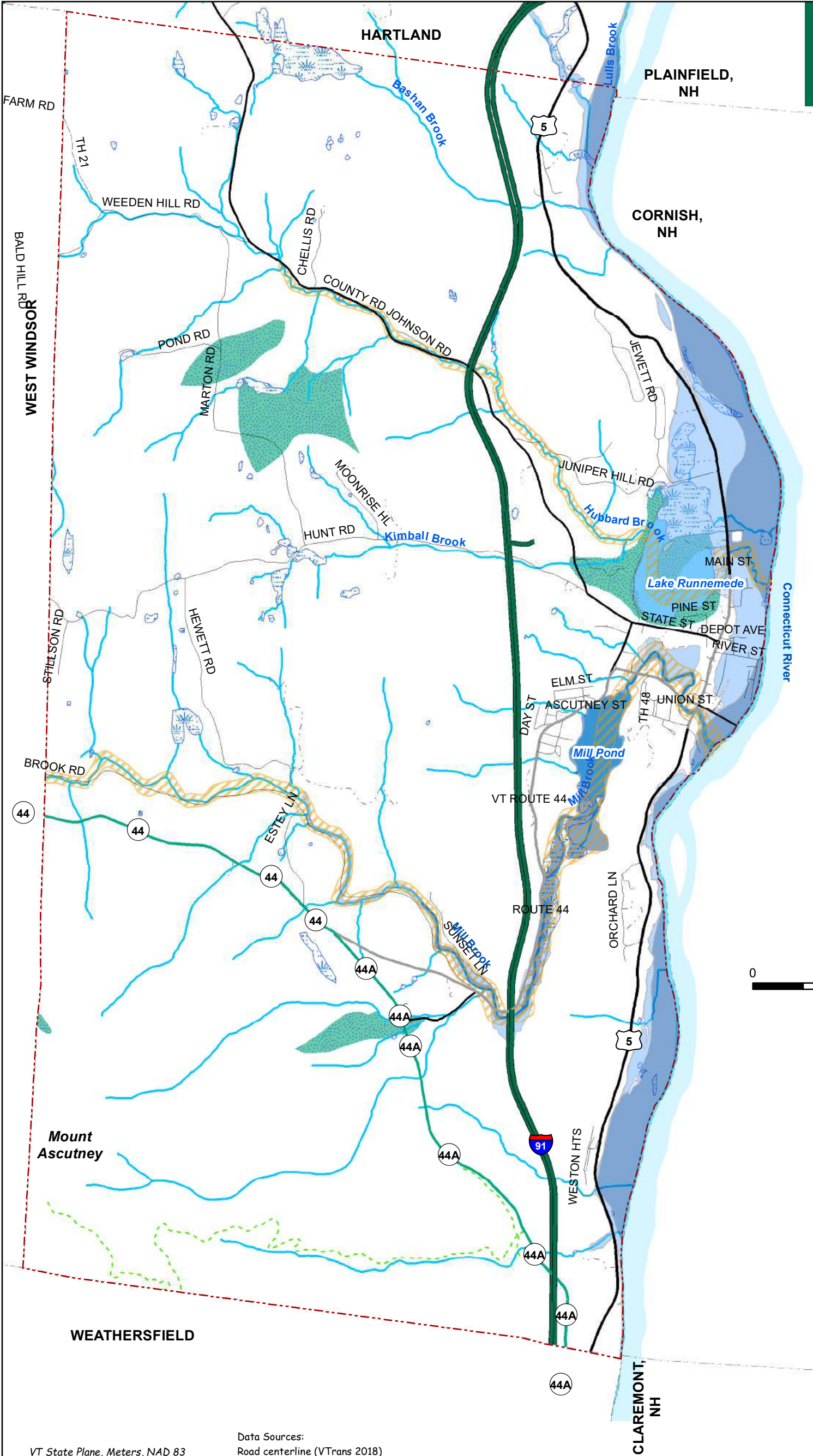


SOUTHERN WINDSOR COUNTY
REGIONAL PLANNING COMMISSION
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For planning purposes only
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Drawn September 23, 2019



Water Resources Map
Town Plan 2019
Town of Windsor, VT
Adopted November 12, 2019



- Interstate Highway
- US Highway
- VT State Highway
- Class 1 Town Highway
- Class 2 Town Highway
- Class 3 Town Highway
- Class 4 Town Highway
- Forest Road (Windsor only)
- Legal Trail (Windsor only)
- Private Road (Windsor only)
- Town Boundary
- Floodway
- Zones A and AE
- 0.2 % Annual flood
- River Corridors
- Lake or Pond
- River or Stream
- Wetlands (VSWI)
- Groundwater Protection

Note: The ANR stream line data for Hubbard Brook shown here is known to be incorrect. The corresponding River Corridor is therefore also mapped incorrectly.

VT State Plane, Meters, NAD 83
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.

