

CERTIFICATE OF LOCAL ADOPTION

Town of Waterford, Vermont

A Resolution Adopting the Update to the All-Hazards Mitigation Plan Update

WHEREAS, the Town of Waterford has worked with its residents and stakeholders to identify its hazards and vulnerabilities, analyze past and potential future losses due to natural and human-caused hazards, and identify strategies for mitigating future losses; and

WHEREAS, the Town of Waterford All-Hazards Mitigation Plan contains recommendations, potential actions and future projects to mitigate damage from disasters in the Town of Waterford; and

WHEREAS, the Town of Waterford and the respective officials will pursue implementation of the strategy and follow the maintenance process described in this plan to assure that the plan stays up to date and compliant; and...

WHEREAS, a meeting was held by the Town of Waterford to formally approve and adopt the Multijurisdictional All Hazards Mitigation Plan.

NOW, THEREFORE BE IT RESOLVED that the Town of Waterford adopts this Hazard Mitigation Plan Update.

Date

Geo Pallin

Selectman

Selectman

Marcia Martel

Selectman

Rosita A. By

Selectman

Musa L Hayes

Debra Benoit

Attested to by Town Clerk

LOCAL MITIGATION PLAN REVIEW TOOL

Town of Waterford, VT

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Town of Waterford, VT	Title of Plan: Town of Waterford All-Hazards Mitigation Plan	Date of Plan: 4/4/2016
Single or Multi-jurisdiction Plan? SINGLE		New Plan or Plan Update? UPDATE
Regional Point of Contact: n/a		Local Point of Contact: Fed Saar, Selectboard Chair fasaar@outlook.com <i>Gary</i>

State Reviewer: Caroline Massa	Title: State Hazard Mitigation Planner	Date: 3/30/2022; 4/27/22
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FEMA Reviewer:	Title:	Date:
Date Received in FEMA Region I		
Plan Not Approved	3/31/2022	
Plan Approvable Pending Adoption	4/28/2022	
Plan Approved		

**SECTION 1:
REGULATION CHECKLIST**

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT A. PLANNING PROCESS				
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 1.7, p. 5-7	X		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 1.7, p. 5-7	X		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 1.7, p. 6	X		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 1.7, p. 5-7	X		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 5.5.1, p. 61	X		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Sections 5.5.2-5.5.5, p. 66-67	X		
ELEMENT A: REQUIRED REVISIONS				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section 2, pp 12-13, 16, & 21; Section 3, pp 30-31, & 35	X		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Sections 2, pp 9-10; Section 3, p 36	X		

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section 2, p. 12, 14, 17-18; Section 4, pp 41-44	X		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section 3.1.2, p 31; Section 4.4.1, p. 44, 45; page 4	X		
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 5, pp 51-52	X		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	p. 42-43, 45, 49-50	X		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	p. ii, Section 1.5, pp 2-3, Section 5.3, p 53	X		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section 5, pp 58-65	X		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section 5.4.2, p. 56-57	X		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 1.7, p. 5	X		
ELEMENT C: REQUIRED REVISIONS				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	p. 3-4, 42-46	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))		X		

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Sect. 2, p 8 Sect. 5.4.1, pp 54- 55	X		
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	p. ii (second page of document) – an unsigned copy of the adoption resolution has been provided	Templ X		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	This is a single jurisdiction plan.	n/a		
<u>ELEMENT E: REQUIRED REVISIONS</u>				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1.				
F2.				
<u>ELEMENT F: REQUIRED REVISIONS</u>				

**SECTION 2:
PLAN ASSESSMENT**

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Strengths:

- A1: The Hazard Mitigation Planning Team has great representation of the community in number of participants and groups/sectors represented.

Opportunities for Improvement:

- A3: There needs to be a greater focus on engaging the public in the next plan update. A survey and public meetings are great, but consider how to make providing feedback easier for busy people. Don't assume that people know what it means to be impacted by a natural disaster. Explain what a natural disaster is, and why providing information will be helpful to the planning process. For example, providing locations for flooding, power outages, high wind, ice on the roads, etc. Give them the opportunity to say what it is that would help them in hazardous conditions, and what they are most worried about it being prepared for. Additionally, provide a version of the survey online to take the work out of it for the people taking the survey, there are free platforms to use such as survey monkey.

Element B: Hazard Identification and Risk Assessment

Strengths:

- B1/B2/B3: The risk assessment provides focused details into the vulnerability of Waterford.

Opportunities for Improvement:

- B2: There is a nice introduction to climate change at the beginning of the plan, and climate change is again mentioned regarding the plan goals. The plan can continue to improve by integrating climate change throughout the plan, including projected changes to probability of hazards, and community impacts anticipated due to a change in average temperatures.
- B2: The probability of ice events should be specifically identified and not grouped with snow and winter storms together.

Element C: Mitigation Strategy

Strengths:

- C1: Section 5, including goals and table 5-1 work nicely together to show how the community can improve, as well as the specific existing capabilities that will enable those improvements.
- C3: The mitigation goals are in-depth and specific, making it clear what the purpose of the planning process is.
- C4: Prioritized mitigation actions are detailed and focused on mitigating the vulnerabilities identified in the plan. Great job.

- C5: It is great to see the mitigation action prioritization table integrated so well into the plan, this helps with transparency and could reveal how priorities change over time.

Opportunities for Improvement:

- C4: Tasks identified within each action could be actions in themselves. They will take financial and human resources to complete, and being specific about who will lead those projects, what partners there are, funding sources, and timeline may help in ensuring their implementation.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Strengths:

- D1: The plan does a great job of painting a picture of development (or lack thereof) for the community. Data included helps identify what community needs are.

Opportunities for Improvement:

- D2: When reviewing the status of the mitigation actions from the previous plan, it should be clear which actions that are still incomplete are integrated into the new plan. Provide a reason why they are no longer included if they have been removed. It will help to document what challenges the community faced in implementation, such as gaps in resources, or possibly just a change in priorities.
- D3: Related to the change in priorities as stated above, document in the plan how and why priorities have changed for the community – what new hazard experiences have there been since the last update? How have population and needs changed?

B. Resources for Implementing Your Approved Plan

State Sources of Technical Assistance & Funding:

The Vermont State Hazard Mitigation Officer (SHMO) and State Mitigation Planner(s) can provide guidance regarding grants, technical assistance, available publications, and training opportunities. Contact the Vermont **Division of Emergency Management & Homeland Security** (VT DEMHS), the **Department of Environmental Conservation** (DEC), and the **Agency for Natural Resources** (ANR) for further assistance. View agency websites for contact information at <http://demhs.vermont.gov/plans> and <http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection> and <http://anr.vermont.gov/>. Refer to the Vermont State Hazard Mitigation Plan Update (Section 5.6) which identifies a number of potential funding sources for various mitigation activities

http://demhs.vermont.gov/sites/demhs/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP.pdf. Communities are encouraged to work with the State to maximize use of every 406 Hazard Mitigation opportunity when available during federally declared disasters. A better alignment and increasing the effectiveness of 406 and 404 Mitigation funds, greatly benefit the community in the long run.

Federal and Non-Profit Sources of Technical Assistance & Funding:

Federal Grants Resource Center and Grants.gov

Federal agencies may support integrated planning efforts such as rural development, sustainable communities and smart growth, climate change and adaptation, historic preservation, risk analyses, wildfire mitigation, conservation, Federal Highways pilot projects, etc. The Federal Grants Resource Center is located on the website of the national non-profit Reconnecting America, and provides a compilation of key funding sources for projects in your community. Examples are HUD, DOT/FHWA, EPA, and Sustainable Communities grant programs. For more information visit:

<http://reconnectingamerica.org/resource-center/federal-grant-opportunities/> or www.grants.gov.

GrantWatch.com

The website posts current foundation, local, state, and federal grants on one website. When seeking funding opportunities for mitigation, consider a variety of sources for grants, guidance, and partnerships, including academic institutions, non-profits, community organizations, and businesses, in addition to governmental agencies. Examples are The Partnership for Resilient Communities, the Institute for Sustainable Communities, the Rockefeller Foundation *Resilience*, The Nature Conservancy, The Kresge Climate-Resilient Initiative, the Threshold Foundation's *Thriving Resilient Communities* funding, the RAND Corporation, and ICLEI *Local Governments for Sustainability*.

<http://www.grantwatch.com>

FEMA Hazard Mitigation Assistance

FEMA's Hazard Mitigation Assistance provides funding for projects under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). Individuals and businesses are not eligible to apply for HMA funds; however, an eligible applicant or subapplicant may apply on their behalf.

<http://www.fema.gov/hazard-mitigation-assistance>

Recommended FEMA Publications & Websites:

Hazard Mitigation Planning Online Webliography, FEMA Region I

This compilation of government and private online sites is a useful source of information for developing and implementing hazard mitigation programs and plans in New England.

<http://www.fema.gov/about-region-i/about-region-i/hazard-mitigation-planning-webliography>

FEMA Library

FEMA publications can be downloaded for free from its Library website. This repository contains a wealth of information that can be especially useful in public information and outreach programs. Search by keyword to find documents related to a particular topic. Examples include building and construction techniques, the NFIP, integrating historic preservation and cultural resource protection with mitigation, and helpful fact sheets.

<http://www.fema.gov/library>

FEMA RiskMAP

Technical assistance is available through RiskMAP to assist communities in identifying, selecting, and implementing activities to support mitigation planning and risk reduction. Attend any RiskMAP discovery meetings that may be scheduled in the state (or neighboring communities with shared watersheds boundaries) in the future.

<https://www.fema.gov/risk-mapping-assessment-and-planning-risk-map>

FEMA Climate Change Website

Provides resources that address climate change.

<http://www.fema.gov/climate-change>

Other Recommended Publications & Websites:

U.S. Climate Resilience Toolkit

Scientific tools, information, and expertise are provided to help manage climate-related risks and improve resilience to extreme events. This aid assists planning through links to a wide-variety of web-tools covering topics, including coastal flood risk, ecosystem vulnerability, and water resources. Experts can be located in the NOAA, USDA, and Department of Interior.

<https://toolkit.climate.gov>

EPA's Resilience and Adaptation in New England (RAINE) Climate Change Program

A collection of vulnerability, resilience and adaptation reports, plans, and webpages at the state, regional, and community levels. Communities can use the RAINE database to learn from nearby communities about building resiliency and adapting to climate change.

<http://www.epa.gov/raine>

USDA Rural Community Development Grant Programs

USDA operates over fifty financial assistance programs for a variety of rural applications.

<http://www.rd.usda.gov/programs-services>

NOAA Sea Grant

Sea Grant's mission is to provide integrated research, communication, education, extension and legal programs to coastal communities that lead to the responsible use of the nation's ocean, coastal and Great Lakes resources through informed personal, policy and management decisions. Examples of the resources available help communities plan, adapt, and recovery are the *Community Resilience Map of Projects* and the *National Sea Grant Resilience Toolkit*, both located on this website.

<http://seagrant.noaa.gov>

USDA, Natural Resources Conservation Service (NRCS)

Provides conservation technical assistance, financial assistance, and conservation innovation grants.

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/>

The Rockefeller Foundation Resilience

Helping cities, organizations, and communities better prepare for, respond to, and transform from disruption.

<https://www.rockefellerfoundation.org/our-work/topics/resilience/>

*Adopted by the Town of Waterford Select Board on
-----2022*

**Town of Waterford, Vermont
All-Hazards Mitigation Plan
Update**

LAST APPROVED PLAN: 2017

**Physical address:
532 Maple St.
WATERFORD, VT 05848
802-748-2122
FEMA Applicant #: 005-77125-00**

Prepared by:

The Town of Waterford, Vermont

CERTIFICATE OF LOCAL ADOPTION

Town of Waterford, Vermont

A Resolution Adopting the Update to the All-Hazards Mitigation Plan Update

WHEREAS, the Town of Waterford has worked with its residents and stakeholders to identify its hazards and vulnerabilities, analyze past and potential future losses due to natural and human-caused hazards, and identify strategies for mitigating future losses; and

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WHEREAS, a meeting was held by the Town of Waterford to formally approve and adopt the Multijurisdictional All Hazards Mitigation Plan.

NOW, THEREFORE BE IT RESOLVED that the Town of Waterford adopts this Hazard Mitigation Plan Update.

Date

Selectman

Selectman

Selectman

Selectman

Attested to by Town Clerk

Executive Summary

In August of 2021, the Town of Waterford contracted with OPH Consulting Services (OPHC) to update the Town of Waterford's Local All-Hazard Mitigation Plan (LHMP). This update reflects recent changes in the Vermont State Hazard Mitigation Plan and works to identify the updated profiled hazards and associated mitigation actions for the next planning cycle. The results of this work represent the collaborative efforts of the Hazard Mitigation Planning Team and associated residents, towns and agencies that contributed to the development of this plan. As hazard mitigation is a sustained effort to permanently reduce or eliminate long-term risks to people and property from the effects of reasonably predictable hazards, the town has communicated its efforts related to developing this plan to its residents and surrounding municipalities, providing a formal opportunity to provide input and review relevant sections of the plan. Along these lines, the town has documented the planning process so that future updates can follow an efficient pattern in addition to capturing this important component as means of establishing institutional memory. In realization that eligibility to receive federal hazard mitigation grants and optimize state-level reimbursement or "match" dollars during a federally declared disaster is dependent on a federally approved plan, the town remains committed to sustaining its mitigation efforts and by developing this plan, will have a guide for action that will foster enhanced emphasis on mitigation in the years to come. The town realizes the importance of mitigation inherent to its own resilience as well as means to establishing strong partnerships with regional support agencies and associations, state government and FEMA. The pandemic-related events of 2020 have resulted in new considerations in the financial, health and safety arenas and the town feels it must formally engage in pandemic planning to mitigate risk. As the town moves towards formally adopting this All-Hazards Mitigation Plan update, the purpose of this plan is to:

- Identify specific hazards that impact the town
- Prioritize hazards for mitigation planning
- Recommend town-level goals and strategies to reduce losses from those hazards
- Establish a coordinated process to implement goals and their associated strategies by taking advantage of available resources and creating achievable action steps

This plan is organized into 5 Sections:

Section 1: Introduction and Purpose explains the purpose, benefits, implications and goals of this plan. This section also describes demographics and characteristics specific to Waterford and describes the planning process used to develop this plan.

Section 2: Hazard Identification expands on the hazards identified by the Town of Waterford and from a historical perspective with specific municipal-level details on selected hazards.

Section 3: Risk Assessment discusses identified hazard areas in the town and reviews previous federally declared disasters as a means to identify what risks are likely in the future. This section presents a hazard risk assessment for the municipality, identifying the most significant and most likely hazards which merit mitigation activity. The most significant identified hazards for Waterford are broken down in the grid below:

Severe winter/ice storm	High Winds	Flooding/fluvial erosion/dam breach/inundation
Extreme Cold	Pandemic	

Section 4: Vulnerability Assessment discusses buildings, critical facilities and infrastructure in designated hazard areas and estimates potential losses.

Section 5: Mitigation Strategies begins with an overview of goals and policies in the most recent Waterford Town Plan that support hazard mitigation and utilizes the town’s 2015 Road Erosion Site Inventory and 2013 Zoning Bylaws to formulate and support actions that address the identified hazards. An analysis of existing municipal actions that support hazard mitigation, such as planning, and emergency services is also included. The town’s all-hazards mitigation goals are summarized below:

- 1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- 2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
- 3) Maintain and increase awareness amongst the town’s residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
- 4) Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- 5) Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- 6) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission, Selectboard and NVDA and integrate the strategies into the existing town plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- 7) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Planning Commission will review the updated LHMP and use language/actions from it to inform the integration and future update processes. Town Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budget.

Section 5 identifies and provides a detailed discussion of the following Mitigation Actions:

Action #1: Reduce flood and flood-related risk through policy and infrastructure enhancement.

Action #2: Improve resilience to severe winter storms

Action #3: Reduce impact of extreme cold durations

Action #4: Reduce risk and impact of a pandemic

Action #5: Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risk

Action #6: Reduce vulnerability to high wind events.

In conclusion, Section 5 provides an Implementation Matrix to aid the municipality in implementing the outlined mitigation actions with an annual evaluation process to be coordinated and administered by the Waterford Planning Commission and Selectboard

Table of Contents

Executive Summary	i
SECTION 1: INTRODUCTION AND PURPOSE	1
1.1 Purpose and Scope of this Plan.....	1
1.2 Hazard Mitigation	1
1.3 Hazard Mitigation Planning Required by the Disaster Mitigation Act of 2000	1
1.4 Benefits	2
1.5 All-Hazards Mitigation Plan Goals.....	2
1.6 Town of Waterford: Population and Housing Characteristics	3
1.6.3. <i>Income and Employment</i>	5
1.6.4. <i>Hospitals and medical centers near Waterford</i>	5
1.7 Summary of Planning Process	5
SECTION 2: HAZARD IDENTIFICATION.....	8
2.1 Profiled Hazards:.....	9
<i>Table 2-1: Summary of Vermont Emergency Declarations</i>	9
2.1.2 <i>Profiled Hazards</i>	11
<i>High Winds</i>	11
<i>Table 2-4: Saffir–Simpson hurricane wind scale</i>	12
<i>Severe Winter Storm</i>	12
<i>Table 2-5: NOAA’s Regional Snowfall Index (RSI)</i>	14
<i>Table 2-6: Waterford Snowfall vs. US Average</i>	14
<i>Extreme Cold</i>	15
<i>Flooding</i>	17
<i>Table 2-8: 24-Hour Rainfall Depths (inches) for Common Recurrence Intervals (ANR, 2002)</i>	19
<i>Table: 2-9: Caledonia County Rainfall-Intensity Range (in. /hr.)</i>	19
<i>Ice Jams</i>	21
<i>High Hazard Dams</i>	21
<i>Inundation and Floodplains</i>	23
<i>Fluvial Erosion</i>	24
SECTION 3: RISK ASSESSMENT.....	27
3.1 Designated Hazard Areas.....	27

3.1.1 Flood Hazard Areas	27
3.1.2. Fluvial Erosion Hazard Areas	28
3.2 Non-designated Hazard Areas	28
3.2.1. 1998 Ice Storm Damage.....	28
3.2.2. High Winds and Lightning	28
3.3 Previous FEMA-Declared and Non-declared Natural Disasters	29
Table 3-1: Town of Waterford, FEMA-declared disaster Summary, 2004-2021	29
Table 3-2: Town of Waterford, FEMA-declared disasters and snow emergencies, 2004-2021	29
3.4 Future Events	31
3.4.1. Natural Hazards	31
Table 3-3: Natural hazards risk estimation matrix.....	33
3.5 Hazard Summary.....	34
SECTION 4: VULNERABILITY ASSESSMENT.....	34
4.1 Vulnerability Narrative by Profiled Hazard	34
4.2 Infrastructure.....	36
4.2.1. Town Highways.....	36
Table 4-2: Town highway mileage by class, Town of Waterford	36
4.2.2. Bridges, Culverts, and Dams	36
Bridges:	36
Culverts:.....	37
Dams:	38
4.3 Estimating Potential Losses in Designated Hazard Areas	39
SECTION 5: MITIGATION STRATEGY.....	41
5. Land Use and Development Trends Related to Mitigation	41
5.0.3. Roads.....	42
5.1 Waterford Town Goals and Policies that support Hazard Mitigation.....	43
5.1.1. Flood Resilience Goals:	43
5.1.2. Capital Improvement Goals	43
5.1.3. Public Participation Goals	44
5.1.4. Regulatory Devices Goals.....	44
5.1.5. Land Use	44
5.1.6. Policies.....	46
5.1.7. Transportation	46

5.1.8. Utilities and Facilities Goals	46
5.2 Existing Town of Waterford Actions that Support Hazard Mitigation.....	47
Table 5-1: Existing municipal actions that support hazard mitigation	48
5.3 Town of Waterford All-Hazards Mitigation Goals.....	49
5.4 Mitigation Actions	50
5.4.1. Current Capabilities and Need for Mitigation Actions	50
5.4.2 Specific Mitigation Actions	52
5.4.2. Prioritization of Mitigation Strategies	53
5.5 Implementation and Monitoring of Mitigation Strategies	61
5.5.1. Public Involvement Following Plan Approval.....	61
5.5.2. Project Lead and Monitoring Process	61
5.5.4. Plan Update Process.....	62
5.5.5. Implementation Matrix for Annual Review of Progress	63
Table 5-3: Waterford All-Hazards Mitigation Plan Implementation Matrix	64
APPENDICES	71
Appendix B: Community Survey.....	71
Appendix A: River Corridor Map: Town of Waterford.....	72
Appendix B: Community Survey:	73

SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

The purpose of this Local All-Hazards Mitigation Plan update is to assist the municipality in continuing to identify all hazards facing their community and in identifying strategies to continue to reduce the impacts of those hazards. The plan also serves to better integrate and consolidate efforts of this municipality with those outlined in the most recent and future Town Plans as well as those of NVDA, relevant state agencies, including the Vermont State Hazard Mitigation Plan. The town is aware that community planning can aid significantly in reducing the impact of expected, but unpredictable natural and human-caused events. This document constitutes an All-Hazards Mitigation Plan for the Town of Waterford with a goal to provide hazard mitigation strategies to aid in increasing the overall resilience of the Town, Caledonia County and the state as a whole.

