



Town of Chelsea, VT

Local Hazard Mitigation Plan

Adopted December 7, 2021

Approved December 10, 2021

Prepared by the Two Rivers-Ottawquechee Regional
Commission and the Town of Chelsea, VT



U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

December 10, 2021

Stephanie A. Smith, State Hazard Mitigation Officer
Vermont Emergency Management
45 State Drive
Waterbury, Vermont 05671-1300

Dear Ms. Smith:

As outlined in the FEMA-State Agreement for FEMA-DR-4474, your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. Our Agency has been notified that your office completed its review of the Town of Chelsea, VT Local Hazard Mitigation Plan and approved it effective **December 10, 2021** through **December 9, 2026** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

With this plan approval, the jurisdiction is eligible to apply to Vermont Emergency Management for mitigation grants administered by FEMA. Requests for funding will be evaluated according to the eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in this community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

The plan must be updated and resubmitted to the FEMA Region I Mitigation Division for approval every five years to remain eligible for FEMA mitigation grant funding.

Thank you for your continued commitment and dedication to risk reduction demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please contact Jay Neiderbach at (617) 832-4926 or Josiah.Neiderbach@fema.dhs.gov.

Sincerely,

Paul F. Ford
Acting Regional Administrator
DHS, FEMA Region I

PFF:jn

cc: Ben Rose, Recovery and Mitigation Section Chief, VEM

CERTIFICATE OF ADOPTION
December 7, 2021
TOWN OF Chelsea, Vermont Selectboard
A RESOLUTION ADOPTING THE Chelsea, Vermont 2021 Local Hazard Mitigation Plan

WHEREAS, the Town of Chelsea has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **Chelsea, Vermont 2021 Local Hazard Mitigation Plan**, which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of **Chelsea** has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its **Chelsea, Vermont 2021 Local Hazard Mitigation Plan (Plan)** under the requirements of 44 CFR 201.6; and

WHEREAS, the **Plan** specifically addresses hazard mitigation strategies, and Plan maintenance procedures for the Town of **Chelsea**; and

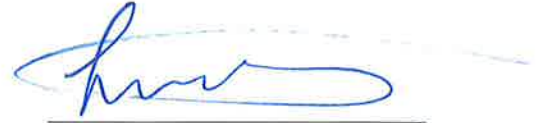
WHEREAS, the **Plan** recommends several hazard mitigations actions (projects) that will provide mitigation for specific natural hazards that impact the Town of **Chelsea** with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this **Plan** will make the Town of **Chelsea** eligible for funding to alleviate the impacts of future hazards; now therefore be it

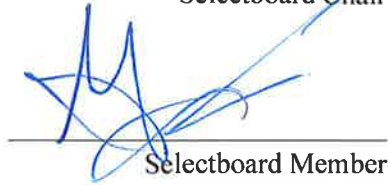
RESOLVED by Town of **Chelsea** Selectboard:

1. The **Chelsea, Vermont 2021 Local Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of **Chelsea**;
2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution; and
4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of **Chelsea** this 7 day of December, 2021.

A blue ink signature, appearing to be "H. M.", written over a horizontal line.

Selectboard Chair

A blue ink signature, appearing to be "M. J.", written over a horizontal line.

Selectboard Member

Attest

A blue ink signature, appearing to be "Phyllis Hayward", written over a horizontal line.

Town Clerk Assistant

A blue ink signature, appearing to be "Mark White", written over a horizontal line.

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I. Introduction

Natural and human-caused hazards may affect a community at any time. Natural hazard events cannot be stopped; however, their impact on human life and property can be reduced through community planning. Accordingly, this Local Hazard Mitigation Plan (hereafter referred to simply as the Plan) seeks to provide an all-hazards mitigation strategy that will make the community of Chelsea more disaster resistant.

“Mitigation” is defined as any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Previous Federal Emergency Management Agency (FEMA), State and Regional Project Impact efforts have demonstrated that it is less expensive to anticipate disasters than to repeatedly ignore a threat until the damage has already been done. While hazards cannot be eliminated entirely, it is possible to identify prospective hazards, anticipate which might be the most severe, and recognize local actions that can be taken ahead-of-time to reduce the damage. These actions, also known as ‘hazard mitigation strategies’ can (1) avert the hazards through redirecting impacts by means of a structure, land treatment, or land use pattern change (2) adapt to the hazard by modifying structures or standards or, (3) avoid the hazard through improved public education, relocation/removal of buildings in the flood zone, or ensuring development is disaster resistant.