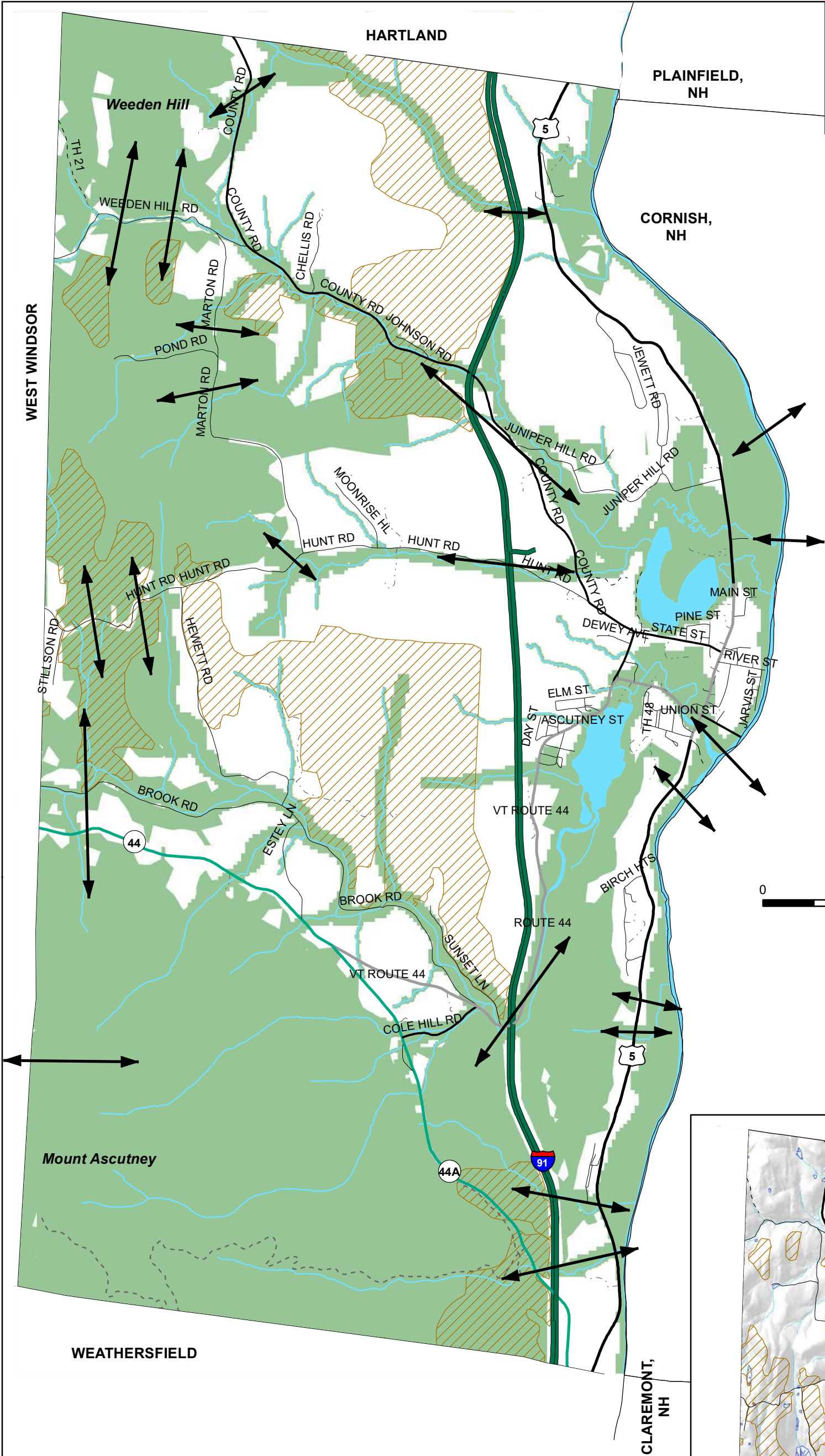
Data Sources:
Road centerline (VTrans 2018)
Waterbodies (VHD 2010), Town boundary (VCGI 2016), Groundwater Protection Area (ANR 2016), Surface water protection area (ANR 2016), Wetlands (ANR 2016), Floodplain (FEMA 2015), River Corridor (ANR 2015).

Notes:
The groundwater protection areas are for the Southeast Correction Vermont Facility well and the Town of Windsor Water Department.
There are no surface water protection areas or mapped Class 3 Vermont significant wetlands within town.
The floodplain and floodway were calculated by FEMA. Zones A and AE shown are for a 100 year flood and are regulated by local food hazard review.



For planning purposes only
Not for regulatory interpretation
Drawn June 17, 2019

Wildlife and Forest Resource Map
Town Plan 2019
Town of Windsor, VT
Adopted November 12, 2019



- Priority Forest Blocks & Habitat Connectors
- Probable Wildlife Crossing Areas
- Deer Wintering Areas
- Interstate Highway
- US Highway
- VT State Highway
- Class 1 Town Highway
- Class 2 Town Highway
- Class 3 Town Highway
- Class 4 Town Highway
- Lake or Pond
- River or Stream

0 0.5 1 Miles



- Deer Wintering Areas
- Rare, Threatened & Endangered Natural Communities
- Wetlands (VSWI)

Windsor Priority Forest Blocks & Habitat Connectors were identified in consultation with the VT Department of Fish and Wildlife. The Forest and Habitat Connector Blocks incorporate a variety of natural resource areas as previously mapped by the Agency of Natural Resources (ANR). These resources include conserved lands, priority forest and connectivity blocks, water and riparian areas, and rare and responsibility physical landscapes.

VT State Plane, Meters, NAD 83
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.

Data Sources:
Road centerline (VTrans 2018), Town boundaries (VCGI 2016 and NH Granit 2009), Waterbodies (VHD 2010), Protected Lands (ANR 2017), Highest Priority Connectivity and Interior Forest Blocks (ANR 2016), Surface Water and Riparian Areas (ANR 2016), Physical Landscapes (ANR 2016), Hillshade (derived from 10m DEM, USGS/VCGI 2012) Rare Threatened and Endangered Communities (ANR 2016), Wetlands (ANR 2016), Deer Wintering Areas (ANR 2012)