1.2 Hazard Mitigation

The 2018 Vermont State All-Hazards Mitigation Plan (SHMP) states:

“The impact of anticipated yet unpredictable natural events can be reduced through community planning and implementation of cost effective, preventive mitigation efforts. The State of Vermont understands that it is not only less costly to reduce vulnerability to disasters than to repeatedly repair damage, but that we can also take proactive steps to protect our economy, environment and most vulnerable citizens from inevitable natural hazard events. This Plan recognizes that communities have the opportunity to identify mitigation strategies during all phases of emergency management (preparedness, mitigation, response, and recovery) to more comprehensively address their vulnerability. Though hazards themselves cannot be eliminated, Vermonters can reduce our vulnerability to hazards by improving our understanding of both the natural hazards we face and their potential impacts. The 2018 Vermont State Hazard Mitigation Plan (SHMP) presents the hazard impacts most likely to affect Vermont and a mitigation strategy to reduce or eliminate our most significant vulnerabilities.”

Hazard mitigation strategies and measures can reduce or eliminate the frequency of a specific hazard, lessen the impact of a hazard, modify standards and structures to adapt to a hazard, or limit development in identified hazardous areas. This plan aligns and/or benefits from the State’s 2018 Hazard Mitigation Plan and as part of the Emergency Relief Assistance Funding (ERAF) requirements. With enhanced emphasis on community resiliency, many state agencies and local organizations have an increased awareness of the importance of mitigation planning and have produced plans and resources that towns can use to support their planning efforts. This plan will reference, when relevant, pertinent tools and resources that can be used to enhance mitigation strategies.

1.3 Hazard Mitigation Planning Required by the Disaster Mitigation Act of 2000

Hazard mitigation planning is the process that analyzes a community’s risk from natural hazards, coordinates available resources, and implements actions to reduce risks. According to 44 CFR Part 201, Hazard Mitigation Planning, this planning process establishes criteria for State and

local hazard mitigation planning authorized by Section 322 of the Stafford Act as amended by Section 104 of the *Disaster Mitigation Act of 2000*. Effective November 1, 2003, local governments now must have an approved local mitigation plan prior to the approval of a local mitigation project funded through federal Pre-Disaster Mitigation funds. Furthermore, the State of Vermont is required to adopt a State Pre-Disaster Mitigation Plan in order for Pre-Disaster Mitigation funds or grants to be released for either a state or local mitigation project after November 1, 2004.

There are several implications if the plan is not adopted:

- After November 1, 2004, Flood Mitigation Assistance Grant Program (FMAAGP) funds will be available only to communities that have adopted a LHMP
- For disasters declared after November 1, 2004, a community without a plan is not eligible for HMGP project grants but may apply for planning grants under the 7% of HMGP available for planning
- For the Pre-Disaster Mitigation (PDM) program, a community may apply for PDM funding but must have an approved plan in order to receive a PDM project grant
- For disasters declared after October 14th, 2014, a community without a plan will be required to meet a greater state match when public assistance is awarded under the ERAF requirements (Emergency Relief Assistance Funding)

1.4 Benefits

Adoption and maintenance of this LHMP will:

- Make certain funding sources available to complete the identified mitigation initiatives that would not otherwise be available if the plan was not in place
- Ease the receipt of post-disaster state and federal funding because the list of mitigation initiatives is already identified and action can be taken prior to the next event
- Support effective pre and post-disaster decision making efforts
- Lessen each local government's vulnerability to disasters by focusing limited financial resources to specifically identified initiatives whose importance have been ranked
- Connect hazard mitigation planning to community planning where possible

1.5 All-Hazards Mitigation Plan Goals

This All-Hazards Mitigation Plan establishes the following general goals for the town as a whole and its residents:

This All-Hazards Mitigation Plan establishes the following general goals for the town as a whole and its residents:

- Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.

- Maintain and increase awareness amongst the town’s residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
- Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- Maintain mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the multi-jurisdictional municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission, Selectboard and NVDA and integrate the strategies into the existing town plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- Maintain mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Planning Commission will review the plan and use language/actions from it to inform the integration and update process. Town Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budgets.

1.6 Town of Waterford: Population and Housing Characteristics

Chartered: November 8th, 1780
 Coordinates: 44 22’N 71 57’W
 Altitude ASL: 1,306’

1.6.1. Population

The Town of Waterford is a small rural community in north-central Vermont. This Caledonia county community is part of an area known as the Northeast Kingdom and covers 39.7 square miles with 1.4 of that as water. The town is located along the Connecticut River between St. Johnsbury, Vermont and Littleton, New Hampshire, both of which are under 10 miles away. There is a population of 1280 residents with a density of about 33 people per square mile. Population figures indicate a 15.9% increase in population in 2010. Since 1980, the population has increased by 398.

Table 1-1: Town of Waterford, selected population characteristics, 2010 Census

Category	Number	%
Total Population	1280	100
Median Age	45.8	--
Population age 60 years and over	311	24.3
Population under 20 years old	328	25.6
Population between 20 and 40	200	15.6

Population between 40 and 60	411	32.1
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1.6.2. Housing and Demographics

Since the last approved plan, there has been no new development in the SFHA according to town records and the Zoning Administrator. The town continues to have no repetitive loss properties. Since 2005, the next amendment to the town’s zoning regulations occurred in 2013 and clear rules on development in the designated hazard areas were presented as follows:

<p>§ 326: Flood Hazard Area Requirements</p> <p>326.01 Lands to which these regulations apply. These regulations shall apply in all areas in the Town of Waterford identified as areas of special flood hazard on the National Flood Insurance Program maps which are hereby adopted by reference and declared to be part of these regulations.</p> <p>326.02 Development permit required. A permit issued by the administrative officer is required for development in areas of special flood hazard. Conditional use approval by the DRB is required for the construction of new buildings, the substantial improvement of existing buildings or floodway development prior to the issuance of a zoning permit by the administrative officer.</p>

With this and the zero development in the SFHA policy that the town plans to adopt in 2016, the town has taken the necessary steps to eliminate increased risk to new development in the SFHA.

The entire population of Waterford is housed, with more than half living in traditional nuclear families. The average family size is 2.84 and the average household size is 2.52. Estimated median household income is above the state average and the median house value is slightly below state average. Since 2010, there have been 13 new homes built averaging about \$170,000. The unemployment rate is significantly below state average as is the number of residents renting. The length of stay since moving is significantly above state average and house age is significantly below state average. The main source of household heating energy is fuel oil (66%), then wood (19%), bottled, tank, or LP gas (12%), electricity (1%), utility gas (1%) and coal (1%). *The following shows the types of housing within Waterford*

Table1-2: Town of Waterford, selected housing unit data, 2010 Census Block Group 2

Category	Number	%
Total Housing Units	580	--
Occupied housing units	505	87
Vacant housing units	75	13
Owner-Occupied	462	79.7
Renter Occupied	43	7.4
Population in Renter-occupied	87	--

Households with individual over 65	145	25
Householders living alone over 65	43	--

1.6.3. Income and Employment

The Waterford unemployment rate is 2.3% compared to the state average of 3.7%. Most common employment sectors are; Construction (9%), agriculture, forestry, fishing and hunting (9%), health care (6%), educational services (5%), electrical equipment, appliances, and components (4%), public administration (4%) and accommodation and food services (4%). The most common occupations are electrical equipment mechanics and repair occupations (7%), farming (6%), non-farming management (6%), grounds and maintenance (5%), auto repair (4%), other (4%). The town has an asphalt manufacturing plant, a concrete fabrication plant, a school, an inn and restaurant, the town office, library and a post office. The majority of the working population within the town work out of town.

1.6.4. Hospitals and medical centers near Waterford

- Northeastern Vermont Regional Hospital: Critical Access Hospital (about 7 miles away; St. Johnsbury, VT)
- St. Johnsbury, VT Health and Rehab (Nursing Home, about 7 miles away; St. Johnsbury, VT)
- FMC OF ST. Johnsbury Dialysis (about 7 miles away; St. Johnsbury, VT)
- Caledonia Home Health Care (about 7 miles away; St. Johnsbury, VT)
- Pines Rehab and Health Center (Nursing Home, about 11 miles away; Lyndonville, VT)
- North Country Home Health and Hospice Agency (Home Health Center, about 11 miles away; Littleton, NH)
- Lafayette Center, Genesis Healthcare (Nursing Home, about 14 miles away; Franconia, NH)

1.7 Summary of Planning Process

In August of 2021, the town contracted with OPH Consulting Services (OPHC) to facilitate the update of the plan. The last approved plan for the town was in 2017. In late August of 2021, the planning team was developed, representing the community s as best as possible. The kick-off meeting was convened on August 30, 2021. The planning team discussed the mitigation-related actions since the last approved plan, the current planning process and pertinent facts related to the town. Additionally, a survey was drafted asking for community input and made available through the town’s standard public notification process with access on the town’s website or in the town office. The survey introduced the importance and informational needs of a LHMP and asked for specific concerns the resident and/or business owner had. The survey and final planning team roster were approved and adopted by the select board in August 2021. All towns bordering Waterford were sent notification of the plan’s development, subsequent draft sections and were given an opportunity to provide input. The input received focused on both flood and

severe winter storm response and planning with additional concern over the ability of the town to respond to major highway accidents. Incorporation and implementation since 2017 was assessed to the greatest extent possible and addressed in all relevant sections of this update. Monthly communication on plan development were included in each Selectboard meeting and an overview of hazards and disaster history was given at both the September Selectboard and Planning Commission meetings, where a discussion to incorporate facets of the updated LHMP into the next town plan and subsequent zoning regulations was had. Following FEMA guidance in Local Mitigation Plan Review Tool Regulation Checklist, the plan was written using data sources that included:

- 2016 Waterford Town Plan and updated language for the next adoption (including the 2016 Zoning Regulations)
- Waterford Winter Operations and Emergency Operations Plans provided current policies and procedures supporting hazard mitigation
- ACCD Mobile Home Resilience Plan: Provides resources for planners and residents with clearly defined recommendations for mitigating risk
- Surveys collecting public comment (issues raised were addressed in the plan and the public meeting)
- 2016 Waterford Zoning Bylaws (provided basis of current development protocol supporting hazard mitigation)
- 2018 Vermont State Hazard Mitigation Plan (provided key guidance language and definitions throughout the plan).
- Vermont Agency of Natural Resources (ANR) and Transportation (VTrans) (Provided key policy recommendations on environmental conservation, high accident locations, climate change and fluvial erosion data).
- Vermont Departments of Health (VDH) and Environmental Conservation (DEC) (provided information related with public health services that could be impacted during a disaster and state support functions designated to both VDH and DEC. DEC also provided river corridor data for mapping purposes.
- FEMA Open Source (data.gov) Data for Disaster History and PA funding (provided comprehensive declared disaster by year and type as well as project descriptions and cost per event).
- FEMA P-956: Living with Dams (provides clear guidance on planning and considerations for municipalities with dams).
- FEMA NFIP “Bureau.Net” database (provided detailed information on repetitive loss properties and associated flood insurance claims).

While many small communities in Vermont face similar circumstances (e.g., flooding, winter storms and remote residents), each one has unique considerations and opportunities. There was a point made to capture the subtle characteristics of the town, its history and its residents. From this, the specific risks, vulnerabilities and mitigation strategies were developed. Based on information obtained and input from town officials, the planning team, state plans, federal data

bases, local associations and NVDA, the updated plan was drafted. The 2021 Hazard Mitigation Planning Team includes:

Jeff Gingue	FIRE CHIEF
Bill Vinton	EMERGENCY COORDINATOR
Lisle Houghton	ROAD FOREMAN
Bill Piper	SELECTMAN
Warner Hodgdon	SELECTMAN
Fred Saar	SELECTMAN
Jessy Pelow	TOWN CLERK
Chris Miller	WATERFORD SCHOOL PRINCIPAL
Alicia Mallaber	CALEX (Ambulance service)
Tim Bradshaw	PIKE INDUSTRIES
Sharron Caplan	SENIOR LIVING CENTER
Lisa Hale	DAY CARE
Bruce Melendy	NVDA - Emergency Mangement Specialist
Gary Allard	Resident

The following summary represents the timeline for the planning process:

- 8/30/21: Planning Team named and introduced to update process. “Kick-off” meeting at warned community meeting with proposal and acceptance of updated hazards. Community survey logistics decided upon. The public was notified; however, no comments were received.
- 10/5/21: Meeting with Town Road Foreman to discuss mitigation projects and progress on 2016 mitigation action items related to infrastructure
- 10/5/21: Planning team was sent draft sections I and II of update. Comments received included enforcement of wetland protection and suggested addition of the school, town offices, and town garage to “notable location” list.
- 12/9/21: Selectboard planning update: Qualitative risk assessment was modified to include pandemic and extreme cold. Outreach to school related to ESSER funding for COVID mitigation and Fire Department. Comments received but no updates to plan required.

- 1/10/22: Selectboard planning update: Vulnerability assessment update in progress and will be sent to planning team for review. No questions or comments received.
- 1/17/22 Planning team review of sections 3 and 4. Team review led to further outreach to Great River Hydro to discuss Dam preparedness and notification processes. Additional minor corrections to road names made as well.
- 1/25/22: Planning team review of Section 5 initiated. Feedback included specific information related to fire department equipment, the maintenance of an informal, functional mutual aid agreement with two adjacent towns, and the continuation of the annual contract with CALEX Rescue for EMS services.
- 2/14/22: Proposed mitigation goals and actions were discussed at warned community meeting. The public was notified and in attendance at this meeting, however, no comments were received.
- 2/15/22: All neighboring towns received notice of availability of draft plan for review and comment via the town clerk. No comments were received.
- 3/8/22: Plan was submitted to VEM for review. As of this date, no survey responses obtained.

SECTION 2: HAZARD IDENTIFICATION

For this update, the planning team considered the continued inclusion or deletion of the 2017 hazards profiled by developing and researching the natural hazard categories outlined in the state mitigation plan and for each, considered prior history, current trends and available data to estimate risk. Some profiled hazards remain a risk for the town. However, other hazards, due to lack of occurrence frequency, risk and/or vulnerability have been removed in this update. The definitions of each hazard, along with historical occurrence and impact, are described below. Of note, the previous planning phase had no natural hazard occurrences that exceeded previous extent data for the town specifically. However, the 2019 “Halloween” flood and wind event was a major one for many communities in the NEK and beyond. But for Waterford, there was a single declared disaster where the town sustained damage and subsequent funding for infrastructure repair (DR4380: Hale Road Project) during the last planning phase.

Types of Natural Hazards: weather /climate hazards (drought, hurricane/tornado, high winds, severe winter storm, extreme temperatures, climate change, lightning, hail), flooding, geological hazards (landslide / erosion, earthquake, naturally occurring radiation), and fire hazards.

2022 Updated Profiled Natural Hazards: Severe Winter Storm/Ice, Flooding/fluvial erosion, Extreme Cold Temperature, Pandemic (listed as “Epidemic” in 2016 plan), High winds

2.1 Profiled Hazards:

There have been 30 major disasters declared since 1998 and 4 Emergencies declared since 1977. Waterford was impacted by a fraction of these declarations. The following discussion on natural hazards is based upon information from several sources. General descriptions are based upon the 2018 Vermont State Hazard Mitigation Plan. Due to rural nature of Northeast Kingdom, there is little historical data available for presentation related to all hazards but when available, relevant data is included.

Table 2-1: Summary of Vermont Emergency Declarations

Number	Year	Type
3437	2020	Pandemic (COVID-19) national 3/13/20
3338	2011	Hurricane Irene
3167	2001	Snowstorm
3053	1977	Drought

Source: FEMA

Table 2-2: Summary of Vermont Major Disaster Declarations since 1998 (Caledonia County in Bold with events that resulted in PA funding for the town with an “(*)—Waterford”)

Number	Year	Type
*4532	2020	COVID-19
4474	2020	Severe Storm and Flooding
4356	2018	Severe Storm and Flooding
*4380	2018	Severe Storm and Flooding
4207	2015	Severe Winter Storm
4178	2014	Severe Storms and Flooding
4232	2015	Severe Storms and Flooding
4163	2014	Severe Winter Storm
4140	2013	Severe Storms and Flooding
4120	2013	Severe Storms and Flooding
4066	2012	Severe Storms, Tornado and Flooding
4043	2011	Severe Storms and Flooding
4022	2011	Tropical Storm Irene
*4001	2011	Severe Storms and Flooding—Waterford
1995	2011	Severe Storms and Flooding
1951	2010	Severe Storm
1816	2009	Severe Winter Storm
1790	2008	Severe Storms and Flooding
1784	2008	Severe Storms, Tornado and Flooding
1778	2008	Severe Storms and Flooding
1715	2007	Severe Storm, Tornado and Flooding
*1698	2007	Severe Storms and Flooding—Waterford
*1559	2004	Severe Storms and Flooding—Waterford
1488	2003	Severe Storms and Flooding
1428	2002	Severe Storms and Flooding

1358	2001	Severe Winter Storm
1336	2000	Severe Storms and Flooding
1307	1999	Tropical Storm Floyd
1228	1999	Severe Storms and Flooding
1201	1998	Ice Storm

Source: FEMA

2.1.1. An Introduction to Climate Change:

“Over the past several decades, there has been a marked increase in the frequency and severity of weather-related disasters, both globally and nationally. Most notably, the Earth has experienced a 1°F rise in temperature, which has far-reaching impacts on weather patterns and ecosystems. This statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer), is known as climate change. The Intergovernmental Panel on Climate Change (IPCC) forecasts a temperature rise of 2.5°F to 10°F over the next century, which will affect different regions in various ways over time. Impacts will also directly relate to the ability of different societal and environmental systems to mitigate or adapt to change⁶. Increasing temperatures are forecasted to have significant impacts on weather-related disasters, which will also increase risk to life, economy and quality of life, critical infrastructure and natural ecosystems. The IPCC notes that the range of published evidence indicates that the costs associated with net damages of climate change are likely to be significant and will increase over time. It is therefore imperative that recognition of a changing climate be incorporated into all planning processes when preparing for and responding to weather-related emergencies and disasters. Most of the natural hazards identified in this plan are likely to be exacerbated by changes in climate, either directly or indirectly. The National Aeronautics & Space Administration (NASA) reports that global climate change has already had observable effects on the environment: glaciers are shrinking, sea ice is disappearing, sea level rise is accelerating, heat waves are occurring more frequently and intensely, river and lake ice is breaking up earlier, plant and animal ranges have shifted, and trees are flowering sooner. Though climate change is expected to have global reach, the impacts differ by region. While the southwestern United States is expected to experience increased heat, wildfire, drought and insect outbreaks, the northeastern region is predicted to experience increases in heat waves, downpours and flooding. Accordingly, consideration of climate change was identified as a key guiding principle of the 2018 SHMP, addressed in each of the pertinent hazard profiles and incorporated into all relevant mitigation actions.” 2018 SHMP

From 1962 to 2006, each five-year period resulted in 0-6 Major Disaster Declarations in Vermont. From 2007-2020, there were 23. It is commonly accepted that weather extremes are becoming more commonplace in Vermont. Since 2011, record setting snow, rain and cold have been experienced in the state. In recent years, it has become evident that human activities, mostly associated with the combustion of fuel, have added to the natural concentration of greenhouse gases in the atmosphere and are contributing to rapid climate change on a global scale. While projections of the effects of climate change vary, it is generally predicted that Vermont will have warmer temperatures year-round, with wetter winters and drier summers. An increase in the size and frequency of storms is also predicted. Thus, climate change in the next century will likely

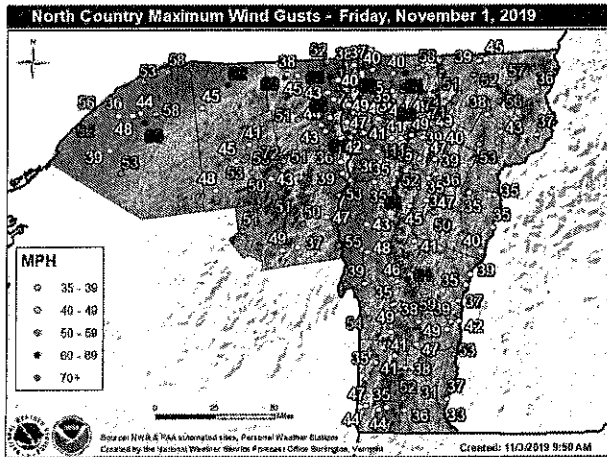
increase the chance of weather-related hazards occurring. An increase in precipitation may also result in increased flooding and fluvial erosion. Drier summers may increase the chance of drought and wildfire. A warmer climate may also result in the influx of diseases and pests that cold winters previously prevented. The severity of climate change is difficult to predict, though the effects may be mitigated somewhat if greenhouse gas emissions are reduced soon. In 2011, Governor Shumlin formed the *Vermont Climate Cabinet*. The Cabinet, chaired by the Secretary of Natural Resources, is a multidisciplinary approach to enhance collaboration between various state Agencies. Its primary objectives include providing the Governor with advisory information and facilitating climate change policy adoption and implementation. In 2013, the Vermont Agency of Natural Resources (ANR) released the Climate Change Adaptation Framework which addresses climate change exposures, vulnerability-specific elements within each of the natural resource sectors, and ongoing and proposed actions that can be or have been taken to prepare for the expected changes. In line and in conjunction with the ANR report, the primary goal of a VTrans climate change adaptation policy is to minimize long-term societal and economic costs stemming from climate change impacts on transportation infrastructure.