The Four Phases of Emergency Management

Mitigation planning is only one of four phases of emergency management. Preparedness, response, and recovery are the other pieces of the cycle. At any one time, a community may be in more than one phase of emergency management. It is important to distinguish between these four phases, especially between mitigation and preparedness. Mitigation is often confused with preparedness, and vice versa. Below are descriptions of each of the four phases of emergency management:

- **Mitigation:** preventing future emergencies or minimizing their effects
 - Includes any activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies.
 - Buying flood and fire insurance for your home is a mitigation activity.



Figure 1. Four Stages of Emergency Management

- Mitigation activities take place before and after emergencies.
- **Preparedness:** preparing to handle an emergency
 - Includes plans or preparations made to save lives and to help response and rescue operations.
 - Training and proper equipment are preparation
 - Evacuation plans and stocking food and water are both examples of preparedness.
 - Preparedness activities take place before an emergency occurs.
- **Response:** responding safely to an emergency
 - Includes actions taken to save lives and prevent further property damage in an emergency situation. Response is putting your preparedness plans into action.
 - Rescuing people from flooding or putting out a fire are both response activities.
 - Response activities take place during an emergency.
- **Recovery:** recovering from an emergency
 - Includes actions taken to return to a normal, preferably incorporating mitigation actions to create an even safer situation following an emergency.
 - Recovery includes getting financial assistance to help pay for the repairs.
 - Rebuilding damaged roads or providing loans to businesses are both recovery activities.
 - Recovery activities take place after an emergency.

II. Purpose of the Plan

The purpose of this Plan is to assist Chelsea in identifying all hazards facing the town, ranking them according to local vulnerabilities, and identifying strategies to reduce risks from vulnerabilities of highest concern. Implementation of this plan will make our community more resistant to harm and damages in the future. And reduce public costs.

The Town of Chelsea seeks to be in accordance with the strategies, goals, and objectives of the State Hazard Mitigation Plan.

This document is updated from the 2015 Chelsea Local Hazard Mitigation Plan, which was the first stand-alone mitigation plan drafted for the town. Previously, the Town had a town-specific 2009 Annex in the Regional (multi-jurisdiction) Pre-Disaster Mitigation Plan. The 2015 Plan was re-organized, and the following sections had been added, including:

- Program eligibility subsequent to plan approval
- Authority for plan development
- Participating jurisdictions
- Funding for plan development
- Brief information about the community

Old assumptions have been challenged throughout, and new information has been added to make the plan stronger and more useful for the Chelsea town officials and residents who will implement the hazard mitigation strategies in the future.

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This 2021 Plan expands upon the 2015 plan by analyzing new hazards, adding new and relevant data, and creating new mitigation actions for the Town to follow over the next five years. In addition, this newer Plan also serves as an important financial incentive during federally declared disasters. In October 2014, the state enacted new Emergency Relief and Assistance Fund (ERAF) rules that provide additional state matching funds for federal disaster relief under FEMA's Public Assistance Program (FEMA typically requires a 25% match). To qualify, municipalities must have taken four actions: (1) adopt updated road standards, (2) participate in the National Flood Insurance Program (NFIP) by adopting flood hazard area regulations, (3) annually adopt a local emergency management plan, and (4) have a local Hazard Mitigation Plan approved by FEMA. Under ERAF, there is a financial incentive that allows the town to lessen their financial burden during federally declared disasters. By having taken these four basic actions, the state will contribute half (12.5%) of the 25% match on federal disasters.

A fifth action, that not many communities in Vermont do, is to either adopt a River Corridor bylaw or participate in the Community Rating System (CRS). River Corridor bylaws regulate lands mapped by the State of Vermont that are usually beyond the FEMA mapped flood zone, with the concern being erosion that can undermine structures. CRS is a complex administrative process with a simple premise – that taking additional flood prevention steps will lessen flood damages. Communities in the CRS enjoy lower flood insurance rates. Doing either of these fifth actions will lower the financial burden under the ERAF rule to only a 7.5% match for the town. At the time of this writing, the town is financially responsible for 17.5% on the dollar in federally declared disasters due to the expiration of the local hazard mitigation plan.

Separately, in 2014, state planning law (24 V.S.A. Chapter 117) required that all updated municipal comprehensive plans must include a "flood resilience" element, addressing both flooding and fluvial erosion hazards. This requirement was met with the adoption of Stockbridge's Town Plan on August 20th, 2015.