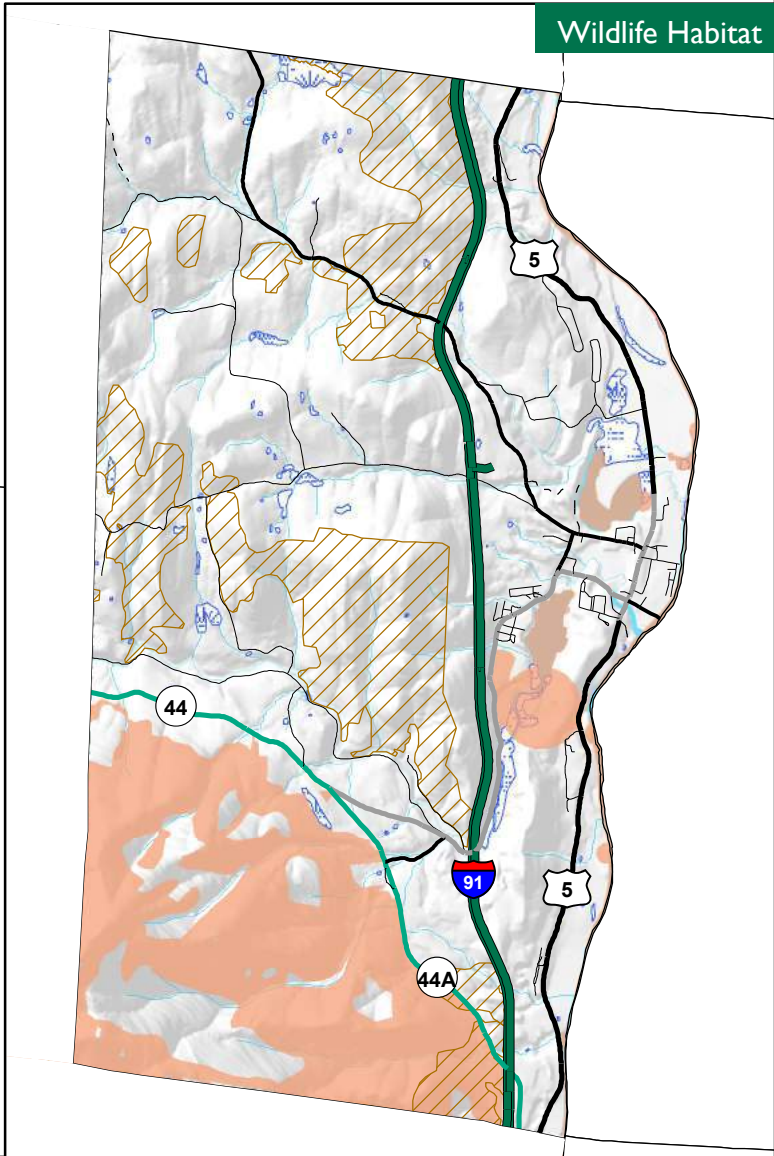
2019 Update



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Drawn June 17, 2019

Wildlife Habitat



Future Land Use Map
Town Plan 2019
Town of Windsor, VT
Adopted November 12, 2019

HARTLAND

PLAINFIELD,
NH

CORNISH,
NH

WEST WINDSOR

Draft Future Land Use Catagories

- Conservation
- Industrial
- Institutional
- Residential
- Rural
- Roadside
- Downtown District

Downtown Neighborhoods

- Bridge Street Neighborhood
- Central Business District
- Industrial Heritage Area
- Riverfront Neighborhood
- North Main Street
- South Main Street

Overlays

- Forest Blocks & Habitat Connectors
- Agriculture and Open Land

See
Downtown
Inset

WEATHERSFIELD

CLAREMONT,
NH



0 0.5 1 Miles

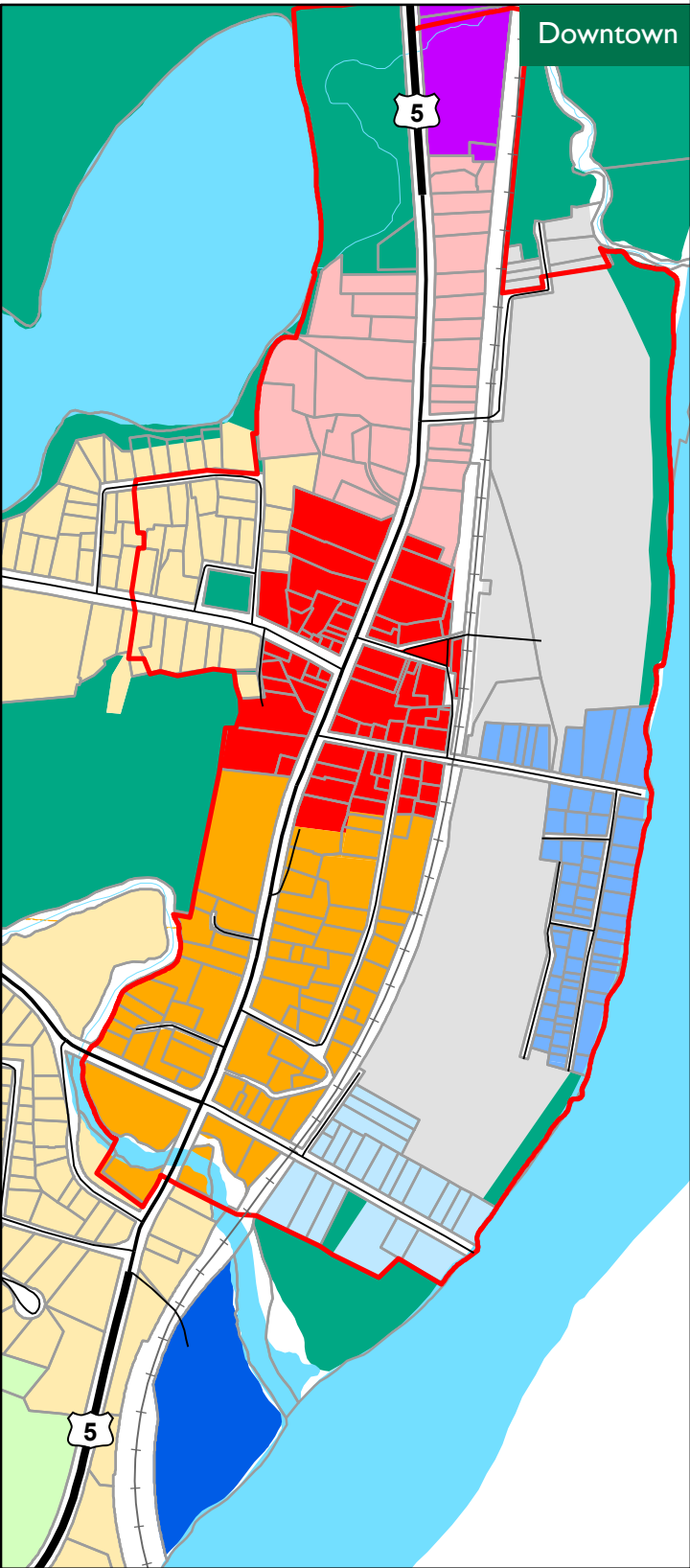
VT State Plane, Meters, NAD 83
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based on best available information.
Some of the data do not line up.