2.1.2 Profiled Hazards

High Winds

High wind events do occasionally cause damage for the town, normally measured in downed power lines. The last recorded high wind event as tracked by the National Weather Service was recorded on 17-18 January 2012. An 81-mph wind gust was measured atop Vermont's highest peak Mount Mansfield. During this event, Caledonia County had wind speeds of 30-40 mph. Specific data for Waterford was not available but town officials recall the 2012 event as being the most severe in memory and the town expects high wind events that may reach category 2 speeds but it is unlikely, based on previous events, that a category 3 event will occur in the region. The "Halloween" storm of 2019 (DR4474) proved to be the most damaging flood event for many areas of the County in recent memory. This powerful storm system tracked across the eastern Great Lakes late on October 31st, 2019 and produced an axis of 3 to 5 inches of rain, which caused significant flooding across the region. Record rainfall occurred at Burlington, Vermont with 3.30 inches on October 31st, along with a record high temperature of 71 degrees. In addition, very gusty southwest winds developed behind this potent storm, which generated scattered to widespread power outages. Surface wind gusts measured up to 65 mph across northern New York and parts of Vermont, with gusts over 100 mph at the summits. The core of the strongest winds occurred early morning on November 1st across New York and spread into Vermont during the daytime hours. At the peak, over 120,000 customers were without power across the region. Given how saturated the soils were from the recent heavy rainfall, shallow rooted trees were easily uprooted, exacerbating power outages. A few peak wind gusts included 69 mph at Ellenburg, 65 mph in Potsdam and 62 mph in Malone, New York, while a gust to 71 mph was measured in Johnson, 66 mph at Burton Island and 111 mph at Mount Mansfield in Vermont. Figure 2 below shows a map of observed peak wind gusts across the North County on 1 November 2019. Waterford did sustain some wind damage that was addressed by electric and telephone service providers.

Table 2-3: Maximum Wind Gust Map for 11/1/2020



The following table describes the Saffir–Simpson hurricane wind scale.

Table 2-4: Saffir–Simpson hurricane wind scale

Category	Wind speeds
Five	≥70 m/s, ≥137 knots ≥157 mph, ≥252 km/h
Four	58–70 m/s, 113–136 knots 130–156 mph, 209–251 km/h
Three	50–58 m/s, 96–112 knots 111–129 mph, 178–208 km/h
Two	43–49 m/s, 83–95 knots 96–110 mph, 154–177 km/h
One	33–42 m/s, 64–82 knots 74–95 mph, 119–153 km/h
Related classifications	
Tropical storm	18–32 m/s, 34–63 knots 39–73 mph, 63–118 km/h
Tropical depression	<17 m/s, <33 knots <38 mph, <62 km/h

Severe Winter Storm

Winter storm frequency and distribution varies from year to year depending on the climatological patterns. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are brought down by falling trees and branches. Winter storms impact the entire planning area and can include snowstorm, cold, blizzard and ice. According to the 2018 Vermont State All-Hazards Mitigation Plan:

“Severe winter storms bring the threat of heavy accumulations of snow, cold/wind chills, strong winds, and power outages that result in high rates of damage and even higher rates of expenditures. A heavy accumulation of snow, especially when accompanied by high winds, causes drifting snow and very low visibility. Sidewalks, streets, and highways can become extremely hazardous to pedestrians and motorists. Severe winter storms develop through the combination of multiple meteorological factors. In Vermont and the northeastern United States, these factors include the moisture content of the air, direction of airflow, collision of warm air masses coming up from the Gulf Coast, and cold air moving southward from the Arctic. 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.”

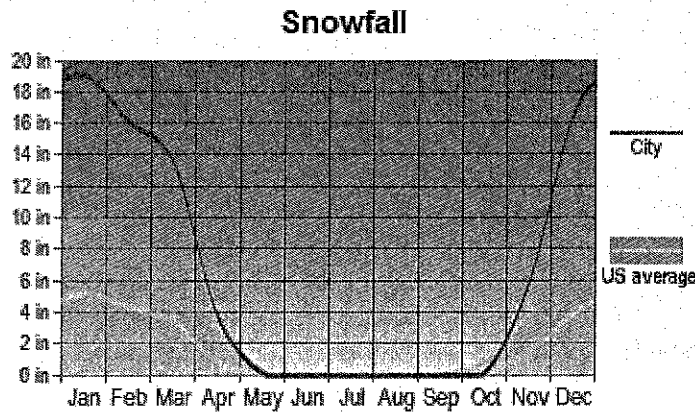
The winters of 1969-72 produced record snowfalls for nearby St. Johnsbury, and greater than normal precipitation was recorded in 8 of the 11 years during 1969-79. The Fairbanks Museum Weather Station receives precipitation measurements from an independent residing in Waterford. According to the available history specific to Waterford, the max 24-hour snowfall occurred February 24-25, 1969 at 34” with an additional 2.12” of rain during the period. The winter of 2010-2011 was the third-snowiest on record with a total of 124.3 inches for the county. The record for the county was 145.4 inches set in 1970-1971. The potential for a major snowstorm that exceeds the capabilities of town exists every year but with the recent increase in snow fall totals and cold temperature duration, the town realizes the further consideration are required. NOAA's National Centers for Environmental Information is now producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. NCEI has analyzed and assigned RSI values to over 500 storms going as far back as 1900. New storms are added operationally. As such, RSI puts the regional impacts of snowstorms into a century-scale historical perspective. The index is useful for the media, emergency managers, the public and others who wish to compare regional impacts between different snowstorms. The RSI and Societal Impacts Section allows one to see the regional RSI values for particular storms as well as the area and population of snowfall for those storms. The area and population are cumulative values above regional specific thresholds. For example, the thresholds for the Southeast are 2”, 5”, 10”, and 15” of snowfall while the thresholds for the Northeast are 4”, 10”, 20”, and 30” of snowfall. 2010, 2012 and 2015 have some of the highest rankings for notable storms. These rankings are based, in part on the severity of the storm using the following system. Since 2000, there has only been one event that reached a category 4 in the Northeast, five reached Category 3, eight were “significant” and all others

were notable. Despite having considerably more snow than the U.S. average, Waterford has had no major PA funding related to damage from snow events.

Table 2-5: NOAA's Regional Snowfall Index (RSI)

CATEGORY	RSI VALUE	DESCRIPTION
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18.0+	Extreme

Table 2-6: Waterford Snowfall vs. US Average



While declared snowstorm disaster have been declared for the county, Waterford has not received PA funding for these events. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are brought down by falling trees and branches.

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. 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 (2018 SHMP).

Ice Storm:

Major Ice Storms occurred in January 1998 and again in December 2013. Waterford received the most significant damage to forest stands in recorded history and power was disrupted for over seven days. The North American Ice Storm of 1998 was produced by a series of surface low pressure systems between January 5 and January 10, 1998. For more than 80 hours, steady freezing rain and drizzle fell over an area of several thousand square miles of the Northeast, causing ice accumulation upwards of 2” in some areas. Waterford received .5 to 1 inch of ice. On December 13th, 2013, another ice storm hit portions of Caledonia County, including Waterford but the extent of this storm is unknown. While there is evidence that supports an increase in weather and precipitation severity, the incidence of ice storms remains fairly spaced out. The town expects to have another ice storm but unlike rain and snow events, the occurrence of a major ice storm is not expected every year. In the records available to the town regarding power outage, the longest duration outage was in May of 2013 at 24.35 hours and affecting 100 customers.

Extreme Cold

Recent extremes in cold temperatures is a concern. 2015 tied the coldest winter (January to March) on record (1923) for Vermont as a whole according to the NOAA’s National Climatic Data Center whose dataset dates to 1895. Cold temperatures are expected in the Northeast but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. Maintaining a safe living environment for livestock during extreme temperatures, especially cold extremes, is a real concern for Waterford and the rest of the state. Waterford’s winter of 2015 was the coldest anyone could remember with a mean temperature of 7.8 degrees Fahrenheit and a max-low of -26 degrees Fahrenheit in February. However, the January of 1970 had a mean temperature of 6.6 degrees Fahrenheit which is the coldest mean temperature for the county and January is the statistically coldest month in all of Vermont. Since 1900, January produced temperatures in the negative 20’s and 30’s consistently for Caledonia County with record cold temperatures occurring in 1914 (-38). Cold temperatures are expected in the Northeast but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. Maintaining a safe living environment for livestock during extreme temperatures, especially cold extremes, is a real concern for farmers in Waterford and the rest of the state and while the temperatures for the town remain within averages seen in the last 85 years, the town expects dangerously cold temperatures every winter. The impact of extreme cold is summarized in the 2018 State Hazard Mitigation Plan:

“Extreme cold temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure (e.g. burst pipes from ice expansion and power failure). What constitutes “extreme cold” can vary across different areas of the country based on what the population is accustomed to in their respective climates. Exposure to cold temperatures can cause frostbite or hypothermia and even lead to heart attacks during physically demanding outdoor activities like snow shoveling or winter hiking. When temperatures dip below freezing, incidents of icy conditions increase, which can lead to dangerous driving conditions and pedestrian-related slipping hazards. A large area of low pressure and cold air surrounding the poles, known as a polar vortex, is strengthened in the winter. When these polar vortex winds are distorted, due to cyclical strengthening and weakening or interaction with high-amplitude jet stream patterns, they have the potential to split into two or more patterns, allowing arctic air to flow southward along a jet stream¹. As this arctic air is able to access more southerly regions, extreme cold conditions can be observed in Vermont, which also have the potential to remain over the region for extended periods”

Prior to the summer of 2021, the region had not seen the risk of drought conditions in decades but with wells running dry in other areas of the NEK, the town is aware of the potential for this. High temperatures can help to create severe storms as the one evidenced on September 11th, 2013, where record heat helped to produce damaging hail and winds in parts of the NEK and other areas of Vermont and New York. Recent extremes in cold temperatures is a concern and impact the entire planning area and region. 2015 tied the coldest winter (January to March) on record (1923) for Vermont according to the NOAA’s National Climatic Data Center whose dataset dates to 1895. The National Weather Service has the following, recent, temperature records for Newport City:

- Highest: 95 degrees, August 2001
- Lowest: -38 degrees, February 1933

Cold temperatures are expected in the Northeast, but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. The winter of 2015 was the coldest anyone could remember with a mean temperature of 7.8 degrees Fahrenheit. However, the January of 1994 had a mean temperature of 2.7 degrees Fahrenheit which is the coldest mean temperature since 1930 and January is the statistically coldest month in all of Vermont. Since 1930, January produced temperatures in the negative 20’s and 30’s consistently for Orleans County with record cold temperatures occurring in 1957 and 1933 (-38). While the temperatures for the town remain within averages seen in the last 85 years, dangerously cold temperatures are expected every winter. The NOAA Wind Chill Chart identifies those temperatures and associated wind speeds that may cause frostbite if skin is exposed to the air over a certain period of time:

Table 2-7: NOAA Wind Chill Chart

Wind Speed (mph)	Temperature (°F)																	
	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-25	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-36	-42	-49	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-6	-13	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-53	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-18	-25	-32	-39	-46	-53	-61	-68	-76	-83	-91	-98

Frostbite Times
30 minutes
10 minutes
5 minutes

$$\text{Wind Chill (}^\circ\text{F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$
 Where, T = Air Temperature (°F) and V = Wind Speed (mph)

In anticipation of extreme cold temperatures, the National Weather Service may issue the following watches, warnings or advisories, which are aimed at informing the general public as well as the agricultural industry:

- 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

Flooding

There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash flooding and urban flooding. Flooding has also been known to occur because of ice jams in rivers adjoining developed towns and cities. While ice jam risk for the town is considered low, these events may result in widespread damage in major river floodplains or localized flash flooding caused by unusually large rainstorms over a small area.

The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private and/or beaver dams. Rainstorms are the cause of most flooding in town. Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding, especially when coupled with high rain levels. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation and

erosion damage to property and infrastructure. The 2018 Vermont State All-Hazards Mitigation Plan discusses flooding extensively:

“Flooding is the most common recurring hazard event in Vermont. In recent years, flood intensity and severity appear to be increasing. Flood damages are associated with inundation flooding and fluvial erosion. Data indicate that greater than 75% of flood damages in Vermont, measured in dollars, are associated with fluvial erosion, not inundation. These events may result in widespread damage in major rivers’ floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of both inundation flooding and fluvial erosion can be exacerbated by ice or debris dams, the failure of infrastructure (often as a result of undersized culverts), the failure of dams, continued encroachments in floodplains and river corridors, and the stream channelization required to protect those encroachments.”

Vermont experienced major floods long before Federal disaster assistance became available. But in November of 1927, Vermont experienced catastrophic flooding. In the month before the flood, rains more than 150% of normal precipitation fell after the ground had frozen. The flood itself was precipitated by 10 inches of rain falling over the course of a few days. The flood inundated parts of many towns and damaged or destroyed numerous bridges in the county. As the history of the flooding cited above bears out, the geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Numerous floods have resulted in Presidentially declared disasters and an influx of federal disaster assistance. Of these disasters, the 1973 flood inflicted the most widespread damage, and the residual rains of Hurricane Belle in 1976 resulted in the second highest amount of federal disaster assistance in Vermont.

Widespread, steady rainfall from frontal systems, tropical cyclones, or "northeasters" can result in flooding of large areas. Extensive and disastrous floods are rare but can result from intense spring rains combined with warm, humid winds that rapidly release water from the snowpack. Such was true for the devastating flood of March 11-12, 1936. During this flood, total rainfall and snowmelt ranged from 10 to 16 inches over the southeastern one-half of the State. Rainfall alone can cause disastrous flooding similar to that in November 1927. During that flood, rainfall totals of 5-9 inches were common, and much more occurred at higher altitudes. Intense rainfall caused extensive flooding on September 21, 1938, when the "great hurricane" reached landfall in the southern area of the State. Severe thundershowers more commonly cause localized street and cellar flooding.

Flooding is the most common recurring hazard event in the state of Vermont. June, 2015 broke records across the state for the wettest on record. Waterford received nearly 6 inches of rain in June, 2015 but flooding did not result. This amount is high but not highest for the region. 9.65” fell in 1973 in Saint Johnsbury and the greatest 24-hour rainfall records for the town occurred in May 30th, 2011 at 6.47”. Recent history, including the flooding events of 2011 and the records set in 2015 suggest that increases in total rain fall and severity are to be expected along the lines seen with the records set across the state recently. There are three sources of historical precipitation data for Vermont. The data are reported at the county level: 1) recurrence time intervals for 24-hour rainfall storm depth, 2) annualized daily frequency of rainfall, and 3) rainfall-intensity frequencies. The first source of data is the recurrence time intervals for 24-hour

rainfall storm depth. The recurrence depth data describes the expected intensity of major rainfall events with respect to both rainfall depth and frequency of occurrence.

Table 2-8: 24-Hour Rainfall Depths (inches) for Common Recurrence Intervals (ANR, 2002)

County: Caledonia
1-yr, 24-hr Rainfall Depth: 2.1''
2-yr, 24-hr Rainfall Depth: 2.2''
10-yr, 24-hr Rainfall Depth: 3.1''
100-yr, 24-hr Rainfall Depth: 5.0''

The second source of data are the annualized daily frequencies of rainfall, which were obtained from the National Climatic Data Center (NCDC), Climate Normals program for 1981 – 2010. The data provides the average number of days per year with measurable precipitation (greater than 0.01 inches) on a county-by-county basis. This data allows for the conversion of the annual probabilities derived from the recurrence time intervals to daily probabilities. The annualized estimated daily frequency of measurable rainfall for Caledonia County is 174 days (highest in the state) with 119 days of rain and 55 days of snow. The final source of data are rainfall-intensity frequencies. Hourly precipitation totals throughout the state of Vermont were obtained from the NCDC's Cooperative Observer Program (COOP). Hourly rainfall data were available for 26 COOP locations between 1962 through 2012. Each station is associated with the specific county in which it was located, and the hourly precipitation totals for each station are aggregated by county to yield a frequency distribution of hourly rainfall intensities.

Table: 2-9: Caledonia County Rainfall-Intensity Range (in. /hr.)

County: Caledonia
$x \leq 0.01$: 22.5%
$0.01 < x \leq 0.05$: 25.6%
$0.05 < x \leq 0.10$: 38%
$0.10 < x \leq 0.15$: 3.2%
$0.15 < x \leq 0.20$: 5.9%
$0.2 < x \leq 0.25$: .8%
$0.25 < x$: 4.7%

Tropical cyclones (storms) are officially ranked on one of five tropical cyclone scales, according to their maximum sustained winds and which tropical cyclone basin are located. Only a few scales of classifications are used officially by the meteorological agencies monitoring the tropical cyclones, but some alternative scales also exist, such as Accumulated cyclone energy, the Power Dissipation Index, the Integrated Kinetic Energy Index, and Hurricane Severity Index. Of most recent importance for Vermont was Tropical Storm Irene in 2011. Irene first struck the U.S. as a Category 1 hurricane in eastern North Carolina, then moved northward along the Mid-Atlantic Coast. Wind damage in coastal North Carolina, Virginia, and Maryland was moderate, with considerable damage resulting from falling trees and power lines. Irene made its final landfall as a tropical storm in the New York City area and dropped torrential rainfall in the Northeast that caused widespread flooding. Irene resulted in the worst Vermont flooding in 83 years but Waterford was spared from damage resulting from this event.