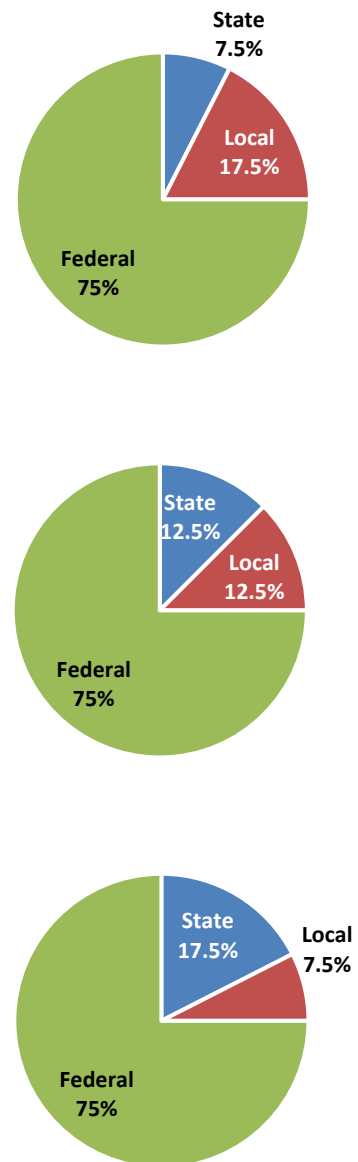


Figure 2. Different Levels of ERAF

III. Community Profile

Chelsea is located near the center of Orange County, and, in 1795, it was designated as the seat of county government, thus becoming the "Shire Town," to use an old English term. The courthouse that stands at the head of the South Common was built in 1847, on nearly the same site as the 1801 structure. In 2010, the population of Chelsea was 1,233, well below their historical high of 1,940 in the late 1800's. Between 2010-2020, the population decreased by .4%.

According to Vermont Housing Data, there were 746 housing units in Chelsea in 2019, an increase of 7.3% from the number of housing units in 2010, which was 695. According to 2019 data, nearly 15.7% of the Town's housing stock was comprised of units for seasonal, recreational, or occasional use. Nearly 33.2% of Chelsea residences were built prior to 1939, according to 2019 housing data.

The Town lies within the service area of Green Mountain Power, which supplies electrical power to the sections of town located along the main roads in Chelsea. Washington Electric Coop supplies electric to the majority of residents located off the main roads.

Volunteer personnel and the equipment of the Fire District Number One provide fire protection for the Town. The Fire Station is located near the center of Chelsea Village on Rt. 110. All of the firefighting apparatuses are housed within this building, along with rented space used by First Branch Ambulance.

The Fire District has an agreement with the Town of Washington to respond to calls south of the height of land, and it also has a mutual assistance agreement with the Tunbridge Fire District. Further, the District is a member of the Capital Fire Mutual Aid System.

In 1995, the Municipal Water System was upgraded along with a very adequate fire hydrant system. In 1995, the Fire Department purchased an air compressor for breathable air. This gives the Fire Department the capability to refill the air bottles on the self-contained breathing apparatus used by firefighters. The District currently has a 2006 tanker that carries 2,500 gallons with a 1,000 gpm pump. The Fire Station has a stand-by generator.

The Orange County Sheriff, Chief Deputy Sheriff and an Administrative Manager provide police services for Chelsea and 17 other towns. The Orange County Sheriff's Office and adjacent facility are located in Chelsea Village on Route 113 (Jail Street). The police facility consists of a set of four rooms for the office, a block of six cells to accommodate 12 detainees on the ground floor, and six cells on the second floor (of which none of them are being used). Detention is limited to 72 hours or to weekend prisoners. A dispatcher is on duty at this location 24 hours a day to accept calls and dispatch a Deputy if one is available. The Sheriff's office also provides a safe environment for victims of domestic violence, sexual violence. After hour court workers, Safeline, Clara Martin staff along with several different law enforcement agencies use our facility after normal daytime hours. The Sheriff's office also can be used for emergency operations center if needed.

Since State Law does not provide for the County to tax residents for law enforcement expenses, including salaries and equipment, the Sheriff's Department operates under contract to towns desiring their patrolling and response services. In addition, the Department contracts for traffic control during road

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paving, utility construction, and other projects at a rate higher than that for contracted services. The difference allows the Sheriff to provide law enforcement to towns in addition to the contracted amount.

The Town of Chelsea also may elect a Constable annually who provides such services as requested by the Selectmen. The Constable has the same authority as the State Police only if they are certified by the Vermont Criminal Justice training counsel.

Chelsea is also served by the First Branch Rescue Squad, which provides service to Chelsea, Tunbridge, and surrounding towns. The closest hospital is Gifford Medical Center, located in Randolph. Medivac services are available by the DHART helicopter.

IV. The Planning Process

A. Plan Developers

Jake Palant, a Regional Planner at the Two Rivers-Ottawaquechee Regional Commission (TRORC), assisted the Town of Chelsea with updating its Hazard Mitigation Plan. LHM Planning Team members who assisted with the revisions include:

This section of the Plan satisfies 44 CFR 201.6(b)(1) and 201.6(c)(1) (or, A3.a and A3.b of FEMA's Local Mitigation Plan Review Guide, 2011).