Data Sources:
Road centerline (VTrans 2018), Parcels
(VCGI 2018), Railroad (VTrans
2017 and NHGranit 1993), Waterbodies
(VHD 2010), Future Land Use and
Overlays (RPC 2019 draft), Forest
Blocks and Habitat Connectors
(RPC 2019 draft).



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For planning purposes only
Not for regulatory interpretation
Drawn September 23, 2019



Appendix B

Agendas, Sign-In, Public Notice

TOWN OF WINDSOR
LOCAL HAZARD MITIGATION PLAN UPDATE
Hazard Mitigation Committee
Thursday, February 4, 2021
Virtual Meeting

AGENDA

1. Virtual Meetings- schedule, sign-in, facilitation
2. Purpose
3. Changes in process since last plan update and what will be updated
4. FEMA Review Tools – Required Plan Elements
5. Planning Process
6. Conduct Preliminary Hazard Assessment Exercise
7. Identify Vulnerabilities and Risks – Community areas, places and structures (ongoing)
8. Public Outreach – How best to obtain local input
9. Match - Recording your time as in-kind match
10. Next Meeting – date and topics

VOLUNTEER/STAFF FORM TO DOCUMENT HMP MEETINGS - MATCH INFORMATION

PROGRAM: Local Hazard Mitigation Plan Update
DATE OF MEETING: February 4, 2021
MEETING LOCATION: Virtual
TOPIC: see Agenda
MEETING TIME: 1 PM - 3 PM

VOLUNTEER/STAFF* ATTENDEES - CLAIMED						
No.	NAME	AFFILIATION	MILEAGE ROUND TRIP	MEETING HOURS	TOTAL MILEAGE	TOTAL TIME
					0.565	\$24.14
1	Tom Marsh	Windsor Town Manager		2	-	48.28
2	Kevin McAllister	Windsor Fire Chief and Emergency Management		2	-	48.28
3	Pete Johnson	Windsor Highway Foreman		2	-	48.28
4	Bob Haight	Windsor Zoning & Development Administrator		2	-	48.28
5	Diane Foulds	public		2	-	48.28
6					-	-
7					-	-
8					-	-
9					-	-
10					-	-
11					-	-
12					-	-
13					-	-
14					-	-
15					-	-
16					-	-
17					-	-
18					-	-
34					-	-
35					-	-
Sub Total			0.00	10.00	\$0.00	\$241.40

FEDERALLY SUPPORTED PERSONNEL - CAN NOT CLAIM						
No.	NAME	AFFILIATION	MILEAGE ROUND TRIP	MEETING HOURS	TOTAL MILEAGE	TOTAL TIME
					0.565	\$24.14
1	Cindy Ingersoll	Mount Ascutney Regional Commission			-	-
2					-	-
3					-	-
4					-	-
5					-	-
6					-	-
7					-	-
8					-	-
9					-	-
10					-	-
Sub Total			0.00	10.00	\$0.00	\$0.00

TOTAL MATCH \$241.40

TOTAL Non-Volunteer Match -

TOTAL VOLUNTEER MATCH \$241.40

TOWN OF WINDSOR
LOCAL HAZARD MITIGATION PLAN UPDATE
Hazard Mitigation Committee
Thursday, March 4, 2021
1:00 PM – 3:00 PM
Virtual Meeting

AGENDA

1. Introduction if Public is Present
2. Prior Meeting Output on Hazard Assessment and Hazards to be Profiled (attached)
3. Status of Current Policies, Programs, Resources since 2016 LHMP (attached)
4. Status of Hazard Mitigation/Preparedness Actions since 2016 LHMP (attached)
5. Review of 2019 Town Plan related goals, policies and recommendations (attached)
6. Relevant Changes in Other Town Planning Efforts and Documents
7. New Relevant Reports, Studies, Plans Resources
8. Reminders:
 - a. Identify Vulnerabilities and Risks (attached template)
 - b. Hazard Occurrences Over Past 5 Years (attached template)
 - c. Record match hours (attached excel template)
9. Next Meeting – date and topics

VOLUNTEER/STAFF FORM TO DOCUMENT HMP MEETINGS - MATCH INFORMATION

PROGRAM: Local Hazard Mitigation Plan Update
DATE OF MEETING: March 4, 2021
MEETING LOCATION: Virtual
TOPIC: see Agenda
MEETING TIME: 1 PM - 3 PM

VOLUNTEER/STAFF* ATTENDEES - CLAIMED						
No.	NAME	AFFILIATION	MILEAGE ROUND TRIP	MEETING HOURS	TOTAL MILEAGE	TOTAL TIME
					0.565	\$24.14
1	Tom Marsh	Windsor Town Manager		2	-	48.28
2	Kevin McAllister	Windsor Fire Chief and Emergency Management		2	-	48.28
3	Pete Johnson	Windsor Highway Foreman		2	-	48.28
4	Bob Haight	Windsor Zoning & Development Administrator		2	-	48.28
5					-	-
6					-	-
7					-	-
8					-	-
9					-	-
10					-	-
11					-	-
12					-	-
13					-	-
14					-	-
15					-	-
16					-	-
17					-	-
18					-	-
34					-	-
35					-	-
Sub Total			0.00	8.00	\$0.00	\$193.12

FEDERALLY SUPPORTED PERSONNEL - CAN NOT CLAIM						
No.	NAME	AFFILIATION	MILEAGE ROUND TRIP	MEETING HOURS	TOTAL MILEAGE	TOTAL TIME
					0.565	\$24.14
1	Cindy Ingersoll	Mount Ascutney Regional Commission		2	-	48.28
2					-	-
3					-	-
4					-	-
5					-	-
6					-	-
7					-	-
8					-	-
9					-	-
10					-	-
Sub Total			0.00	10.00	\$0.00	\$48.28

TOTAL MATCH \$241.40

TOTAL Non-Volunteer Match 48.28

TOTAL VOLUNTEER MATCH \$193.12

TOWN OF WINDSOR
LOCAL HAZARD MITIGATION PLAN UPDATE
Hazard Mitigation Committee
Thursday, April 1, 2021
1:00 PM – 3:00 PM
Virtual Meeting