Table 2-10: TSI Rain and Wind Extremes

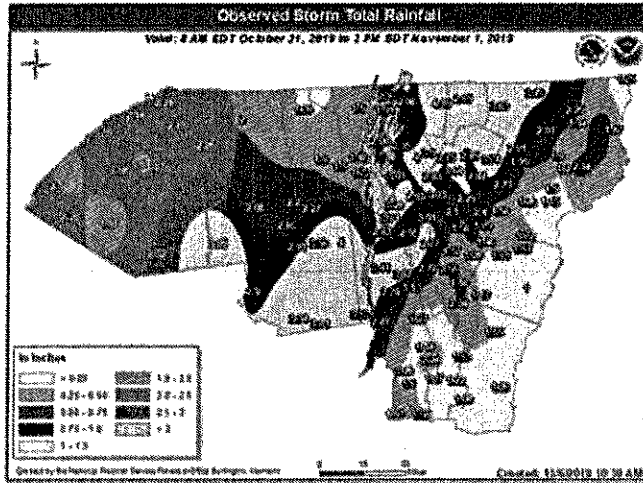
Tropical Storm Irene Rain and Wind Extremes	
Rainfall	Wind
Mendon, 11.23 inches	Burlington, 51 mph
Walden, 7.60 inches	Morrisville, 40 mph
Randolph Center, 7.15 inches	Springfield, 40 mph

Source: <http://www.accuweather.com/en/weather-news/irenes-infamous-top-ten-1/54348>

While not classified as a Tropical Storm, the April 2011 rain totals for the NEK reached nearly 7" compared to the normal precipitation for the month at 3". The heaviest rainfall event was associated with thunderstorms during the late afternoon of April 26th into the early morning hours of April 27th, 2011. These storms resulted in record and near record rainfall and flooding across portions of northern Vermont. Specific records for the town of Waterford regarding rainfall totals were not available but in using nearby Newport City (where the 7" of rain was recorded), the town feels that this event can be used as a benchmark regarding extent.

The "Halloween" storm of 2019 (DR4474) proved to be the most damaging flood event for many areas of the County in recent memory. This powerful storm system tracked across the eastern Great Lakes late on October 31st, 2019, and produced an axis of 3 to 5 inches of rain, which caused significant flooding across the region. Record rainfall occurred at Burlington, Vermont with 3.30 inches on October 31st, along with a record high temperature of 71 degrees. In addition, very gusty southwest winds developed behind this potent storm, which generated scattered to widespread power outages. Surface wind gusts measured up to 65 mph across northern New York and parts of Vermont, with gusts over 100 mph at the summits. The heavy rainfall washed out numerous roads and culverts from Essex County, New York into parts of central and northern Vermont, while 10 rivers reached flood stage with 8 reaching moderate to major levels. A new record high level of 14.72 feet was attained at North Troy on the Missisquoi River. Extensive flooding was observed in the following river basins: Missisquoi, Lamoille, Winooski, and Ausable, while flash flooding with very sharp rises of smaller streams and rivers occurred across the higher terrain of the eastern Adirondacks into central and northern Green Mountains of Vermont, including the Champlain Valley. Observed total rainfall recordings were 5.26 inches in East Berkshire, 4.85 inches in Enosburg Falls, 4.80 in Fletcher, 4.32 Westford, and 4.0 inches in Elizabethtown, New York. Table 2-7 below shows the storm total precipitation from 31 October at 8 AM to 1 November 2019 at 2 PM.

Table 2-11: Observed storm total rainfall from 8 AM EDT on 31 October to 2 PM EDT on 1 November 2019



Ice Jams

Ice jams, which can cause rapid and catastrophic flooding, are considered increasingly hazardous in parts of Vermont. In addition to the inundation damage they cause, ice jams can block infrastructure such as roads and culverts. Ice jams are not as much of a concern in Waterford as elsewhere in Vermont. This is most likely due to the relationship between ice jams and the dam, the Moore Reservoir freezes over but the river is normally open. Water is drained in the reservoir for power generation and floating ice gets stuck behind the dam and in spring the water is generally low. Ice on the river below Moore Dam would back up at Comerford Dam. A list of historic ice jams, including municipalities and streams, is maintained by DEMHS and the Vermont Agency of Natural Resources (ANR). The US Army Corps of Engineers Cold Regions Research and Engineering Laboratory maintains a more specific database of ice jams, which includes over 903 events in Vermont with the latest occurring in 2013. Despite Waterford not having any recorded events, nearby Passumpsic had 19 (10th highest in the state) and St. Johnsbury had 38 (5th highest in the state) with the Connecticut River being number one in the state with 84 recorded ice jams and the Passumpsic River with only one. (Source: http://rsgisias.crrel.usace.army.mil/apex/f?p=524:39:10954063060296::NO::P39_STATE:VT)

High Hazard Dams

The 2018 Vermont State All-Hazards Mitigation Plan state:

While a rare occurrence, dam failure and resulting flooding can be devastating and threaten life and property downstream of dams. Dam failure can occur not only during large storms and high flows, but also during normal, sunny day conditions. While the depths and extents of flooding caused by dam failure are most severe during storms when reservoir elevations and rivers are at their highest, the public is generally conscience of flooding under these conditions. For this reason, it is often the sunny day failure scenario, that occurs with no warning, that is most dangerous. Dam failure is caused by the overtopping or structural failure of a dam resulting in a significant, rapid release of water, which can lead to flooding. Structural failure can be caused

by many factors, such as internal soil erosion in earth embankment dams, sliding or overturning of concrete dams, gate failure, or caused by other means, such as deliberate sabotage. Dams are classified according to their potential for causing loss of life and property damage in the area downstream of the dam if it were to fail using the general classification system: High Hazard, Significant Hazard, and Low hazard. It is important to note that the hazard class is independent of the condition of a dam. Depending on the entity that regulates the dam, these definitions have minor but notable differences. In Vermont, dams are regulated by four distinct entities depending on the purpose and owner of the dam:

- Dams that are part of the production of power (i.e. hydropower) constructed before 1935 (with a few exceptions) are regulated by the State of Vermont Public Utility Commission (PUC). The PUC regulates approximately 25 dams, six of which are considered HIGH hazard and five of which are considered SIGNIFICANT hazard.*
- Hydropower Dams constructed after 1935 (with a few exceptions) are regulated by the Federal Energy Regulatory Commission (FERC). FERC regulates approximately 80 dams, 18 of which are considered HIGH hazard and seven of which are considered SIGNIFICANT hazard.*
- Dams owned by the Federal Government (i.e. United States Army Corps of Engineers, USACE) are essentially self-regulated by that agency. Federal entities regulate approximately 5 HIGH hazard dams and one SIGNIFICANT Hazard dam.*
- Non-federal, non-power dams are regulated by the Department of Environmental Conservation, (DEC). The DEC regulates approximately 41 HIGH Hazard Dams and 110 SIGNIFICANT hazard dams*

In 2018, the Vermont State Legislature passed a law updating the existing regulation of dams, Statute 10 V.S.A. Chapter 43 which applies to the DEC and PUC. The purpose of the law is to serve to protect public safety and provide for the public good through the inventory, inspection, and evaluation of dams in the State. The law aims to provide a definition for a dam, update and modernize the State's dam inventory and give the DEC rulemaking authority for items such as exemptions, registration, hazard classifications, EAPs, inspections and design standards. These rules will be developed over the next several years.

Failure of any of these dams could result in significant downstream flooding. There are 55 high hazard dams on the dam inventory, none of which are considered at significant risk for failure in the town. The Moore Reservoir, owned by TransCanada, is an impoundment of the Connecticut River and occupies 3,181 acres. Created by the completion of the Moore Reservoir in 1956, several villages were flooded, including a portion of old Waterford. With a capacity of 192 megawatts, it is the most productive of TransCanada's 13 hydroelectric facilities in New England. Also owned by TransCanada and downstream from the Moore Dam, the Comerford Reservoir is a 1029-acre impoundment located on the Connecticut River and formed by the Comerford Dam in the towns of Barnet, VT and Monroe, NH, impounding water into Littleton, NH and Waterford, VT nearly to the Moore Reservoir. There have been no recent or historically relevant flooding events associated with the failure of any dam in Vermont. However, as stated in FEMA Guide P-956 "*Living with Dams: Know Your Risks*" (2013): "*Although dam failures are infrequent, the impacts can be catastrophic, often far exceeding typical stream or river flood events.*" A breach of the Moore Dam would result in catastrophic flooding in the town with inundation scenarios depicted the interstate being flooded with 30 feet of water for a time.

Inundation and Floodplains

Waterford's floodplains are depicted on a FEMA Flood Insurance Rate Map (FIRM). This map depicts the Special Flood Hazard areas, which are floodplains that would likely become inundated during a significant flood known as a "base flood." The base flood is often referred to as the "100-year flood." Waterford's FIRM is not accompanied by any insurance studies or base flood elevations, which would indicate how high the water would rise in a 100-year flood event. Regarding flood inundation issues, the 2018 Vermont State All-Hazards Mitigation Plan states:

"Recent studies have shown that most flooding in Vermont occurs in upland streams and road drainage systems that fail to handle the amount of water they receive. Due to steep gradients, flooding may inundate these areas severely, but only briefly. Flooding in these areas generally has enough force to cause erosion capable of destroying roads and collapsing buildings. These areas are often not mapped as being flood prone and property owners in these areas typically do not have flood insurance (DHCA, 1998). Furthermore, precipitation trend analysis suggests that intense local storms are occurring more frequently. Additionally, irresponsible land use and development will exacerbate the preexisting vulnerability. Urban flooding usually occurs when drainage systems are overwhelmed and damages homes and businesses. This flooding happens in all urban areas, but specifically in Burlington where the area is located at the bottom of a gradient, which adds to the intensity of this localized flooding...

...Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Heavy rains with previous ground saturation, which causes runoff, are a significant part of the flooding formula in Vermont. Steep topography and narrow, inhabited, stream and river valleys further increase the dangerous nature of this hazard. Furthermore, precipitation trend analysis suggests that intense, localized storms that can cause flash flooding are occurring with greater frequency. While flooding will continue, planning and other mitigation measures can help minimize damages.

All of Vermont's major rivers have inhabited flood plains. While residents in mountain valleys are at risk, they may not be aware of the danger or may choose to ignore it. There are many reasons property owners are reluctant to relocate to less flood prone ground, not the least of which is the lack of personal experience of flooding. In addition, many communities originated beside rivers and streams, some of the most attractive property is located in vulnerable areas. Lakeshore property in Vermont is vulnerable to flooding from high water levels, either by surface water erosion or flooding. Occasionally, water-saturated ground and high-water tables cause flooding to basements and other low-lying areas. Lakeshore property is highly desirable and valuable, making the development of lakeshore areas very likely, even with the high potential for flooding. Restrictions on lakeshore property development have significant negative economic and tax revenue impacts that must be carefully weighed against the gains in personal safety and protection of property."

Flooding is a significant hazard in Waterford. However, despite having both the Connecticut and Passumpsic Rivers, associated reservoirs and numerous brooks and ponds with geography

characterized by steep alterations in elevations where infrastructure is located at the low points, there are no repetitive loss properties in the town. And while DR 4001 resulted in significant damage, the mitigation work completed prior to Hurricane Irene withstood the storm where many neighboring towns were hit just as hard. Protecting river systems as a preventative measure, protecting property, and protecting human health and safety remain priorities for flood-related hazard mitigation and response in the state and the town. The Connecticut River is the longest river in New England (410 miles) and runs through the town. Despite this, the river is not a source of major concern for the town due to the relative absence of significant development near the river (15 homes located in the floodplain and all are on River Road) yet none are repetitive loss properties. Roads most susceptible to flooding include:

- Simpson Brook
- Hale Road
- East Village Road

Fortunately, these are not residential roads. Designated floodplain areas include areas of the Moose River, Stiles Brook leading onto Stiles pond, the Passumpsic River and west covering a portion of the railroad and river road, Simpson Brook, Chandler Brook, Mad Brook and the Connecticut River. The Gingue Farm on Stiles Road was flooded in the May floods of 2011 but this was land inundation, not structural. Stiles road, Lower Waterford Rd. (State Road 2), Hale Road (at Duck Pond Merger) have a history of flooding to the extent that residents can become isolated without means to get in or out but there is no additional history of property damage for these residents. The Passumpsic River passes through the western corner of the town and floods almost annually. Several smaller streams have a history of overflow and resulting damage in the town. These include Simpson Brook, Chandler Brook, and Mad Brook. The town does maintain current river corridor maps that include properties located within the river corridor (which may or may not include associated floodplains). Despite some historic damage to roads and bridges, the town remains protected from structures being damaged because of their location within the floodplain and/or river corridor and has no history of receiving major or repetitive damage to municipal buildings, critical facilities or residential property. From rains and resultant flooding on May 4-5, 2018, the town experienced damage to Hale Road and other areas to a minor degree. On July 30, 2018, a disaster was declared and the town pursued funding for what can historically be considered a small project (<\$50,000).

Fluvial Erosion

Erosion occurs on a consistent, but small-scale, basis within the riparian corridor of the towns streams and rivers. This is a part of normal natural processes and as such is necessary for the proper functioning of the ecosystem of these waterways. However, fluvial erosion on a large scale can damage stream banks and undercut infrastructure such as roads, bridges and culverts as well as agricultural land and structures, causing severe damage. Fluvial erosion on a large scale can cause stream bank collapses, which are generally classified as landslides. Most flood damage is associated with fluvial erosion rather than inundation. The *2018 Vermont State All-Hazards Mitigation Plan* contains the following discussion of fluvial erosion:

“Recent studies have shown that most flooding in Vermont occurs in upland streams and road drainage systems that fail to handle the amount of water they receive. Due to steep gradients,

flooding may inundate these areas severely, but only briefly. Flooding in these areas generally has enough force to cause erosion capable of destroying roads and collapsing buildings. These areas are often not mapped as being flood prone and property owners in these areas typically do not have flood insurance (DHCA, 1998). Furthermore, precipitation trend analysis suggests that intense local storms are occurring more frequently. Additionally, irresponsible land use and development will exacerbate the preexisting vulnerability. Urban flooding usually occurs when drainage systems are overwhelmed and damages homes and businesses. This flooding happens in all urban areas, but specifically in Burlington where the area is located at the bottom of a gradient, which adds to the intensity of this localized flooding...

...Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Heavy rains with previous ground saturation, which causes runoff, are a significant part of the flooding formula in Vermont. Steep topography and narrow, inhabited, stream and river valleys further increase the dangerous nature of this hazard. Furthermore, precipitation trend analysis suggests that intense, localized storms that can cause flash flooding are occurring with greater frequency. While flooding will continue, planning and other mitigation measures can help minimize damages.

All of Vermont's major rivers have inhabited flood plains. While residents in mountain valleys are at risk, they may not be aware of the danger or may choose to ignore it. There are many reasons property owners are reluctant to relocate to less flood prone ground, not the least of which is the lack of personal experience of flooding. In addition, many communities originated beside rivers and streams, some of the most attractive property is located in vulnerable areas. Lakeshore property in Vermont is vulnerable to flooding from high water levels, either by surface water erosion or flooding. Occasionally, water-saturated ground and high-water tables cause flooding to basements and other low-lying areas. Lakeshore property is highly desirable and valuable, making the development of lakeshore areas very likely, even with the high potential for flooding. Restrictions on lakeshore property development have significant negative economic and tax revenue impacts that must be carefully weighed against the gains in personal safety and protection of property."

The Vermont Agency of Transportation (VTrans) applies the term "scour critical" to stream crossing structures especially vulnerable to streambed scour—the undermining of bridge supports by water action and erosion. A spreadsheet database is maintained by VTrans and continually updated by the Bridge Inspection Program. Structures inspected are only those of 20 feet or longer owned by a municipality or the state. The scour critical rating is based on the structure itself, and does not take into account debris jams, outflanking, channel change, or other issues commonly associated with fluvial erosion. Water supply source and distribution systems are also endangered by fluvial erosion. Many water distribution systems involve buried pipes that cross streams, which are vulnerable to fluvial erosion, however, the town does not have a municipal water supply. In December 2014 the Vermont Department of Environmental Conservation (DEC) released the "[Flood Hazard Area and River Corridor Protection Procedures](#)" guide, outlining specific actions and considerations for all towns in the state. Waterford remains committed to enhancing awareness and incorporating recommendations in future planning and mitigation work. There is one location in the town that is a scour site, and this area is located at

Simpson Brook at Hale Road in the “narrows”. This site was a major project for the town following the May flooding of 2011 but remained intact during Irene.

In summary, flooding is a significant hazard in Waterford, a fact that is unlikely to change. Protecting river systems as a preventative measure, protecting property and human health and safety from flooding and flood-related damage remains important facets of mitigation planning for most Vermont communities including Waterford. Waterford remains committed to enhancing awareness and incorporating recommendations in future planning and mitigation work. The most common consequence to flooding for many Vermont towns is road and bridge (infrastructure).

Pandemic

Pandemic planning in Vermont appears to ebb and flow. Following the H1N1 Virus Outbreak in 2009-2010, increased emphasis on pandemic planning was seen across the state. From 2010 to 2019 however, without another major U.S. event, emphasis on pandemic planning diminished. While Vermont, due to its rural nature, has some level of protection from national infection rates during a pandemic, the financial implications experienced during the COVID-19 pandemic in 2020 hit the state extremely hard.

COVID-19 is a new disease, caused by a virus not previously seen in humans. COVID-19 is highly contagious and people with COVID-19 who do not have any symptoms can spread the virus to other people. On March 13, 2020, President Trump declared a nationwide emergency pursuant to Sec. 501(b) of Stafford Act to avoid governors needing to request individual emergency declarations. All 50 states, the District of Columbia, and 4 territories have been approved for major disaster declarations to assist with additional needs identified under the nationwide emergency declaration for COVID-19. Additionally, 32 tribes are working directly with FEMA under the emergency declaration. FEMA announced that federal emergency aid has been made available for the state of Vermont to supplement the state and local recovery efforts in the areas affected by the Coronavirus Disease 2019 (COVID-19) pandemic beginning on January 20, 2020 and continuing. Public Assistance federal funding was made available to the state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency protective measures (Category B), including direct federal assistance under Public Assistance, for all areas in the state of Vermont affected by COVID-19 at a federal cost share of 75 percent.

In early 2020, there was a quick return to the tenets of effective pandemic planning. Preparing for hospital surge, high death rates and the medical equipment necessary for both patients and health care workers are examples of the state’s early focus. Public information and guidance on safety, isolation, travel and quarantine also became extremely important while mitigating the pervasive economic consequences of reducing work forces, sending students home and closing businesses. Additionally, Vermont had to consider the implication of, and work to control, the immigration of people from other states. Both infection risk and taxing of local resources were the main concerns associated with this real consequence of the pandemic.

While the Northeast Kingdom remained insulated from infection rates (and subsequent deaths) seen elsewhere in the state (e.g., Burlington), issues of border closure, implementing safety

protocol and procedures and economic resilience were experienced in every community, including Waterford. As of January 13, 2022, there have been 83,994 cases and 490 deaths in the state. According to the current data, Waterford has had less than 100 cases. Despite these low numbers, the economic and operational consequences of pandemic are of concern to the town. Having the capacity to navigate the funding opportunities as result of the pandemic for the town and residents is a concern in addition to providing resources to residents to mitigate spread (e.g., testing and vaccination services) and assure continuity of operations for government and community-based organizations. (<https://www.healthvermont.gov/response/coronavirus-covid-19/current-activity-vermont#town>)

SECTION 3: RISK ASSESSMENT

This section first explores and defines specific locations of known, historic risk within the town with a disaster and non-disaster expenditure summary. Following, a qualitative risk analysis is documented for each hazard category. The highest ranked hazards, coupled with historic data, therefore, substantiate the profiled hazards in this update.

3.1 Designated Hazard Areas

3.1.1 Flood Hazard Areas

According to the Waterford Town Plan, designated flood hazard areas exist in the town but most major infrastructure and roadways are out of harm's way. 12 residences are in the floodplain and no commercial property other than hay fields and a few hay barns exist with the 100-year flood plain. Roads most susceptible to flooding include Simpson Brook, Hale and East Village roads. Fortunately, these are not residential roads. Designated floodplain areas include areas of the Moose River, Stiles Brook leading onto Stiles Pond, the Passumpsic River and west covering a portion of the railroad and river road, Simpson Brook, Chandler Brook, Mad Brook and the Connecticut River. Stiles road, Lower Waterford Rd. (State Road 2), Hale Road (at Duck Pond Merger) have a history of flooding to the extent that residents can become isolated without means to get in or out. The Passumpsic River passes through the western corner of the town and floods almost annually. Several smaller streams have a history of overflow and resulting damage in the town. These include Simpson Brook, Chandler Brook, and Mad Brook. With strict zoning laws regarding development in the flood hazard area and as stated in the 2013 Waterford Zoning Bylaws:

- 1. Development within the floodway is prohibited unless a registered professional engineer certifies that the proposed development will not result in any increase in flood levels during the occurrence of the base flood.*
- 2. Junkyards and storage facilities for floatable materials, chemicals, explosives, flammable liquids, or other hazardous or toxic materials, are prohibited within the floodway.*

The major risk for the town is road, bridge and culvert damage which can then have a secondary risk associated with resident's being isolated due to impassable roads. The state tracks and rates bridges and culverts for each town.

3.1.2. Fluvial Erosion Hazard Areas

Simpson Brook at Hale Road is rated as Scour Critical by the State Agency of Natural Resources. With the amount of work put into this area after the May floods of 2011 however, the resilience of this area has been significantly improved. While portions of the Mad Brook have some fluvial erosion potential, the town has not seen any major increase in erosion since 2011, when repeated flooding inundated much of the state, nor since the last planning phase. In light of this and the potential for more severe weather events, the town remains cautious and realizes that the situation can change quickly. In support, Vermont has seen a dramatic increase in agency collaboration in recent years. The result of this enhanced cohesion has resulted in several published resources for all towns to use to guide mitigation efforts and enhance resiliency. With the recent emphasis on climate change and subsequent weather-related disasters, the town remains committed to aligning with all applicable and logistically feasible recommendations and considerations resulting from the work of State agencies. River Corridor Maps have been produced and lists associated properties and infrastructure. While there are some properties very close to the defined river corridor, very few are located within it. Appendix A includes the river corridor map for the town with properties and infrastructure indicated. This map can serve as a basis for developing mitigation strategies and/or outreach strategies.

Repetitive Loss Properties:

The town has no repetitive loss claims or properties according to the FEMA Repetitive Losses / BCX Claims spreadsheet for Vermont.

3.2 Non-designated Hazard Areas

3.2.1. 1998 Ice Storm Damage

Impacts of the January 1998 ice storm in Waterford were minimal in comparison to other areas of the state.

3.2.2. High Winds and Lightning

Ridgeline and hilltop homes as well as homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. High tension line runs along VT RT 5 and the Vermont Agency of Transportation along with utility providers work to keep limbs trimmed.

3.3 Previous FEMA-Declared and Non-declared Natural Disasters

3.3.1. Road Infrastructure Failure

The town has had damage to its roads, most of which occurred in the spring floods of 2011 (DR 4001), with Hale Road needing a substantial amount of repair. Despite being hit hard with DR 4001, the town did not require any PA funding in relation to road failures during Tropical Storm Irene (DR 4022). This is explained primarily by the quality of work done in the spring to improve resilience of town infrastructure as many nearby towns were hit just as hard by 4022 as they were in 4001. The remainder of historic PA assistance for infrastructure has been relatively minor with ditching and drainage projects not exceeding \$15,000 per project. During the previous planning phase, the town has received FEMA funding for one infrastructure project related to damage incurred during a declared disaster. That was Hale Road in 2018 for nearly \$35,000. Non-declared disaster damage to infrastructure has also occurred and will be described in a later section. As with any town, each year provides both new areas in need of upgrade and/or repair as well as new funding opportunities. These locations for the next five years will be addressed in another section. Since 2007, the town has had \$587,000 in road expenses resulting from washouts and flooding. Of this amount, \$64,000 (10.9%) has been paid for by the town. The remainder has been paid for by FEMA and ERAF. Waterford has received public assistance funding from FEMA for the following natural disasters:

Table 3-1: Town of Waterford, FEMA-declared disaster Summary, 2004-2021

Disaster #	Date	Type
1559	09/23/2004	Severe Storm(s)
1698	05/04/2007	Severe Storm(s)
4001	07/08/2011	Severe Storm(s)

Table 3-2: Town of Waterford, FEMA-declared disasters and snow emergencies, 2004-2021

Disaster Number	PW Number	Application Title	Applica nt ID	Damage Category Code	Project Amount	Federal Share Obligated	Total Obligated
4001	217	TIM Waterford Old County Grime	005-77125-00	C - Roads & Bridges	\$20,119.48	\$15,089.61	\$15,089.61
4001	218	TIM Waterford Simpson Brook	005-77125-00	C - Roads & Bridges	\$83,932.93	\$62,949.70	\$62,949.70
4001	222	TIM Waterford Lee Farm	005-77125-00	C - Roads & Bridges	\$10,343.86	\$7,757.90	\$7,757.90
4001	223	TMWAC12	005-77125-00	C - Roads & Bridges	\$6,385.97	\$4,789.48	\$4,789.48
4001	226	TMWAC09 E. Village Road	005-77125-00	C - Roads & Bridges	\$46,581.89	\$34,936.42	\$34,936.42
4001	317	TMWAC01 Hale Road: Lower	005-77125-00	C - Roads & Bridges	\$33,220.22	\$24,915.17	\$24,915.17

4001	364	TMWAC02	005-77125-00	C - Roads & Bridges	\$85,132.57	\$63,849.43	\$63,849.43
4001	366	TMWAC10 Valley View	005-77125-00	C - Roads & Bridges	\$35,999.25	\$26,999.44	\$26,999.44
4001	378	TMWAC06 Old County Rd (power side)	005-77125-00	C - Roads & Bridges	\$20,806.92	\$15,605.19	\$15,605.19
4001	382	TMWAC11 Mad Brook Rd.	005-77125-00	C - Roads & Bridges	\$82,983.80	\$62,237.85	\$62,237.85
4001	383	TMWAC07 Daniels	005-77125-00	C - Roads & Bridges	\$16,078.22	\$12,058.67	\$12,058.67
4001	384	TMWAC08 High Ridge	005-77125-00	C - Roads & Bridges	\$18,435.06	\$13,826.30	\$13,826.30
4001	409	PRWAB01	005-77125-00	B - Protective Measures	\$6,688.56	\$5,016.42	\$5,016.42
4001	547	TMWAC01 Hale Rd. Bank Stabilization	005-77125-00	C - Roads & Bridges	\$115,000.00	\$86,250.01	\$86,250.01
1559	81	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$5,549.98	\$4,162.49	\$4,415.57
1559	82	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$7,491.11	\$5,618.33	\$5,959.92
1559	83	GRAVEL ROAD AND DRAINAGE DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$14,604.78	\$10,953.59	\$11,619.58
1559	84	GRAVEL ROAD EROSION	005-77125-00	C - Roads & Bridges	\$1,863.13	\$1,397.35	\$1,482.30
1559	85	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$17,456.61	\$13,092.46	\$13,888.48
1559	86	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$4,935.60	\$3,701.70	\$3,926.77
1698	93	DEBRIS REMOVAL	005-77125-00	A - Debris Removal	\$12,719.65	\$9,539.74	\$10,119.75
1698	109	DONATED RESOURCES	005-77125-00	B - Protective Meas.	\$1,822.77	\$1,367.08	\$1,450.19
1559	81	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$5,549.98	\$4,162.49	\$4,415.57
1559	82	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$7,491.11	\$5,618.33	\$5,959.92
1559	83	GRAVEL ROAD / DRAINAGE DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$14,604.78	\$10,953.59	\$11,619.58
1559	84	GRAVEL ROAD EROSION	005-77125-00	C - Roads & Bridges	\$1,863.13	\$1,397.35	\$1,482.30
1559	85	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$17,456.61	\$13,092.46	\$13,888.48
1559	86	GRAVEL ROAD AND DITCH REPAIR	005-77125-00	C - Roads & Bridges	\$4,935.60	\$3,701.70	\$3,926.77
1698	93	DEBRIS REMOVAL	005-77125-00	A - Debris Removal	\$12,719.65	\$9,539.74	\$10,119.75
1698	109	DONATED RESOURCES	005-77125-00	B - Protective Measures	\$1,822.77	\$1,367.08	\$1,450.19

Sources: Town Records, Project Worksheets, financial report forms and award letters.

Non-Declared Disaster Summary:

As with any municipality, maintaining transportation routes through road, bridge and culvert repair and replacement is ongoing and requires fiscal, environmental, communication and engineering planning to be successful. The work accomplished in Waterford since 2010 that was not directly related to a declared disaster has supplemented the work accomplished in direct response to disaster-related damage to town roads and bridges. The cumulative effect of this work has served to enhance overall resilience to future events while assuring to the best degree possible, consistent use of transportation infrastructure in the face of severe weather precluding a level of disaster declarations.

3.4 Future Events

Although estimating the risk of future events is far from an exact science, the Planning Team used best available data and best professional judgment to conduct an updated Hazards Risk Estimate analysis, which was subsequently reviewed and revised by town officials in the fall 2015. This analysis assigns numerical values to a hazard's affected area, expected consequences and probability. This quantification allows direct comparison of very different kinds of hazards and their effect on the town and serves as a method of identifying which hazards hold the greatest risk based on prior experience and best available data. Although all assets may be affected by hazards, some assets are more vulnerable because of their physical characteristics or socioeconomic uses. This section provides an overall summary of the town's vulnerability to the identified hazards. The following scoring system was used in this assessment:

Area Impacted: Scored from 0-4, rates how much of the municipality's developed area would be impacted.

Consequences: Consists of the sum of estimated damages or severity for four items, each of which are scored on a scale of 0-3:

1. Health and Safety Consequences
2. Property Damage
3. Environmental Damage
4. Economic Disruption

Probability of Occurrence: Scored from 1-5, estimates the anticipated frequency of occurrence.

To arrive at the overall risk value, the sum of the Area and Consequence ratings was multiplied by the Probability rating. The highest possible risk score is 80.

3.4.1. Natural Hazards

According to the updated Hazard and Risk Estimation for Waterford, the following natural hazards received the highest risk ratings out of a possible high score of 80:

- Severe Winter Storm (32)
- Flooding (44)
- High Winds (28)
- Extreme cold (32)

Flooding remains the most likely event to incur the most cost for the town based on historical analysis and disaster declaration-related funding since 2004 has all been a result of severe rainstorms. Given the magnitude of damage to such few areas during DR 4001, the realization that a major flooding event can result in major expense is evident, lending support that that flooding is likely to have a significant impact over a smaller area while a severe winter storm tends to affect the entire town. As with most Vermont towns, there is almost an inherent resilience to winter weather events because they are expected. However, as severity increases and consequences mount (e.g., power outage, road closures, etc.), the risk for health and safety also increases. High wind and lightning events happen and have the potential to disrupt functionality of the town, but the town is not at any increased risk in comparison to other areas of the state, but the sum area impacted, and probability of occurrence raise these two events in the hazard analysis methodology.

Table 3-3: Natural hazards risk estimation matrix

Waterford Risk Analysis: NATURAL HAZARDS	Drought	Flooding	High Winds	Fluvial Erosion	Landslide	Lightning	Multi-Structure Urban Fire	Pandemic	Winter Storm	Extreme Cold
	Area Impacted									
Key: 0 = No developed area impacted										
1 = Less than 25% of developed area impacted										
2 = Less than 50% of developed area impacted										
3 = Less than 75% of developed area impacted										
4 = Over 75% of developed area impacted	1	4	1	1	1	1	1	1	3	4
Consequences										
Health & Safety Consequences										
Key: 0 = No health and safety impact										
1 = Few injuries or illnesses										
2 = Few fatalities or illnesses										
3 = Numerous fatalities	0	1	1	0	1	1	1	3	1	2
Property Damage										
Key: 0 = No property damage										
1 = Few properties destroyed or damaged										
2 = Few destroyed but many damaged										
3 = Few damaged but many destroyed										
4 = Many properties destroyed and damaged	0	2	2	1	1	1	1	1	1	1
Environmental Damage										
Key: 0 = Little or no environmental damage										
1 = Resources damaged with short-term recovery										
2 = Resources damaged with long-term recovery										
3 = Resource damaged beyond recovery	2	2	1	2	1	1	1	1	1	1
Economic Disruption										
Key: 0 = No economic impact										
1 = Low direct and/or indirect costs										
2 = High direct and low indirect costs										
2 = Low direct and high indirect costs										
3 = High direct and high indirect costs	2	3	1	1	1	1	1	2	2	1
Sum of Area & Consequence Scores	5	12	6	5	5	5	5	8	8	9
Probability of Occurrence										
Key: 1 = Unknown but rare occurrence										
2 = Unknown but anticipate an occurrence										
3 = 100 years or less occurrence										
4 = 25 years or less occurrence										
5 = Once a year or more occurrence	1	4	4	4	1	4	1	1	4	4
TOTAL RISK RATING										
Total Risk Rating =	5	48	24	20	5	20	5	8	32	36
Sum of Area & Consequence Scores										
x Probability of Occurrence										

3.5 Hazard Summary

According to the risk estimation analysis, the highest rated hazards for Waterford are:

1. Flooding
2. Extreme Cold
3. Severe Winter Storm
4. High Winds
5. Fluvial Erosion

Flooding is highest rated hazard for Waterford, due in large part to their widespread nature and frequent occurrence. A severe winter storm is expected and while the town is well-equipped to handle winter storms and cold temperatures, the resilience of its residents is dependent on effective town emergency planning when intervention strategies are required.

SECTION 4: VULNERABILITY ASSESSMENT

Vulnerability refers to the potential impact of a specific loss related to an identified risk. Waterford is a small town with very few buildings aside from residential. While the loss of any one facility would cause a disruption in town services and operations, the vulnerability is low as all critical facilities are not in the SFHA. There are roads, bridges and culverts vulnerable to flooding and those are identified below. The hydroelectric plant (Moore Reservoir) is a concern solely because dams are identified targets for malicious activity (terrorism) and the impact of such activity could be catastrophic, but the town does not manage the Dam. Additionally, loss of fire and rescue services due to equipment issues (unrelated to profiled hazards however) makes the town vulnerable in several ways.

Of the profiled hazards, the following vulnerability rating (high, moderate, low) is given below. This vulnerability rating is based on the disaster case history for the town and when the greatest financial impact was seen due to the disaster. The specific vulnerability to the population as a whole or any specific sub-population (e.g., elderly) is subjective because there is no historical data to rank vulnerability to health and safety of Waterford residents, workers or travelers.

4.1 Vulnerability Narrative by Profiled Hazard

Severe winter/ice storm: Moderate

Summary: While all structures are vulnerable to major snow loads, there is little evidence to support concern over structure failure due to snow loads on roofs, ice on gutters, etc. Town snow removal equipment is vulnerable to damage with greater use, especially during emergency situations as well as road damage from plowing. Populations caught outdoors, commuting or working outside during a severe winter storm are more vulnerable to cold-related injury and/or snow related accidents but winter comes every year and residents, and the town are accustomed to making intelligent decisions regarding safety and protection of infrastructure. Special populations (e.g., aging, disabled, etc.) are more vulnerable in terms of mitigating structure loads, hazardous travel and relocating to safety.

Extreme Cold: Moderate

Summary: Recent evidence shows that greater extremes in temperature and overall weather fluctuation are occurring with increased frequency. A long-duration cold snap can cause significant damage to structures due to bursting pipes and the residential health and safety considerations include factors related to financial resources, fuel supply, sheltering, provisions and employment.

Pandemic: High

Summary: Not only is the COVID-19 current during the drafting of this plan but it will likely remain active for some time to come. While Vermont has remained relatively insulated from the worst-case scenarios already seen in other states in regard to infection rates and deaths, there have been significant financial impacts for the region and state. There are several important considerations for the town and villages to take on. Issues such as tax revenue reductions from failure to pay on a large scale to how a major storm event could compromise pandemic response (e.g., sheltering operations and resource allocation).

High Winds: Moderate

The entire town is vulnerable to the results of high wind exposure. Significant damage possible to trees, power lines, building roofs.

Flooding (including fluvial erosion/dam breach/inundation): High

Flooding is the most common recurring hazard event in the state of Vermont. There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash flooding and urban flooding. Flooding has also been known to occur as a result of ice jams in rivers adjoining developed towns and cities. These events may result in widespread damage in major river floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private and/or beaver dams. Rainstorms are the cause of most flooding in Waterford. Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding, especially when coupled with high rain levels. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation and erosion damage to property and infrastructure.

Previous experiences have proven to the town that flooding is the greatest risk and another flood event is probable. With this conviction, the need to complete viable mitigation actions to town infrastructure becomes incredibly important and the town remains aware of this. The estimated Capacity-Disruption Levels Given a Measured Rainfall Event can be interpreted as the conditional probability that a particular roadway capacity disruption occurs, given that a rainfall event occurs. For Caledonia County, the probability that the intensity of a rain event will result in approximately a 2%, 7.5%, or 13.5% roadway capacity reduction are 28.2%, 69.2%, or 2.6%, respectively (Source: *A Risk-Based Flood-Planning Strategy for Vermont’s Roadway Network, 2015*).

4.2 Infrastructure

Flooding is the highest risk profiled hazard and town infrastructure has high vulnerability to damage during major flood events. The information presented below summarizes town infrastructure and high vulnerability areas.

4.2.1. Town Highways

The following is a statistical overview of roads in the Town of Waterford. These tables show the range of road types within the town, from highways to unpaved roads. The different road types have different hazard vulnerabilities. Unpaved roads are more vulnerable to being washed out in a flood or heavy storm, while traffic incidents are more likely to occur on large, arterial roads.

Table 4-2: Town highway mileage by class, Town of Waterford

Class 1	Class 2	Class 3	Class 4	State Hwy	Total 1, 2, 3, State Hwy
0	10.5	30.51	9.01	13.88	63

Source: data derived from VTrans GIS data –Waterford Town Plan

4.2.2. Bridges, Culverts, and Dams

Bridges:

Scour is by far the primary cause of bridge failures in the United States. Regionally, the vulnerability of bridges to flood damage became evident from the damage seen to Vermont bridges in the 2011 Tropical Storm Irene. Successfully mitigating scour-related problems associated with bridges depends on the ability to reliably estimate scour potential, design effective scour prevention and countermeasures, design safe and economical foundation elements accounting for scour potential, and design reliable and economically feasible monitoring systems. (*Scour Damage to Vermont Bridges and Scour Monitoring: UVM Transportation Research Center Report 15-002 June 10, 2015*).

There are five¹ bridges in the town:

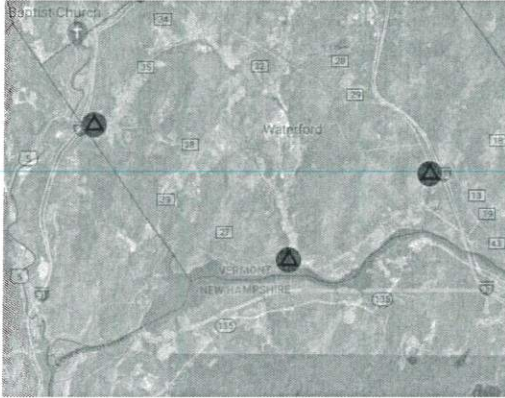
1. Higgins Hill
2. Lower Waterford Road (High Importance)
3. Mad Brook
4. Shadow Lake
5. Simpson Brook

According to the VTCulverts.org, only the Lower Waterford Road Bridge (Latitude: 44.344768648230264 Longitude: -71.98973389894846) is considered “High Importance”. All bridges listed in VTCulvert inventory have a good condition rating. Bridges are

¹VT Culverts lists 3 bridges only (Hale, Lower Waterford, Mad Brook) in 2022

expensive and the Lower Waterford Road and the Simpson Brook bridges are most vulnerable due to geographical location and prior history of damage in the area but specifically to the bridges themselves.