AGENDA

1. Introduction if Public is present
2. Review of 2019 Town Plan related goals, policies and recommendations (attached)
3. New Relevant Resources (Reports, Studies, Plans)
4. Identify Hazard Mitigation Goals (attached examples)
5. Identify Hazard Mitigation/Preparedness Actions (problem statements, vulnerable areas and assets lead to mitigating actions)
6. Prioritize Hazard Mitigation/Preparedness actions, phased actions, assign timeline and responsible parties.
7. Plan Monitoring Process
8. Next Meeting - TBD

VOLUNTEER/STAFF FORM TO DOCUMENT HMP MEETINGS - MATCH INFORMATION

PROGRAM: Local Hazard Mitigation Plan Update
DATE OF MEETING: April 1, 2021
MEETING LOCATION: Virtual
TOPIC: see Agenda
MEETING TIME: 1 PM - 3 PM

VOLUNTEER/STAFF* ATTENDEES - CLAIMED						
No.	NAME	AFFILIATION	MILEAGE ROUND TRIP	MEETING HOURS	TOTAL MILEAGE	TOTAL TIME
					0.565	\$24.14
1	Tom Marsh	Windsor Town Manager		2	-	48.28
2	Kevin McAllister	Windsor Fire Chief and Emergency Management		2	-	48.28
3					-	-
4					-	-
5					-	-
6					-	-
7					-	-
8					-	-
9					-	-
10					-	-
11					-	-
12					-	-
13					-	-
14					-	-
15					-	-
16					-	-
17					-	-
18					-	-
34					-	-
35					-	-
Sub Total			0.00	4.00	\$0.00	\$96.56

FEDERALLY SUPPORTED PERSONNEL - CAN NOT CLAIM						
No.	NAME	AFFILIATION	MILEAGE ROUND TRIP	MEETING HOURS	TOTAL MILEAGE	TOTAL TIME
					0.565	\$24.14
1	Cindy Ingersoll	Mount Ascutney Regional Commission		2	-	48.28
2					-	-
3					-	-
4					-	-
5					-	-
6					-	-
7					-	-
8					-	-
9					-	-
10					-	-
Sub Total			0.00	6.00	\$0.00	\$48.28

TOTAL MATCH \$144.84

TOTAL Non-Volunteer Match 48.28

TOTAL VOLUNTEER MATCH \$96.56

Windsor Public Notice for Hazard Mitigation Planning Update Meetings:

Reducing Risk to Natural Hazards and Disasters in Windsor: Voice your concerns during the Local Hazard Mitigation Plan update.

The Town of Windsor is updating its Local Hazard Mitigation Plan. The purpose of this planning effort is to protect life, property, economy, quality of life, and environment of the Windsor Community from hazards and disasters. We are requesting input from the local community regarding experiences and concerns about hazard events and the potential risks and vulnerabilities to hazards, such as flooding, erosion, extreme temperatures, winter storms and drought.

The Town's Hazard Mitigation Committee plans to virtually meet on a monthly basis on the first Thursday of the month, 1:00 PM to 3:00 PM. The next meeting is scheduled for March 4, 2021. Meetings will be via ZOOM and conducted by the Mount Ascutney Regional Commission (MARC). The public is encouraged to participate and share their thoughts.

If you are interested in participating, please email Cindy Ingersoll at cingersoll@marcvr.org for ZOOM link. You can also provide your concerns, comments, and questions regarding this planning effort via email to Cindy Ingersoll.

Meeting agendas, planning materials, and templates which you can use to provide your input can be found on the MARC website under the Town of Windsor page at <https://marcvr.org/town-of-windsor/> under '**2021-2026 Windsor Local Hazard Mitigation Planning Update Process**'. Contents will be updated biweekly. Feel free to review the Town Plan and the current 2016 Local Hazard Mitigation Plan which can also be found on the webpage.