Map 4-3a: Bridge Locations and condition (green=good)

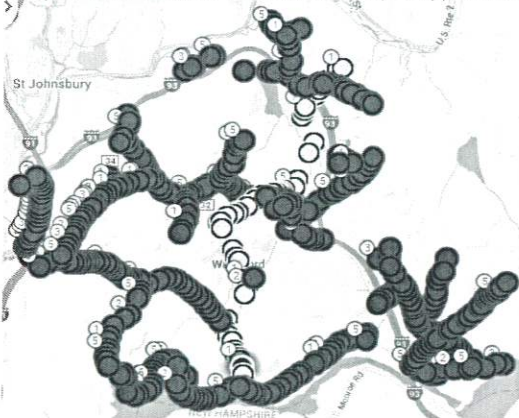


The entire Bridge Inventory with maps for the town can be found on the state site: <https://vtculverts.org/bridges#list>

Culverts:

The Town maintains a culvert inventory that assesses 471 culverts with data on length, overall condition, size and location. This data guides the town's culvert maintenance and replacement plan. High Risk Culvert areas (Red dots) include Daniels Farm Rd., Lower Waterford Rd and one location on I93. Duck Pond: Medium Risk are indicated by yellow dots and low risk in green. Riverside Cemetery Road (ID 322) is listed in critical condition. Since 2005, the culvert maintenance program has succeeded in reducing vulnerabilities for road washouts during flood events. The PA funding and listed projects provided in this plan explain, specifically, the work that was accomplished to reduce vulnerability to the areas of road listed. The work accomplished as result of the May 2011 flood events have had the greatest impact on reducing vulnerability for town roads as proven by the reduction in damage during the September 2011 flood event.

Map 4-3b: Culvert locations by High, Medium and Low Risk of Flooding



Source: <https://www.vtculverts.org/structures>

Dams:

There have been no recent or historically relevant flooding events associated with the failure of any dam in Vermont. However, as stated in FEMA Guide P-956 “Living with Dams: Know Your Risks” (2013): “Although dam failures are infrequent, the impacts can be catastrophic, often far exceeding typical stream or river flood events.” Great River Hydro now owns all dams along the Connecticut river. They are required to update and reprint its Emergency Action Plan for the dam every five years pursuant to requirements under the Federal Regulatory Commission (FERC). The plan also maps Breach and Non-Breach Conditions that may occur during a probable maximum flooding event. There exists a robust Planning Tool and notification system to assess and alert, respectively. The Planning Tool is portal-based and includes PDF maps with worst-case scenarios and GIS mapping with layers that allow time-since-breach modeling as well as structures impacted, including bridge decks and homes. The alerting system is based within VTAlert which uses the Everbridge system to alert the public. This methodology shows exceptional success during drills and exercises (96% contact success rate).

Water, Wastewater and Natural Gas Service Areas

The Town currently has no water, wastewater or natural gas service areas. Water and sewer systems are the sole responsibility of the property owner, and they are required to meet state and federal regulatory standards. Vulnerability is low for the town.

Electric Power Transmission Lines and Telecommunications Land Lines

High-tension electric transmission run through the Town of Waterford, running along VT RT 5. Vulnerability is low for the town.

Critical Facilities

The Center for Disaster Management and Humanitarian Assistance defines critical facilities as: “Those structures critical to the operation of a community and the key installations of the economic sector.” *Map 4-1* shows the geographic distribution of some critical facilities and utilities. *Table 4-1* identifies critical facilities in Waterford, excluding critical facilities designated as hazardous materials storage sites. As mentioned in the summaries above, some critical facilities have increased vulnerability during specific hazard events. However, there is no evidence to suggest that any critical facility is highly vulnerable during any hazard event.

Table 4-4: Critical facilities in the Town of Waterford

Facility Type	Number of Facilities
Education Facility	1
Fire Station	1
Emergency Shelters	2
Emergency Operations Center	1
Government	1
Hydroelectric plant	1

4.3 Estimating Potential Losses in Designated Hazard Areas

Flooding: 12 residences and 0 commercial/industrial structures are located within the 100-year floodplain. Assuming the most recent median grand list value, the estimated potential losses due to a major flood event inundating the floodplain is less than 1%. This estimate only takes structures into account, it does not account for personal property or business losses. Regarding town roads, losses can and have been substantial. With an approximate total cost of \$500,000 to repair damages incurred during DR4001 and with a substantial percentage of damage occurring in the designated hazard areas, the town's entire yearly road budget could be exhausted with one event. Fortunately, the town has no repetitive loss properties.

Table 4-5: Town of Waterford Hazard Risk and Vulnerability Summary

Hazard	Vulnerability	Extent (Storm Data from most severe event)	Impact (economic/health and safety consequence)	Probability
Flood	Culverts, bridges, road infrastructure. 12 critical or public/residential infrastructure in SFHA/.2% FHA	The greatest 24-hour rainfall record for immediate region occurred in late October 31st, 2019 at 3". The greatest level of precipitation in any month occurred in August 2011 at 11" No detailed data was available for fluvial erosion damage in town in terms of numbers of acres lost during each event.	May 2011 flooding resulted in most damage for the town, including sergeant lane bridge and 6 other sites. Over \$300,000 in PA was received	High
Extreme Cold/ Snow/Ice Storm	The entire planning area is vulnerable, including road infrastructure, town and privately-owned buildings, utility infrastructure	Snowfall has varied, from a few inches to over a foot or more. Heavy snow and wind may down trees and power lines. Snow/ice contributes to hazardous driving conditions.	For roof collapse: monetary damages will depend on each structure but, collapse of barn roof is often a total loss. This does not include the loss of livestock. Collapse of a house roof may be at a 50% loss. For car crashes due to poor driving conditions: minimal damage to vehicle to	High

			totalled vehicle and operator injury. Health impacts could vary significantly. Loss of energy or communication capabilities may occur and impede recovery.	
Pandemic	The entire planning area is vulnerable in both health and financial stability	COVID-19 has far-exceeded severity of 2009-2010 HINI Pandemic	2020 COVID-19 has resulted in the greatest infectious disease-related financial consequence for the planning area in history	High
High Wind	Medium	The entire town is vulnerable to the results of high wind exposure. Significant damage possible to trees, power lines, building roofs.	5/2012 event: Confirmed EFO (gale) tornado in W. Glover (40 miles from Waterford), hail greater than an inch in diameter, damaging winds, flash flooding, total rainfall of 3-5 inches	High

SECTION 5: MITIGATION STRATEGY

The greatest advancement in mitigation planning the town has achieved is from the direct experiences in responding to, and recovering from, the major disasters that have impacted the town in the last decade. These disasters, have, to a large extent, redefined how the entire state views and approaches mitigation. The work of state agencies, including those devoted to transportation, planning and emergency management have also changed the way towns go about their day-to-day operations and planning, both in emergency situations and out. It is because of this that the town views this update as the new standard in their mitigation planning efforts. This plan update allows for a continuation of the systematic documentation of mitigation efforts in the next planning cycle. We feel that the implementation matrix captures specific progress in certain areas but more importantly, gives the town a guide from which all future action and updates can be based on.

5. Land Use and Development Trends Related to Mitigation

The land use plan represents a broad policy statement of the desired future land uses in Waterford and is a summation of all the other surveys, inventories, analyses, and categorical plans which have preceded it. It is also based on surveys of existing conditions and trends and capabilities relative to land use. It is intended to work as a guide to public officials and private citizens in coordinating the future development of the town. It is the document upon which the Town's Zoning Bylaw is based. As a participating municipality in the NFIP, the town is committed, through its zoning laws, to minimize flood vulnerability to the greatest extent possible. There have been no changes in development in hazard prone areas that have impacted vulnerability since the last approved plan.

5.0.1 Future Development and Housing

The town welcomes future development and there have been very minor increases in development since 2016. There has been no major increase in new housing development and while the town does not anticipate significant new buildings or infrastructure development in the next planning cycle, the town will move to adopt zoning policy that will prohibit future development in flood hazard areas and follow a "No Adverse Impact" methodology when opportunity arises to discuss the potential of new structure development in other areas. The 2016 Waterford Zoning Bylaws hold to the recommended practices under the NFIP and all continued compliance and participatory requirements are managed by the town Zoning Administrator. The Planning Commission has, as part of the mitigation planning process, discussed implementing regulations that simply will not allow development of any kind within the defined flood hazard area. As a participating community in the NFIP, the following graph represents the currently available information regarding properties with Flood Insurance (two residential, single family properties). There are no repetitive loss properties in the town.

Table 5.1: NFIP Policies in Waterford

Community: WATERFORD, TOWN OF State: VERMONT
 County: CALEDONIA COUNTY CID: 500200

Overview	Occupancy	Zone	Pre/Post FIRM	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	\$ of Closed Paid Losses	Adjustment Expense
Single Family				2	\$872	\$700,000			
2-4 Family				0	\$0	\$0			
All Other Residential				0	\$0	\$0			
Non Residential				0	\$0	\$0			
Total				2	\$872	\$700,000	0	\$0.00	\$0.00

	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	\$ of Closed Paid Losses	Adjustment Expense
Condo	0	\$0	\$0			
Non Condo	2	\$872	\$700,000			
Total	2	\$872	\$700,000	0	\$0.00	\$0.00

Source: <http://bsa.nfipstat.fema.gov/reports/reports.html>

5.0.2. Housing

The majority of Waterford’s housing stock has been rated in “sound” condition with 20 mobile homes, the majority of which are occupied full time. The town maintains the ruling that “dilapidated houses that are standing vacant should be condemned and removed by public order, as they pose potential problems to public health and safety.” (2016 Waterford Town Plan).

Additional housing regulations that support mitigation in a primary and/or secondary sense are as follows:

“3. Mobile and modular homes are recognized as a form of housing and it is intended that provision be made for their use in the Town. Mobile and modular homes will be permitted anywhere in Town that conventional single-family dwellings are permitted. Regulations pertaining to mobile and modular homes should be incorporated into the Zoning Bylaw requiring them to have permanent foundations.

4. Recreational vehicles should not be allowed for use as a dwelling unit for more than 30 days in any calendar year without special approval by the Development Review Board, and recreational vehicles and campgrounds should only be allowed in the Rural Residential District and only after site plan approval by the Development Review Board.

5. Large housing developments (five lots or more) should not be permitted unless they are proven to be completely self-contained in terms of services and facilities open space, new road construction and maintenance, and only upon site plan approval by the Development Review Board.

6. It is the Town’s desire to: 1) retain its presently dispersed settlement pattern; 2) retain the pristine quality of environment waters and prevent soil erosion; 3) protect its resources, agricultural and forest land, historic and scenic areas, natural resources; and 4) retain a balance between town revenue and town expenses.” -2016 Waterford Town Plan

5.0.3. Roads

The town has listed the following recommendations regarding future town road plans in its Town Plan:

- No new construction of roads is necessary
- The present classification system should remain as is, and there should not be any up grading of classifications

- It is recommended that Route 18 be maintained at its present level as a Class 1 primary highway and not be downgraded

5.1 Waterford Town Goals and Policies that support Hazard Mitigation

5.1.1. *Flood Resilience Goals:*

- Continue supporting state standards with local, POS water/sewer sources.
- Take advantage state and regional-level preparedness programs to support resiliency from the impacts of disasters.
- Formalize the planning commission stance on not allowing development in known flood hazard areas.
- Mitigate Waterford’s flood hazards in the most cost-effective manner possible.
- Minimize the risk exposure and associated expense to Waterford tax payers.
- Ensure the Town and its facilities are prepared to meet the demands of the next flood.
- Ensure the Town can receive the maximum outside assistance in the event of the next Federally declared disaster.
- Identify and protect natural flood protection assets, including floodplains, river corridors, other lands adjacent to streams, wetlands, and upland forested cover.
- Review and evaluate river corridor information to protect property and natural flood protection measures.
- Consider adopting regulations that will protect erosion prone areas for additional development and encroachment.

5.1.2. *Capital Improvement Goals*

- Provide services and facilities deemed necessary for the orderly and rational development of the Town.
- Assure that the Highway Department has enough funding to fulfill the goals of the following year and in adjunct, increase awareness on eligibility requirements for infrastructure projects under the Hazard Mitigation Grant Program (HMGP).
- Continue to meet or exceed the VTrans Road and Bridge standards. Participate in regional road foreman trainings and Transportation Advisory Committee meetings to stay abreast of flood resilience measures for the Town’s roads and bridges.
- Continue to update the Town’s transportation infrastructure information in the Vermont Online Bridge and Culvert Inventory Tool (vtculverts.org).

- e. Replace undersized and failing culverts.

5.1.3. Public Participation Goals

- a. Continue to solicit input regarding planning issues from town residents and from other entities which can help to offer solutions and insight into the problems the Town faces both now and in the future via formal meetings and advertised opportunities for input.
- b. Utilize LEPC meetings, drills and exercises to increase awareness, enhance planning and promote resilience in the community.

5.1.4. Regulatory Devices Goals

- a. Continue to amend and enforce zoning bylaws that promote flood protection.
- b. Continue participation in the National Flood Insurance Program (NFIP) and reflect or exceed recommendations for best practices accordingly in Zoning Bylaws.

5.1.5. Land Use

- a. Work to develop a Flood Hazard Area Overlay District to include all designated flood hazard areas. The purpose of the Flood Hazard Area Overlay District is to protect public health, safety, and welfare by preventing or minimizing hazards to life and property due to flooding, and to ensure that private property owners within designated flood hazard areas are eligible for flood insurance under the National Flood Insurance Program (NFIP).
- b. Follow recommendations associated with a “No Adverse Impact” methodology in land use decisions.

5.1.6. Natural Resources

- a. Ensure that the existing health ordinance is enforced to maintain protection of both surface and groundwater supplies.
- b. Ensure that permits issued for development near sensitive areas, such as steep slopes, high elevations, wetlands, scenic vistas and wildlife habitats contain conditions assuring conformance to the goals set forth in this plan.
- c. The Planning Commission should work with the NVDA to continue the process of identifying the Town’s land conservation priorities and to the degree possible, link them to broader regional conservation work.
- d. The Planning Commission shall also be an active participant in the local management plans for Waterford’s Natural Areas.
- e. With recent FEMA guidance on Climate Resilient Mitigation Actions funded under the HMA program, the town will incorporate recommendations accordingly. In line with the VTrans mission statement regarding climate change, the town remains committed to:
 - Ensure that there are viable alternative routes around vulnerable infrastructure such as bridges and roadways

- Make safety a critical component in the development, implementation, operation and maintenance of the transportation system
- Develop contingency plans for a wide variety of climate impacts to be implemented as data/information becomes available
- Utilize information technology to inform stakeholders during times of emergency
- Educate of the public and other stakeholders on the threats posed by climate change and fluvial erosion hazards
- Increase inspection of infrastructure if warranted by climate change indicators
- Apply a decision-making framework to incorporate cost-benefit analyses into adaptive plans and policy
- Work to protect essential ecosystem functions that mitigate the risks associated with climate change
- Educate individuals within the town to use best-practices during recovery periods to avoid ecological damage that may further exacerbate risk
- Recognize the interconnected nature of our built environment with ecological processes
- Protect the state's investment in its transportation system and adapting transportation infrastructure to the future impacts of climate change

f. In line with DEC's best practices regarding fluvial erosion, the town will work to:

- Slowing, Spreading, and Infiltrating Runoff (The State Surface Water Management Strategy is found at: <http://www.watershedmanagement.vt.gov/swms.html> and <http://www.watershedmanagement.vt.gov/stormwater.htm>)
- Avoiding and Removing Encroachments.
http://www.watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm
http://www.watershedmanagement.vt.gov/rivers/docs/rv_RiverCorridorEasementGuide.pdf
- River and Riparian Management: DEC has prepared a compendium of *Standard River Management Principles and Practices* to support more effective flood recovery implementation; improve the practice of river management; and codify best river management practices in Vermont. The document compiles the most current river management practices based on the best available science and engineering methods to create consistent practice and language for risk reduction while maintaining river and floodplain function. Best practices are established to address common flood damages, including:
 - Erosion of banks adjacent to houses and infrastructure
 - Erosion of road embankments
 - Channel movement across the river corridor
 - Riverbed down-cutting that destabilizes banks, undermines structure foundations, exposes utility crossings, and vertically disconnects rivers from adjacent floodplains
 - Bridge and culvert failure

Source: http://www.watershedmanagement.vt.gov/permits/htm/pm_streamcrossing.htm

5.1.6. Policies

- a. Through both town and state-level management, work to:
 - Encourage and maintain naturally vegetated shorelines, buffers and setbacks for all rivers, ponds and streams
 - Allow higher density or cluster development in existing and designated settlement areas and low-density development in the remaining areas
 - Reduce flood hazard and repetitive road and driveway washout through continued updates and adherence to the Town Capitol Budget and Road Plan
 - Identify and manage pollution, flooding and fluvial erosion hazards along rivers and streams as they arise

5.1.7. Transportation

In adjunct to town-specific planning, the town is committed to continually subscribing to all current state standards related to:

- a. Maintaining safe operating conditions on the present system of town roads through design to keep traffic at appropriate speeds and timely maintenance, including consideration of additional paving (though only on portions of roads prone to damage) should state funding become available.
- b. Protection of existing town roads from flood damage and uncontrolled storm water runoff.
- c. Preserving the capacity of town roads and maintain adequate traffic flows and safety.
- d. Support the road maintenance crew through Town-provided training sessions.
- e. Ensuring that owners and managers of recreational areas provide and maintain adequate and safe parking facilities.
- f. Continuing long term access opportunities to gravel and sand deposits for future road maintenance use.
- g. Consider implementation of a formal tracking mechanism by-which all infrastructure work is accounted for on a site-by-site basis. The purpose of this is to open funding possibilities under the HMGP.
- h. Continue to enhance understanding of the Incident Command Structure (ICS) as means to achieving enhanced communications during a response phase where significant increases in highway department responsibilities are required.
- i. Using ICS as a foundation, develop a Standard Operating Procedure for enhanced Highway Department activity (snow and/or flood related) that details the relationship and responsibilities of the Road Commission (Selectboard), Road Foreman and employees that is based on best practices and needs through a collaborative effort.

5.1.8. Utilities and Facilities Goals

- a. Maintain current relationships with the Vermont State Police and rescue for police and emergency medical services, respectively.

- b. Identify effective locations for tanker truck access to water in portions of town that currently do not have adequate supplies.
- c. Promote high-speed internet access throughout town to assist and encourage local businesses to reside in Waterford.
- d. Identify resources/grant programs that can serve to enhance the equipment resiliency of the fire department.

5.1.9.1 Educational Facilities

- a. Ensure that the necessary equipment exists at the school for its use as an emergency shelter.
- b. Increase emergency planning cohesion between school and town EOPs through mutual participation and presentation at scheduled LEPC meetings and town and/or school meetings.

5.2 Existing Town of Waterford Actions that Support Hazard Mitigation

The town has done an excellent job at monitoring and addressing transportation issues, engaging in a documented and systematic approach to mitigation actions. The town has successfully pursued funding to address needs as evidenced by the Total Highway Revenue for 2020 at \$778,926.86 (\$578,678.00 from taxes) and budgets nearly \$704,578.00 for the Highway Department. Fire Department Revenue for 2020 was \$94,227.57; budget was \$93,531.00. The town continues to update highway equipment and purchased a 10-wheel dump truck in 2021.

Using Better Back Roads, Structures Grants, FEMA funding streams and its own resources, the town has been able to enhance its transportation resilience and overall preparedness. By and large, road improvement projects remain the primary focus for the town and there remains outstanding projects as result of the May 2011 event. The town will seek local, state and federal resources to address these sites systematically and as new priorities arise in the next five years. Along these lines, the town has adopted Road and Bridge Standards that meet or exceed the 2013 standards. The town is in process of updating its Town Plan and has updated its Local Emergency Operations Plan. The town participates in the NFIP and has Zoning Regulations that reflect its commitment to mitigating flood risk. The towns Emergency Management Coordinator is active in attending drills and exercises and the school has a crisis planning team and the technology to alert residents of emergencies related to school operations and potentially, all-hazards. Table 5-1 further identifies existing mitigation actions with suggestions for next steps, when applicable.

Table 5-1: Existing municipal actions that support hazard mitigation

Type of Existing Protection	Description /Details/Comments	Issues or Concerns	Responsible Party
Emergency Response			
Police Services	Vermont State Police/ Caledonia County Sherriff	None at this time	n/a
Fire Services	Waterford VFD	The Rescue Truck was replaced in 2016 and in good operational standing. There is a need for a new tanker/pumper which is being built and be ready by the end of 2022	Selectboard, WVFD
Fire Department Personnel	Waterford VFD	Proper training to respond to major highway accidents that may involve hazardous substances.	See above
Fire Department Mutual Aid Agreements	Informal relationship with two bordering towns will continue	None at this time	See above
EMS Services	Calex	Annual contract between town and Calex will continue	Calex
Other Municipal Services			
Highway Services	Town Highway Department	ICS training. Establish SOP with Road Commission in times of heightened response	Road Commission/Foreman
Highway personnel	3 FTE field personnel		See above
Water / Sewer Department	None	None at this time	n/a
Planning and Zoning personnel	Yes	None at this time	Planning Commission/ZA
Residential Building Code / Inspection	No	None at this time	n/a
Emergency Plans			
Local Emergency Operations Plan (LEOP)	2021	Assure sheltering plans and contact information are up to date and vulnerable populations addressed.	Selectboard, EMD, NVDA
School Emergency/Evacuation Plan(s)	2021	Increased collaboration (with town staff, LEPC, NVDA), knowledge of roles and drills are next step. Investigate logistics of using school notification for all-hazard notification.	School Crisis Team, selectboard
Municipal HAZMAT Plan	None	Not required but enhanced knowledge via HMEP funded transportation study through LEPC would benefit town and fire.	Selectboard, EMD, WVFD
Dam Emergency Plans	Great River Hydro has shared its comprehensive Emergency Response Plan with the Town.	Invite representatives to LEPC and town to increase collaboration. Assure understanding of risk and associated protocol for residents and impacted town infrastructure (if any).	Great Bay Hydro, WVFD, EMD
Shelter, Primary	Waterford School	Work with ARC with Sheltering Initiative to obtain training and supplies. Include volunteer staff in planning communication and schedule drills to test efficacy.	EMD, NVDA, Selectboard
Replacement Power, backup generator	Yes, installed	None at this time	See above
Shelter, Secondary:	Union Baptist Church	Assure continued communication lines are open and contacts are correct.	See above
Replacement Power, backup generator	Fire Dept. owns portable generator and can supply church	Need to verify connections, confirm which circuits are powered and have periodic load tests.	See above, WVFD
Municipal Plans			

Town / Municipal Comprehensive Plan	2016	Update in Process	Planning Commission, NVDA
Town of Waterford Road Erosion Site Inventory	Scheduled for 2022	NVDA will complete	NVDA, Road Commission, Foreman
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	Yes, 2013 Zoning Bylaws address	Consider formal adoption of no development in SFHA	Planning Commission, ZA
Participation in National Flood Insurance Program (NFIP) and Floodplain/Flood Hazard Area Ordinance	Yes	Continue best practices and a no-adverse-impact policy approach to development.	ZA
Culvert and bridge Inventory	2015	https://vtculverts.org/map https://vtculverts.org/bridges#list Keep up to date.	Road Commission, Foreman

5.3 Town of Waterford All-Hazards Mitigation Goals

The following goals were developed by the planning team, vetted during a warned community meeting and approved during the development of this plan:

- Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
- Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
- Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- Maintain mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the multi-jurisdictional municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission, Selectboard and NVDA and integrate the strategies into the existing town plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- Maintain mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Planning Commission will review the plan and use language/actions from it to inform the integration and update process. Town Meeting Day will serve as the formal

time that mitigation strategy budgetary considerations will be approved and incorporated into the town budgets.

5.4 Mitigation Actions

In following FEMA guidance, the following mitigation action categories form the basis of the town's future mitigation actions. For each mitigation action to follow, an indication of group will be given with the abbreviations listed below:

Mitigation Action Groups:

(P) Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

(PP) Property Protection: Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter-resistant glass.

(PEA) Public Education & Awareness: Actions to inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

(NRP) Natural Resource Protection: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

(SP) Structural Projects: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms

5.4.1. Current Capabilities and Need for Mitigation Actions

The Town Plan's goals and policies that support hazard mitigation and the existing mitigation actions demonstrate the variety of policies and actions forming the foundation of this All-Hazards Mitigation Plan Update. Generally, the Town considers its existing capabilities are adequate to address the identified priority hazards in this update. As with most towns in the state, mitigating flood-prone areas is a continuous effort that sees increased attention following a major event. The town remains aware and diligent in keeping up with mitigation actions for all municipal systems. There exists a collaborative spirit that not only is valued but serves to

enhance efficiency of action what needs to be done. The Town regards its current hazard mitigation efforts carried out by the road departments as adequate to address winter storm impacts to local roads, however temporary road closure due to winter storms may isolate parts of town. Winter storms are often the cause of the power loss and telecommunications failure. Tree trimming and vegetation management coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation. However, the town can incorporate the use of public information to support community resilience during a power outage. As part of the strategies defined in this plan, the town will develop a plan for mass communication and, if telecommunication lines are down, a method for alerting residents of the alternate means of information dissemination and/or protocol (e.g., shelter logistics). Major infrastructure that has seen repeated damage due to flooding is a concern for the town and remaining active in identifying priorities, working with State Transportation and Natural Resource Agencies as means to increasing infrastructure resilience is a priority.

Progress in Mitigation Efforts

The resulting mitigation actions taken in response to the events of 2011 have served to protect the town during subsequent flooding events. The table below provides status updates on the mitigation actions specific to infrastructure projects listed in the last approved plan.

Table 5-2: Summary of Progress :

Action #1: Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs

Identified Projects and Status:

1. River Road: Replace 2 culverts with one box culvert (Completed)
2. Lower Waterford Road: Replace culverts with 8’Wx6’Hx50L section of concrete and remove 2 current pipes (Completed)
3. Mad Brook Road Culvert: Replace with 8Wx6Hx40’L box culvert (Completed)
4. Duck Pond Road: Upgsize to larger pipe (36’ steel corrugated) (Completed)
5. Hale Road: Remove both pipes and install 4x12 box culvert (Not repaired)
6. Old County Road: Remove both pipes and install 4x12 box culvert (Not repaired)

Status: In addition to the specific projects mentioned above, the town continues an operational protocol that succeeds at maintaining quality of assessment, planning, and address of identified problems.

Action #2: Maintain and improve resilience to severe winter storms

Status: Snow removal operations and machinery are assessed annually to assure optimal performance.

Action #3: Reduce risk and impact of major transportation incidents

No action taken aside from standard sources of information regarding protecting pipes from freezing and financial assistance through state and federal programs.

Action #4: Reduce risk and impact of extreme cold durations

Status: The school and fire department maintain a regular schedule of drills related to evacuation and fire. However, sheltering plans was not addressed or modified in the planning period.

Action #5: Reduce vulnerability to high wind events with accepted best practices

Status: The town continues to maintain coordination with electric utility companies

Action #6: Raise public awareness of hazards, hazard mitigation and disaster preparedness

Status: Of most importance is the role of the town during the COVID-19 pandemic as it relates to local, state and Federal guidance, assistance, and protective measures. The economic impact of the pandemic was felt strongly in addition to the health risk of the virus.

Action #7: Complete fluvial geomorphology (in coordination with state recommendations and Protocol) assessment and develop strategies in response to any identified risk

Status: No action taken based on resources and capacity. However, the state-led road erosion assessment has started for communities in the county and while distinct from river geomorphology, a necessary and functional mitigation action.

5.4.2 Specific Mitigation Actions

The following actions define the mitigation measures to be taken by the town in the next five years:

- Action #1: Reduce flood and flood-related risk through policy and infrastructure enhancement.
- Action #2: Improve resilience to severe winter storms
- Action #3: Reduce impact of extreme cold durations
- Action #4: Reduce risk and impact of a pandemic event
- Action #5: Improve resilience to high wind events
- Action #6: Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risk

5.4.2. Prioritization of Mitigation Strategies

Because of the difficulties in quantifying benefits and costs, it was necessary to utilize a simple “*Action Evaluation and Prioritization Matrix*” in order to affect a simple prioritization of the mitigation actions identified by the town. This method is in line with FEMA’s STAPLEE method. The following list identifies the questions (criteria) considered in the matrix so as to establish an order of priority. Each of the following criteria was rated according to a numeric score of “1” (indicating poor), “2” (indicating below average or unknown), “3” (indicating good), “4” (indicating above average), or “5” (excellent).

- Does the action respond to a significant (i.e. likely or high risk) hazard?
- What is the likelihood of securing funding for the action?
- Does the action protect threatened infrastructure?
- Can the action be implemented quickly?
- Is the action socially and politically acceptable?
- Is the action technically feasible?
- Is the action administratively realistic given capabilities of responsible parties?
- Does the action offer reasonable benefit compared to its cost of implementation?
- Is the action environmentally sound and/or improve ecological functions?

The ranking of these criteria is largely based on best available information and best judgment of project leads. For example, all road improvement projects were initially identified by Road Foreman and approved for inclusion in this plan by the road commission. It is anticipated that, as the town begins to implement the goals and actions of their Mitigation Strategies, they will undertake their own analysis in order to determine whether or not the benefits justify the cost of the project. Also, most proposed FEMA HMGP mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

Table 5-2: Waterford Action Evaluation and Prioritization Matrix

Rank	Mitigation Action	Responds to high hazard	Funding potential	Protection value	Time to implement	Social and Political acceptance ²	Technical feasibility	Admin feasibility	Benefit to Cost	Environmental advantage	TOTAL
1	Improve road infrastructure and municipal systems protection programs	5	4	5	3	5	4	4	5	4	41
2	Improve resilience to severe winter storms	2	5	5	4	5	5	4	5	2	37
5	Reduce impact of extreme cold durations	3	2	4	2	3	2	2	3	3	24
4	Reduce risk and impact of a pandemic event	5	4	5	4	5	3	3	5	1	35
3	Improve resilience to high wind events	4	1	3	5	5	5	5	5	3	36
6	Continue fluvial geomorphology (in coordination with state recommendations and protocol) assessments and develop strategies in response to any identified risk	3	2	4	2	2	2	2	3	3	23

5.4.3. *Specific Mitigation Actions*

Action #1: Reduce flood and flood-related risk through policy and infrastructure enhancement.

Group: SP, NRP, PP

Hazard Addressed: Flooding and Severe Winter Storms

Lead Responsible Entity: Town of Waterford Road Foreman and Selectboard

² All mitigation actions outlined in this plan are, and will continue to be, consistently assessed for feasibility related to the social, political, and financial factors that are inherent to town operations.

Potential Partner Entities: Vermont Agency of Natural Resources; Vermont Agency of Transportation; NVDA, DEMHS, FEMA and the Agency of Commerce and Community Development

Timeframe: Summer 2022- Fall 2026

Funding Requirements and Sources: FEMA or other hazard mitigation grants; FHWA grants; VAOT grants; Municipal Operating and Capital budgets.

Progress: The Road Foreman continually monitors road and storm water management capabilities. Since 2005, all bridges and culverts have been electronically accounted for and the town is diligent in maintaining a comprehensive and newly-formed, Road Erosion Site Inventory Plan that serves to guide action by identifying areas of road erosion, estimated costs of repair and future needs. In 2015, the University of Vermont released Scour research and opportunities for scour sensors.

Specific Identified Tasks:

- 1) Infrastructure Assessment for Storm water Vulnerability – Funding and staff resources permitting, assess the vulnerability and operational capability of municipal-owned roads, culverts and other storm water management infrastructure to predicted storm water and snowmelt in areas with a documented history of recurring problems. The infrastructure will be evaluated regularly prior to replacement or upsizing of the existing infrastructure.
- 2) Policy Actions: Implement a “no development in floodplain” zoning policy
- 3) Road Improvements and Landslide Protection - Within political and financial restraints, re-engineer certain sections of roads to lower overall maintenance costs, improving snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Specific projects, numbered by priority (details included in Road Erosion Site Inventory) include:
 1. **Hale Road 1:** Remove both pipes and install 4x12 box culvert
 2. **Old County Road:** Remove both pipes and install 4x12 box culvert to mitigate scour at narrow portion of road
 3. **Cemetery Road:** Replace metal culvert that is rusting out (critical rating on VTCulverts)
 4. **Hale Road 2:** Culvert upsize required, 100-150 road washes out in area that drains Connecticut River and Chandler Brook
- 4) Documenting – – Develop a methodology that serves to efficiently capture work and expenditures on sites that could benefit from HMGP funding, the town will move forward in mitigating the long-term risk associated with vulnerable infrastructure and its subsequent repair costs. Also, an efficient mapping protocol that combines floodplain areas with zoning, culvert assessments, proposed development and critical facilities is needed and the town will work with NVDA to accomplish this.
- 5) Increase Awareness of Funding Opportunities - Increase understanding of FEMA’s HMGP program so that this potential funding source can be utilized through trainings and communication with the State Mitigation Office.

- 6) ICS Training and Emergency Operations (SOP) Plan Development – Enhance knowledge of the principles of ICS and develop a Standard Operating Procedures that details the relationship, roles and responsibilities of the Highway Department and Road Commission during major events.

Rationale / Cost-Benefit Review: Conducting vulnerability assessments facilitates a targeted and effective approach to road and storm water management infrastructure. This will prove useful in the development and implementation of municipal capital and operating plans as well as the development and implementation of grant-funded mitigation projects. Some areas suffer low-level but consistent damage during heavy rains and snowmelt. Mitigating against these problems would reduce short- and long-term maintenance costs and improve the flow of traffic for personal and commercial purposes during flooding events. Tracking road work and understanding the HMGP program can open funding streams into the town and can make the application process much easier when required information is already available. A basic understanding of ICS will serve the town and at little or no cost. As a requirement for an approved LEOP, municipal ICS-awareness is seen as necessary state-wide. During an emergency event when the Highway Department personnel are required to work beyond normal capacity, increased communication and collaboration between the Highway Department and local entities can be enhanced with a basic SOP. An SOP can also serve to increase institutional memory when there are staff changes at every level as well as provide a template from which tabletops and drills can be based off of.

Action #2: Maintain and improve resilience to severe winter storms

Group: SP, PP, PEA

Hazard Addressed: Severe winter weather

Primary Responsible Entities: Town of Waterford Selectboard, Planning Commission and Emergency Management Director;

Potential Partner Entities: LEPC, Waterford Fire Chief, ARC's Sheltering Initiative Program

Timeframe: Fall 2022- Fall 2026

Funding Requirements and Sources: DEMHS or FEMA hazard mitigation funding; existing programs, contingent on available resources and funding.

Progress: Roads are monitored and altered, when necessary so that plowing can occur without damage to trucks and/or road. Waterford Elementary School has been identified as the primary emergency shelter. The school does have an emergency generator. The Union Baptist Church is the secondary shelter and it does have a generator in place. The Fire Department is the third. Snow clearing equipment is regularly serviced, and the town maintains an adequate supply of salt.

Specific Identified Tasks:

- 1) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the town and intends to move forward on planning and public involvement. More formalized training is required and the

ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.

- 2) Reduce risk of power failure due to ice storms: Enhance collaboration between town road foreman and electric company related to down-limbed induced power failure. Maintain function of generators.
- 3) Notification: Develop a notification/communication plan that conveys essential sheltering information using school phone system and back-up methodology (email, text, etc.)
- 4) Residential Programs: The town will produce and distribute an annual outreach document that will include: family and traveler emergency preparedness information about severe winter weather hazards; installation of carbon monoxide monitors and alarms and education on all fuel-burning equipment that should be vented to the outside.
- 5) Continue to monitor roads for safe and effective plowing: Efficient snow removal is the foundation to winter storm (snow) events, assuring roads are plowable before winter remains an important facet of highway department functions. The town will review its current road equipment plan to assure adequate road and debris clearing capabilities.
- 6) Increase awareness of ICS structure and recommended practices: The town can mitigate the effects of a severe winter by understanding how a large-scale storm is managed when the State EOC is operational. Additional awareness of local-level roles and responsibilities during statewide event is a mitigation action.

Rationale / Cost-Benefit Review:

This mitigation action serves to reduce the economic impact and risk to both human and animal (livestock and pet) health and safety during severe winter storm events by reducing risk and enhancing the mechanisms of winter storm mitigation in the long term. More formalized policy formation in both staffing and notification procedures, especially pertaining to vulnerable populations where transportation and special needs are a concern could potentially significantly reduce the physical, psychological and social impacts of a disaster.

Action #2: Reduce risk and impact of a pandemic event

Group: PEA, PP, SP

Risk or Hazard Addressed: Risk to infrastructure, environment and residents

Lead Responsible Entities: Town of Waterford, ACCD, VDH

Timeframe: Summer 2022- as required

Potential Partner Entities: VEM, FEMA

Funding Requirements and Sources: Pandemic planning funding is secondary to financial stability funding in response to potential economic consequences not known to be a serious consequence of infection mitigation efforts. State and Federal funding are primary sources with limited but important local opportunities.

Specific Identified Tasks:

- 1) Work with facility leads on understanding risk factors and what can be done to mitigate and enhance training and skills for response

- 2) Enhance awareness and planning for COVID-19-related mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability
- 3) Maintain process for funding acquisition related to COVID-19 for schools, government, impacted residents, and other essential services
- 4) Develop and maintain continuity of operations plans for critical government and community services

Action #3: Reduce risk and impact of extreme cold durations

Group: PEA, PP, SP

Risk or Hazard Addressed: Risk to infrastructure, livestock and residents

Primary Responsible Entities: Town of Waterford Selectboard and planning commission, NVDA, Waterford School, local/regional assistance organizations.

Potential Partner Entities: Vermont DMEHS, LEPC

Timeframe: Fall 2022- Fall 2026

Funding Requirements and Sources: Financial factors may produce barriers to change. Strategic planning and understanding of the total scope of needs and potential for change is logical first-step.

Specific Identified Tasks:

- 1) Economic Resilience: Establish relationships with utility companies to offer special arrangements for paying heating bills, if not already required by state law. Develop and sustain a program that serves to connect resource organizations with residents in need of support services.
- 2) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the city and intends to move forward on planning and public involvement. More formalized training is required and the ARC’s “Shelter Initiative Program” can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.
- 3) Assess Vulnerable Population— Develop an awareness of the most at-risk community members during an evacuation and/or sheltering event. Focusing on those that lack resources or capability to reach facilities when in need and create plans, including outreach protocol on how to address this potential hurdle.
- 4) Notification and Education – Investigate and develop a notification/communication plan that conveys essential sheltering information. Educating citizens regarding the dangers of extreme cold and the steps they can take to protect themselves when extreme temperatures occur by sustaining a process that serves to disseminate educational

resources for homeowners and builders on how to protect pipes, including locating water pipes on the inside of building insulation or keeping them out of attics, crawl spaces, and vulnerable outside walls. Inform homeowners that letting a faucet drip during extreme cold weather can prevent the buildup of excessive pressure in the pipeline and avoid bursting through a yearly public service campaign.

Rationale / Cost-Benefit Review:

With an increase in extreme weather, including cold, there is a need to protect property and the population. Given the magnitude of population dependence on social services, indicating economic and other social vulnerabilities, effective outreach, education and collaboration with resources supports this mitigation action category.

Action #4: Reduce vulnerability to high wind events with accepted best practices

Group: P, PP, SP

Lead Responsible Entities: Waterford Planning Commission, Fire Chief, NVDA.