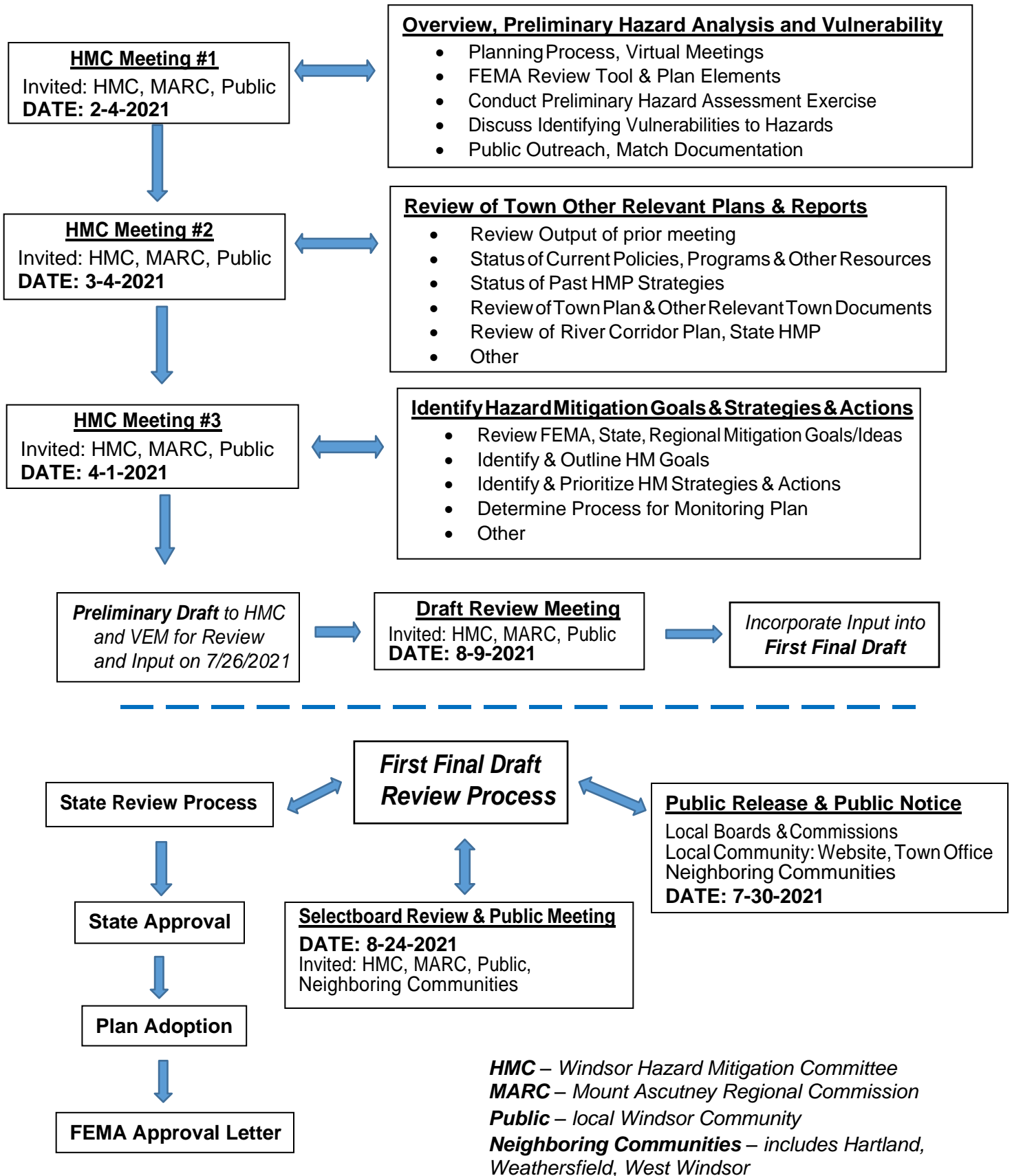
Appendix C

Process Flow Chart

APPENDIX C

Town of Windsor

2021-2026 Hazard Mitigation Plan



Appendix D

Town Plan Review

Windsor Town Plan 2019
Identified Goals and Recommendations Related to Hazard Mitigation
Goals & Recommendations that are addressed in the Windsor LHMP Update

Municipal Services, Utilities and Facilities

Goals & Recommendations:

- Preserve the integrity of public lands that are important to the community through the use of appropriate land use regulations, conservation easements and land purchases.
- Maintain town structures in accordance with sound standards and practices.
- Provide comprehensive emergency public safety services to the communities served.
- Provide consistent, ample amounts of water at sufficient volume and pressure for adequate fire protection.
- Maintain a safe and clean water supply.
- Maintain drainage and dam facilities in accordance with best management practices.
- Support the Paradise Park Commission and efforts to create a Conservation Commission.
- Continue efforts to improve access to the Connecticut River.
- Recruit and train call personnel from within each community served.
- Provide consistent, ample amounts of water at sufficient volume and pressure for adequate fire protection.
- Encourage the installation of sprinkler systems in all new and renovated buildings.
- Encourage the advancement of all personnel to the level of EMT or higher.
- Maintain all apparatus and equipment for maximum safe useful life.
- Maintain an Emergency Management Plan.
- Maintain Hazardous Materials certification.
- Develop a comprehensive Fire Prevention and Public Education Program which includes fire inspections by local department officials, an education program in schools, and public education presentations for local groups and clubs.
- Continue use of the mutual aid system in an effort to manage the cost of fire suppression.
- Seek the funding necessary to address stormwater drainage needs.
- Drainage facilities and structures should be built and maintained in accordance with the town highway and bridge standards as most recently approved by the Selectboard.
- Address the new Municipal Roads General Permit requirements pursuant to Vermont's Clean Water Act

Housing

Goals & Recommendations:

- Apartment buildings are subject to applicable State Building Codes and shall be maintained in safe condition.

- Provide educational workshops to the community on building code and legal requirements, and enforcement and implementation methods.
- Coordinate building code enforcement efforts with the Vermont Division of Fire Safety.
- Develop and enforce local building standards.
- Provide educational workshops to the community on building code and legal requirements, and enforcement and implementation methods.
- Coordinate building code enforcement efforts with the Vermont Division of Fire Safety.

Transportation

Goals & Recommendations:

- Culvert replacement programs should continue to strategically replace structures in poor condition and make upgrades as needed to meet the current standards.
- The Town should conduct a condition assessment of culverts, bridges, roads and sidewalks at least every three years.
- Implement a strategic maintenance program of roads, culverts, bridges and sidewalks through the Capital Budget and Program.
- When replacing bridges and culverts, upgrade structures in accordance with the town highway standards, including conducting hydraulic studies on all roadway structures to be replaced in order to determine the adequate replacement size and promote flood resiliency/climate adaptation.

Land Use

Goals & Recommendations:

- Review and revise the zoning, subdivision and flood hazard bylaws to ensure conformance with the Town Plan. Explore ways to streamline the local permitting process for desirable projects that are consistent with the future land use categories and map.
- Promote the development of a Connecticut River Corridor Greenway through Windsor.

Natural, Scenic and Cultural Resources

Goals & Recommendations:

- All storm water runoff should be managed by best management practices or diverted away from wells and Wellhead Protection Areas.
- Maintain adequate vegetated buffers along surface waters.
- Development on large lots in rural areas shall be designed to focus development activities along existing roadways and on portions of land that have the least constraints (i.e. minimize disturbance of water courses, wetlands, steep slopes and other constraints).

- Paths providing access to shores should not run straight down to the shore so that they provide a conduit for runoff. They should follow best management practices in order to reduce runoff and minimize erosion.
- Adopt and implement the Connecticut River Corridor Management Plan as proposed by the Connecticut River Joint Commissions.
- Development on steep slopes must take special precautions to avoid undue environmental impacts, such as erosion and stormwater.
- Develop an adaptive reuse provision in the zoning regulations to allow and guide continued use of buildings that pre-date zoning regulations and are out of compliance with current zoning standards.
- The Town is developing a community flood study to better understand the development limitations and educate property owners.

Flood Resiliency

Goals:

- Increase disaster preparedness of critical town services to enhance public safety, avoid economic destruction, and reduce human suffering from flood losses'
- Prevent flood damage through land use policies and regulations that control development in flood hazard areas and recognize the natural flood storage capabilities of wetlands.
- Prevent flood damage through proper ongoing maintenance of dams, dikes, berms or other flood control structures.