Timeframe Summer 2022- Fall 2026

Specific Identified Tasks:

1. Developing and maintaining a database to track community vulnerability to severe wind: Use GIS to map areas that are at risk to the wind hazard associated with different non-hurricane conditions and identify concentrations of at-risk structures. Create a severe wind scenario to estimate potential loss of life and injuries, the types of potential damage, and existing vulnerabilities within a community to develop severe wind mitigation priorities.
2. Establish standards for all utilities regarding tree pruning around line: Incorporate inspection and management of hazardous trees into the drainage system maintenance process. Support and suggest the testing of power line holes to determine if they are rotting. Support the inspection of utility poles to ensure they meet specifications and are wind resistant. When feasible, support burying power lines to provide uninterrupted power after severe winds. Avoid use of aerial extensions to water, sewer, and gas lines when possible. Support use of designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.
3. Public Outreach: Ensure that school and hospital officials are aware of the best area of refuge in buildings and that their plans are viable in high wind mitigation events. Instruct property owners on how to properly install temporary window coverings before a storm. Support education to design professionals to include wind mitigation during building design/modification to an extent deemed necessary.

Rationale / Cost-Benefit Review:

High winds have impacted the city and do pose a risk for infrastructure, transportation and public safety. Many mitigation actions associated with high wind risk also address and reduce risk associated with other hazards affecting the city and maintaining the functionality of the city is not only important for the city and its residents but for the region as well.

Action #6: Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risks

Group: P, NRP, PEA, PP

Hazard Addressed: Flooding and fluvial erosion

Primary Responsible Entities: Department of Environmental Conservation District Representative, NVDA Planners, Agency of Natural Resources (VT ANR) District Representative, Town of Waterford Planning Commission.

Potential Partner Entities: Nonprofits, other Town of Waterford officials, and other appropriate entities.

Timeframe: 2016–2021

Progress: DEC has completed assessments for Basin ID 15 (Passumpsic). NVDA can assist in enhanced mapping of the floodplain within the town and has provided the town with updated River Corridor Maps. The town has adopted flood hazard area zoning regulations and is considering a “no development” policy in the SFHA for the future.

Specific Identified Tasks

- 1) Fluvial Geomorphic Assessments – The town will work with DEC through coordinated meetings, workshops and communication to increase understanding of current findings and develop an applicable framework to help guide decisions related to priority infrastructure work and vulnerability.
- 2) Fluvial Erosion Hazard Mapping – Develop a fluvial erosion hazard map for the waterways, using the GIS extension known as SGAT (or Stream Geomorphic Assessment Tool) for assessed stream reaches. As assessments are completed, a map of all assessed waterways in the town will be created.
- 3) River Corridor Management Plans – Using the River Corridor Maps, the town will develop an outreach strategy to residents/structures in or near the defined corridor. This communication should focus on flood resilience measures and opportunities. With the lack of repetitive loss properties in the town, the likelihood of viable HMGP acquisition projects is low but increasing awareness of this program can serve the town well.
- 4) Fluvial Erosion Hazard Mitigation Implementation - The town will draft strategies to avoid or mitigate losses from the identified fluvial erosion hazards. These strategies may include the adoption and implementation of programs, mechanisms or regulations to prevent endangerment of persons and property in riparian corridor areas from fluvial adjustment processes. Efforts could range from a relatively simple, public information campaign about the map to the adoption of a municipal ordinance or by-law that restricts development in such hazard areas.

- 5) Administrative and Zoning Regulations: Zoning administrator will work with town officials and residents to determine if a “Zero Development” policy in high flood/erosion risk areas is required in the town and progress accordingly.

Rationale / Cost-Benefit Review:

Continuing this project will require a sustained succession of grants, state appropriations and other funding to complete assessments in Waterford. Successful completion will provide municipal and regional benefits. The municipality’s fluvial erosion areas would be adequately and electronically mapped. This will enable the municipality to make residents and businesses aware of fluvial erosion hazards and potentially lead to municipally directed programs, mechanisms and regulations that further mitigate against this hazard, protecting existing structures and infrastructure. Identifying fluvial erosion hazard areas could also help the municipality restrict future development in hazardous areas, if that should be an advantage to the town in the future. More accurate knowledge of fluvial geomorphology will enable the community to have a better understanding of hazard areas and what mitigation measures might most effectively address those concerns. Flooding is the most common and most significant hazard that can trigger a Federal disaster declaration in Waterford. Along with an update to the flood hazard area maps, identifying the fluvial erosion hazard areas provides improved opportunities for the community to mitigate potential losses and gauge future development initiatives. With the upcoming advent of an advanced software system (CAI), the town can begin to develop enhanced mapping in-house using currently available data and use this resource as a guide for communication, planning and policy formation.

5.5 Implementation and Monitoring of Mitigation Strategies

5.5.1. Public Involvement Following Plan Approval

After adoption, the town will continue to maintain web-presence of the mitigation plan with an opportunity for community input available on its website. Additionally, the town will hold an annual public meeting after performing the annual progress report for the mitigation plan to discuss achievements and the following year's implementation plan. At town meeting, the town will present mitigation information and provide the public an opportunity to increase understanding and involvement with planning efforts. The LEPC will also host an annual mitigation plan presentation where response/state agencies, neighboring communities and other stakeholders can provide input. The town will also notify its neighboring municipalities of the availability of information for review and any significant risks and/or mitigation actions that have an impact on surrounding towns.

5.5.2. Project Lead and Monitoring Process

The town's Selectboard chair is the project lead and will work in conjunction with the Selectboard, town clerk and NVDA to complete the yearly progress report included in the plan. The town will create a mitigation action collection system that will be used as the source of future updates following the annual evaluation that will occur in conjunction with the progress report using the Plan Implementation Matrix provided below. While mitigation actions are, by default, often addressed at monthly Selectboard meetings, the town will schedule one meeting annually to formally assess the plan and adopt updates following the annual progress report and

community meeting regarding the LHMP. Once the plan is approved by FEMA, the calendar will begin for annual review. The town will take the following implementation matrix and add actions to it each year, modifying tasks and/or needs as required so that the next LHMP update will be populated with the specific actions related to each mitigation strategy by year.

5.5.3 Plan Evaluation and Update Process

The town's Selectboard chair will lead the plan evaluation process as part of the annual progress report. Prior to town meeting and in preparation for the annual town report, a mitigation section will be included that provides an executive summary for the public that addresses the following topics:

- Status of recommended mitigation actions for the five-year planning period
- Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk
- Identification of a lead person to take ownership of, and champion the Plan if different from Selectboard Chair
- An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.)
- Discussion of how changing conditions and opportunities could impact community resilience in the long term
- Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience

By engaging in the annual evaluation, the town will have a viable method for capturing the facets of efficacy and areas needing revision and improvement in its mitigation plan. The town is committed to "institutionalizing" mitigation into its normal operating procedures and with approval of this plan, embarks on the formal incorporation of mitigation actions and discussion, maintaining an awareness that involves not only the Selectboard, Town Clerk and Road Foreman but also the community at large, including the organizations represented by the current planning team. Along these lines, the town will maintain a contact list of the current planning team and make revisions as required, including the team on the evaluation process each year. Through this consistent attention resulting from the evaluation process, progress reports and communication in the annual town report, the town will achieve the consistency required to enhance resilience through planning, assessment and actions devoted to mitigation.

5.5.4. Plan Update Process

The Plan update will be led by the Selectboard Chair and Town Clerk. Depending on funding availability, the town may elect to acquire the assistance of NVDA and/or a consultant to update the plan following a declared disaster and/or the next five-year planning cycle. To assure that the Plan does not expire, the town will begin the update process within no less than six months of the current Plan's expiration date. Following a disaster and during the recovery phase, the town will use the experience to assess the current Plan's ability to address the impact of the most recent disaster and edit the plan accordingly. Using the annual progress reports and evaluation narratives as a guide, along with perceived changes in risk or vulnerabilities supported by data and/or observation, strategies will be captured in accordance with FEMA guidelines, which includes reconvening the planning team during the update process. The town will establish a

“Mitigation File” that documents all evaluations and progress reports, along with actions, especially related to infrastructure improvement projects. While the progress reports are designed to capture the specific actions the town has accomplished related to implementation, keeping a narrative list with dates on all actions relatable to mitigation (e.g. school drills, LEOP updates, Fire Safety Awareness, meetings, etc.), will provide the town the bulk of information required in the update process.

5.5.5. Implementation Matrix for Annual Review of Progress

The following table is intended to aid municipal officials in implementing the mitigation actions for Waterford and to facilitate the annual monitoring and progress reporting. Progress has been included as a guide to future updates. Each year, the town will reserve a Selectboard meeting to review and update the Implementation Matrix as means to establishing an accurate evaluation of the plan’s efficacy and the information required for the succeeding update to the plan. The following table is intended to aid municipal officials in implementing the mitigation actions for Waterford, and to facilitate the annual monitoring of the plan.

Table 5-3: Waterford All-Hazards Mitigation Plan Implementation Matrix

Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Improve road infrastructure and municipal systems protection programs	Town Road Foreman and associated municipal systems managers	Spring 2022 and each subsequent spring	Infrastructure Assessment for Storm Water Vulnerability	
	Town Road Foreman	Spring 2022 and as-needed related to weather patterns	Assessment for Fluvial Erosion, Landslide Vulnerability	
	Town Road Foreman	As needed during entire planning period	Culvert Upgrades	
	Town Road Foreman and associated municipal systems managers	Ongoing each fall and spring of planning period	Continued Monitoring of Vulnerable Infrastructure	
	Town Road Foreman	Spring 2022- Fall 2026 (each project will be selected based on capability and level of need within the planning period	1.Hale Road 1: Remove both pipes and install 4x12 box culvert 2.Old County Road: Remove both pipes and install 4x12 box culvert to mitigate scour at narrow portion of road 3.Cemetery Road: Replace metal culvert	

Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Maintain and improve resilience to severe winter storms	Town Selectboard and Road Foreman	Fall 2022 and each subsequent fall	Maintain Existing Shelter Capability	
	Town Selectboard and Road Foreman	Fall 2022 and each subsequent fall	Reduce risk of power failure due to ice storms	
	Town Selectboard and Road Foreman	Winter 2022- Summer 2026	Notification	
	Town Selectboard and Fire Chief	Winter 2022- Fall 2026	Residential Programs	
	Town Road Foreman	Fall 2022 and each subsequent Fall in planning period	Monitor roads for safe and effective plowing	
	Town Selectboard and Road Foreman, Fire Chief	Fall 2022- Winter 2026	Increase awareness of ICS structure and recommended practices	

that is rusting out (critical rating on VTCulverts)

4. Hale Road 2: Culvert upsized required, 100-150 road washes out in area that drains Connecticut River and Chandler Brook

Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Reduce impact of extreme cold durations	Town, NVDA, School, local/regional assistance organizations.	Winter 2022 and ongoing each fall	Economic Resilience	
	Town EMD and Selectboard	Fall 2022 and ongoing as preparation for winter	Maintain Existing Shelter Capability	
	Selectboard, NVDA, School, local/regional assistance organizations.	Fall 2022 and ongoing as preparation for winter	Notification and Education	
	Fire Chief, Planning Commission,	Fall 2022- Fall 2023	Assess Vulnerable Population	
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Reduce vulnerability to high wind events with accepted best practices	Selectboard, Local Utility leads, Fire Chief, LEPC, NVDA	Summer 2022- Spring 2026	Assure ongoing planning relationships and collaboration with utility leads for mitigated power/communication loss resulting from downed trees. Establish or work to assure standards for all utilities regarding	

	<p>tree pruning around line</p> <p>Support and suggest the testing of power line holes to determine if they are rotting. Support the inspection of utility poles to ensure they meet specifications and are wind resis</p>		
	<p>Developing and maintaining a database to track community vulnerability to severe wind:</p> <p>Use GIS to map areas that are at risk to the wind hazard associated with different non-hurricane conditions and identify concentrations of at-risk structures. NVDA mapping could layer structure density by tree density against known</p>	<p>Summer 2022- Spring 2026</p>	<p>Selectboard, NVDA, Road Foreman</p>

			high-wind risk areas as start.		
	Schools and Selectboard	Fall 2022- Fall 2026	Create a severe wind scenario to estimate potential loss of life and injuries. Initial emphasis should be placed on mobile homes.		
	Planning Commission, Utility leads, Emergency	Fall 2022 and ongoing as needed	Learn the types of potential damage, and existing vulnerabilities to develop severe wind mitigation priorities.		
	Fire Chief, LEPC	Winter 2022 and on-going as needed	Incorporate inspection and management of hazardous trees into the drainage system maintenance process.		
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress	
Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risks	Department of Environmental Conservation, NVDA, Agency of Natural Resources (VT ANR), Selectboard	Spring 2023- Fall 2024	Fluvial Geomorphic Assessments	DEC has a comprehensive and interactive database for Basin 15 and TransCanada has done some of this work in the past that the town can build from.	

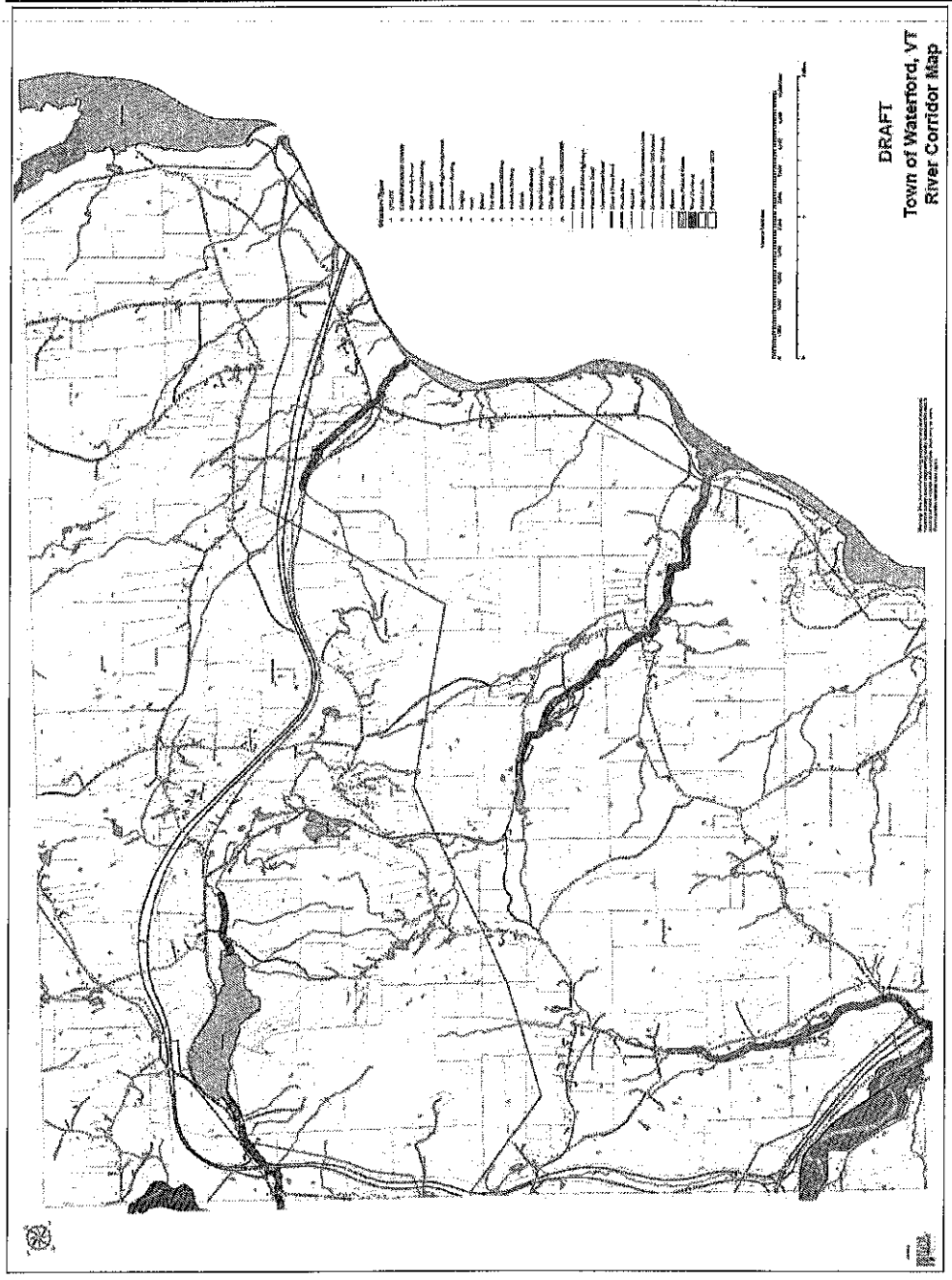
	Department of Environmental Conservation, NVDA, Agency of Natural Resources (VT ANR), NVDA	Spring 2024- Fall 2024	Fluvial Erosion Hazard Mapping	The town has CAI software capabilities and can enhance knowledge and bases for policy with mapping abilities.
	Department of Environmental Conservation, NVDA, Agency of Natural Resources (VT ANR)	Spring 2023- Fall 2023	River Corridor Management Plans	Zoning Administrator has taken the lead in suggesting a no-development policy in SFHA and River Corridor.
	Department of Environmental Conservation, NVDA, Agency of Natural Resources (VT ANR)	Spring 2023- Fall 2023	Fluvial Erosion Hazard Mitigation Implementation	Major infrastructure enhancement has occurred on Simpson Brook (Hale Road) that withstood Irene.
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Reduce risk and impact of a pandemic event	Selectboard. Planning Commission ACCD, VDH, NVDA, school	Summer 2022- Spring 2023 (as-required)	Work with facility leads on understanding risk factors and what can be done to mitigate and enhance training and skills for response. Explore ESSER funding for school.	

	Selectboard, Planning Commission ACCD, VDH, NVDA	Summer 2022- Spring 2023 (as- required)	Enhance awareness and planning for COVID-19-related mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability	
	Selectboard, Planning Commission ACCD, VDH, NVDA	Summer 2022- Spring 2023 (as- required)	Develop and maintain continuity of operations plans for critical positions	

APPENDICES

Appendix A: River Corridor Map: Town of Waterford
Appendix B: Community Survey

Appendix A: River Corridor Map: Town of Waterford



Appendix B: Community Survey:

Solicitation for the Community Survey was made available via the town’s website and ran in the local paper on the following dates:

- Wednesday, January 19th
- Saturday, January 22nd
- Saturday, January 29th

zoom
BOARD MEETINGS
Select board meetings will be held in the Davies Memorial Library

FEMA

Hazard Mitigation Plan Update
Community Input Requested

Waterford is in process of updating its Hazard Mitigation Plan. Your input is important and valued. Please use the link below to obtain a brief survey and submit via email or mail by February 4th, 2022.

Please complete the outreach form (below), and email to townofwaterford@gmail.com, or print and mail to the town, 522 Maple St. Lower Waterford, VT 05848.

[Community Outreach Form](#)

Other Board Meetings may continue to be held via Zoom. The ZOOM login info for each is below. Simply click on the board meeting you wish to join, or follow the info below.

2022 Waterford Hazard Mitigation Community Outreach Form

Introduction: Hello, the town is in process of updated their Hazard Mitigation Plan. Mitigation planning works to protect a community from natural hazard vulnerabilities and is a mandatory requirement before any FEMA funding can be awarded to a town to repair infrastructure or acquire critical equipment. By maintaining an approved plan, the town can earn a greater percentage of state funding during recovery from a disaster and be better prepared to handle a future event. Your input is crucial to the planning process and the information you provide will help produce a plan that will serve the town for years to come. Please take the time to share your thoughts on the questions below. Thank you!

Please return form to: Town of Waterford by February 4th:

- Mail: 532 Maple St. Waterford, VT 05848
- In-person to Town Clerk
- Email: townofwaterford@gmail.com

Community Survey:

1. Have you been impacted by a natural disaster, including COVID-19? Yes or No? If yes, please explain: _____

2. What are your general concerns about emergency events in the area?

3. What do you think the community should plan to accomplish to be better prepared for the next emergency event?

4. What other thoughts or concerns do you have about emergencies, natural hazards and emergency response in the town? _____

(use back of page if needed)