Policies:

- When property is subdivided in flood prone areas, require subdivision plats to clearly show elevations and borders of flood prone areas.
- Development within FEMA floodway and floodplain areas are subject to the flood hazard provisions within Windsor's zoning bylaws.
- The lands along the Connecticut River that are within the Conservation future land use category are intended to only allow land uses that preserve floodplain areas for conveyance and storage of floodwaters, such as farming or outdoor recreation.
- Regulate new development outside the floodplain to minimize adverse effects of increased stormwater runoff on the floodplain.
- Maintain the capacities of drainage channels and detention facilities and avoid substantial reductions in flood storage through wetland destruction.

Recommendations:

- Advise residents about flood hazard, flood insurance, and flood protection measures.
- Assist property owners with proactive management of buildings in the floodway.
- Ensure that potential purchasers of flood prone property are aware of the hazard.

- Maintain a library of references on flood insurance sources and flood protection in the Municipal Building.
- Provide flood warning to the public and develop a response plan.
- Investigate the possibility of earning an improved CRS classification for the Town in order to decrease the adverse effects of flooding on the community and reduce flood insurance rates.
- Work with partners to evaluate erosion hazards along the Mill Brook.
- Update this section and/or the local Hazard Mitigation Plan to analyze and mitigate these erosion hazards in order to improve community resilience to flooding and erosion damages.

Appendix E

Future Mitigation Ideas

MITIGATION ACTION OR STRATEGY FOR FUTURE CONSIDERATION	TYPE ¹	HAZARD ADDRESSED	POTENTIAL RESPONSIBLE PARTY ²	POTENTIAL FUNDING SOURCE ³
Determine the benefits of training on floodplain management and flood regulation Manager	P	Flood, Erosion	Zoning Administrator	TOB
Conduct an assessment of the condition of Prison Pond Dam and seek funding for conceptual engineering plans for selected solution to address hazard risk of breach.	M	Flood, Erosion, Dam Failure	Town Administration, Selectboard, MARC	TCB ANR (ERPG, DIBG) FMA
Evaluate the feasibility of addressing occasional mud slides on Rt. 5 North of Birch Heights to mitigate potential road damage and slope failure.	M	Flood, Erosion	Town Administration, Highway Department, Selectboard, MARC	TCB ANR (ERPG, DIBG) HMA
Work with MARC to review <i>Hazard Mitigation Ideas – Region 1</i> to identify opportunities to enhance public outreach and awareness of all hazards and, particularly new hazards identified for the first time in this plan (extreme heat, ice and drought).	M, P	All	HMC, FD/EMD MARC	TOB HMA
Develop a formal EMS notification procedure to alert community to extreme heat, drought and ice when these events are forecasted and include information on how to minimize exposure risk.	P	Drought, Extreme Heat, Ice	Town Administration HMC, FD/EMD	TOB HMA
Review/enhance pandemic Standard Operating Guidance (PPE, establish supply/inventory, equipment maintenance, and response) from lessons learned to improve preparedness and inventory.	P	Infectious Disease Outbreak	FD/EMD Town Administration Selectboard	TOB VEM PACIF ARPA
Seek funding to conduct an engineering study to evaluate Lake Runnemede North Dike/Levee	M	Flood, Dam Failure	Town Administration, FD/EMD Selectboard MARC	TCB ANR (ERPG, DIBG) HMA ACCD
Address remaining Brook Rd.-River conflict and conserve areas to floodplain and channel storage for sediment	M	Flood, Erosion	Town Administration, Selectboard, Conservation Commission	TCB MRGIA, BRGP Conservation Programs HMA
Mill Brook River Corridor project W12-Floodplain Conservation along the ‘Narrows’. Explore the possibility of a conservation easement along this section of the Mill Brook for long-term protection of the floodplain.	M	Flood, Erosion	Town Administration, Zoning Administrator, Planning Commission	TCB HMA Conservation Program
Seek funding to evaluate the condition and possible upgrade of the Johnson Rd. bridge at the intersection with County Rd. to improve resiliency to flooding.	M	Flood, Erosion	Town Administration, Highway Dept, Selectboard,	THSGP TAP

			MARC	
Work with MARC to develop and conduct a public survey to obtain input from the community on their experiences and concerns on local hazards prior to the next plan update.	M	All	Town Administration, FD/EMD, MARC	TOB HMA EMPG Other
Update inventory of bighted or hazardous structures within or near flood prone areas or river corridors and identify potential options or a phased plan to address those at highest risk of flood.	M	Flood	Town Administration, Zoning Administrator, MARC	TOB
Prepare a phased implementation plan for the Windsor's Riverfront Plan - Connecting the Right Side of the Tracks. Include flood risk awareness on a community and residential level and the demonstration of residential flood proofing techniques as suggested in the plan.	M	Flood, Erosion	Town Administration, Zoning Administrator , Planning Commission	TOB, TCB HMA FMA
Increase awareness of Flood/Erosion Hazard for at-risk Communities Phase I: Work with MARC to update/redesign 2014 Windsor Community Flood Study Phase II: Develop a plan/program to proactively distribute study and other resources to communities/property owners at risk in SFHA and river corridors Phase III: Implement Plan and record and evaluate feedback	M	Flood, Erosion	Town Administration, Zoning Administrator , MARC	TOB, TCB HMA FMA
Suggest and discuss with MARC a more regional approach to outreach (including outreach for some of the actions identified here) with centralized information for some hazards. Highlight and provide link to FEMA and State resources in Town newsletter and website, or through MARC on a seasonal basis.	M	Various	Town Administration, FD/EMD, MARC	TOB
Consider requiring a drainage plan with new development , particularly with driveways which could exacerbate road erosion if not properly designed to avoid excessive runoff to town roads.	M	Erosion	Town Administration, Zoning Administrator Highway Dept, MARC	TOB
Implement Windsor 2016 Stormwater Master Plan . Phase I: Evaluate cost/benefit of the five action items. Phase II: Seek funding and implement, if feasible.	M	Erosion, Flood, Drought	Town Administration , Zoning Administrator MARC	TOB, TCB ANR (DIBG, ERP) HMA VTrans (various)

¹ M – Mitigation, P – Preparedness

² Responsible Party is shown in **Bold** and others listed are support entities

HMC – Hazard Mitigation Committee

FD/EMD - Fire Dept./Emergency Management Dept.

MARC- Mount Ascutney Regional Commission

Appendix F

Plan Monitoring Forms

Windsor 2021-2026 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
Assess County Road drainage issues and seek funding to implement needed stormwater or other practices to reduce erosion.					
Participate in The National Fire Protection Association (NFPA) Community Risk Reduction Resources for improved ISO rating.					
Address Freezing Water Pipes Phase I: Assess issue with freezing water pipes (Day Street) and evaluate permanent solutions. Phase II: Seek funding for conceptual engineering design					
Address risk to infrastructure and public and private property from Emerald Ash Borer Phase I: Form a project committee and conduct inventory assessment of ash trees in the municipal ROW for emerald ash borer and provide public outreach to community on emerald ash borer information and mitigation.					

Phase II: Determine risk to Town infrastructure and develop a plan to address these risks.					
Work with Green Mountain Power to prioritize tree maintenance on County Road to minimize power loss to Ascutney Hospital					
Increase NFIP Participation Phase I: Develop a plan to increase NFIP participation of residents within high flood risk areas. Phase II: Implement plan and evaluate results or feedback.					
Work with MARC to determine feasibility and benefit of having MARC assist with annual monitoring of plan					
Continue progress to upgrade all technical level emergency responders to EMT or higher level to provide more capacity for emergency response. Maintain ER equipment and upgrade to better address climate and hazard trends.					
Seek funding to conduct an engineering study to evaluate Lake Runnemede North Dike/Levee					
Evaluate the feasibility of the remaining proposed solutions from the 2017 Road Erosion Inventory Report to improve flood resiliency of Weeden Hill Rd. (bank stabilization (Site E), Culvert outlet stabilization (Site F), and drainage improvements (Site G) and develop timeline to seek funding for implementation.					
Focus efforts for MRGP compliance on the gravel road segments at the highest risk for erosion assessed as very high priority (Chellis, Hunt, Marton, Weeden Hill)					
Mill Brook River Corridor project W11-Windsor High School Sewer Line. Seek funding to conduct an alternatives analysis to assess options to re-route the sewer line or replace the					

existing structure to improve flood capacity and reduce the risk of debris jamming. Damage to the sewer line in a future storm event would interrupt sewer service to the High School.					
Work with Wilder Dam owner, Great River Hydro, LLC to learn how to access and use their new online interactive emergency management system to enhance current emergency response and evacuation plans.					
Work with the Windsor Historical Society to compile and prioritize a list of historic sites at risk of flood and fire hazard and potential mitigation options					
Address deteriorating brownfield sites near downtown area including the burnt structure on 11 River and the former dry cleaners on 7 Maple which are in or near SFHA or River Corridors.					
Work with MARC to develop a digital Library of Resiliency Resources to better organize information on local hazards to include a glossary of HM terms and a description of each document rather than just links. Include FEMA and other mitigation guide materials, flood mapping and NFIP information.					
Recommend a more watershed-based approach to address flood risk along the Mill Brook. Work with MARC and other watershed towns up stream of Windsor on projects to reduce flooding and fluvial erosion.					
Work with GMP on enhancing tree maintenance to better assess and mitigate the potential impact of heavy snow, ice and wind to protect vulnerable utility infrastructure.					
Update and provide public access to a plan to address evacuation and sheltering for flood events and shelters for extreme cold and extreme heat.					
Make continued progress on Municipal Roads General Permit (MRGP) standards for implementing best management practices on hydrologically-					

connected road segments and participate each year in the Grants-In-Aid Program for funding.					
Prepare and maintain, a 3-year road plan to address high priority town roadways that are susceptible to erosion that can be addressed with GIA, BR and other state funding programs.					
<p>Mitigate ongoing soil erosion in Paradise Park to improve the management of stormwater flowing into the park which has begun to undermine the recreational trails creating an erosion hazard that is exacerbated during heavy rain.</p> <p><u>Phase I:</u> Determine best solution, finalize conceptual engineering design.</p> <p><u>Phase II:</u> Determine funding sources to implement project .</p>					
Continue to promote Windsor Emergency Response program resources on a periodic basis to be determined, for public awareness, particularly for new residents and businesses.					
<p>Consider participation in FEMA's Community Rating System (CRS)- a voluntary incentive program that recognizes and encourages community floodplain management practices.</p> <p>Phase I: Evaluate the benefits (financial and other) of the FEMA CRS program to the community.</p> <p>Phase II: Determine the feasibility and personnel resources for participation.</p>					
Update bridge and culvert inventories and maintain a priority list for upgrades and repairs to reduce risk of damage and infrastructure failure from flooding and erosion					
Maintain and enhance seasonal fire safety awareness program and periodic outreach for schools, residents, landowners, rental properties and town recreational areas.					

Conduct annual review of Hazard Mitigation Plan progress as noted in Section 6.3 prior to capital budgeting process and recommend incorporating projects selected from this plan, if feasible and funding is available.					
Work with MARC to encourage hazard mitigation awareness and incorporate mitigation/preparedness actions into other town planning efforts providing specific examples and language to be discussed and considered.					
Encourage, where feasible, turnoffs and water retention or infiltration practices when addressing road drainage issues.					
Work with MARC to provide a concise and comprehensive list of available funding sources to include a description/examples of eligible project types and application schedules to better coordinate efforts in implementing mitigation projects.					

Note changes or improvements in effectiveness of Community Capabilities and Resources in Table 3:

Note changes in Goals or Objectives:

Windsor 2021-2026 Local Hazard Mitigation Plan
Local Hazard Occurrences
(WORD doc available)

Hazard/Event	Date	Extent (inches snow/rain, MPH winds, degrees or descriptive	Impact (area Impacted, roadway, infrastructure, buildings, property, \$ in damage, can be descriptive)
Flood/Flash Flood			
Fluvial Erosion			
Landslide/Slope Failure			
High Winds/Microbursts/Hurricane			
Extreme Cold/Heat			
Drought			
Structure Fire			
Wildland Fire			
Severe Winter Weather			
Ice Jams/flooding			
Drought			
Infectious Disease			
Invasive Species			
Dam Failure			