Name	Role/Organization	How Participation Was Solicited
Tracy Simon	Emergency Management Director	On July 12, 2021, TRORC Staff contacted Tracy Simon, Chelsea Emergency Management Director to offer his assistance in updating the Chelsea Hazard Mitigation Plan. TRORC also requested that the town assemble a small team of plan developers. TRORC staff coordinated with the LHM Planning Team to schedule an initial meeting to review the Hazard Mitigation Plan on August 3, 2021.
Geoff Clayton	Health Officer, Selectboard	
Alan Ackerman	Fire Chief	
Dickson Corbett	Planning Commission member	
Kate MacLean	Selectboard	
Mark Whitney	Selectboard	
Mary Ellen Parkman	Selectboard Vice Chair	
Levar Cole	Selectboard Chair	
Rick Ackerman	Road Foreman	
Tim McCormick	Chelsea Zoning and Floodplain Administrator	
Doug Lyford	Resident	
Carl Pepperman	Resident	
Marianne McCann	Selectboard Administrative Assistant	
Nolan LaFrancis	Chelsea Water/W.W.	
Gayle Durkee	Treasurer	
Karen Lathrop	Town Clerk	

Figure 3. LHM Planning Team Members

B. Plan Development Process

The 2009 Chelsea Annex was originally part of the 2008 multi-jurisdictional Regional Hazard Mitigation Plan, drafted by Two Rivers-Ottawaquechee Regional Commission, and approved by FEMA on September 30, 2008 with its first local annex. The Chelsea Annex received subsequent FEMA approval, but, since it was part of a larger plan, FEMA treats its start date as September 30, 2008, meaning the Chelsea Annex expired on September 30, 2013.

This section of the Plan satisfies the Element A: Planning Process requirements set out in 44 CFR 201.6.

2015 Changes to the Plan

In 2015, this Plan had been reconstructed as a single jurisdiction, stand-alone Chelsea Local Hazard Mitigation Plan that was adopted by the Town of Chelsea Selectboard on November 3, 2015 and approved by FEMA on November 20, 2015. Several sections were added or updated to include all necessary information. Several meetings were held during the 2015 Plan creation. A letter was drafted and emailed to the Selectboard in August of 2014 to create a committee to start the mitigation plan process. A subsequent meeting was held in 2014 on October 2; and in 2015 subsequent meetings were held January 22, and April 23. Notices for these meetings were posted in The Valley News, Herald of Randolph, Journal Opinion, and the Vermont Standard. No substantive comments were received from neighboring communities. The 2015 LHMP expired in 2020.

The 2015 changes to this Plan include:

- **General**
 - New sections: Plan Development Process, 2009 Mitigation Strategies Status Update chart, Existing Hazard Mitigation Programs, Projects & Activities, Plan Maintenance;
 - Data updates: New hazard incidents, emergency declarations, Census data;
 - Hazards have been reevaluated with the hazard ranking system used by the Vermont Division of Emergency Management and Homeland Security.
- **Hazards Analysis**
 - Hazardous Material Spills and Flash Flood/Flood/Fluvial Erosion remained on the list of “top hazards,” which reflected the local officials’ belief that the Town was still vulnerable to these hazards;
 - Extreme Cold/Snow/Ice Storm had been added to the list of “top hazards,” which reflected the intention/priorities of local officials to expand their analysis of hazards that the Town would vulnerable over the following five years;
 - Structural Fire had been removed from the list of “top hazards;”
 - For each hazard, a location/vulnerability/extent/impact/likelihood table has been added to summarize the hazard description.
- **Maps**
 - A map of the Town of Chelsea depicting critical facilities, town infrastructure, and the NFIP designated floodway, the 100-year and 500-year floodplain has been added.

This section of the Plan satisfies 44 CFR 201.6(b)(3) (or, A4.a and A4.b of FEMA’s Local Mitigation Plan Review Guide, 2011).

2021 Changes to the Plan

The 2015 Plan provided a good base for the 2021 Plan update. The changes to the 2021 plan were primarily focused on identifying new hazards and developing new mitigation strategies. On September 10th, 2021, TRORC staff emailed a draft copy of Royalton's LHMP to the Chelsea LHM Planning Team and Selectboard for comments. On September 15th, TRORC staff then emailed the draft to the chairperson of the Selectboard for each of the neighboring communities (See Appendix D for example), including: Vershire, Strafford, Tunbridge, Randolph, Brookfield, Williamstown, Washington, and Corinth. No comments on the draft plan were received from any of the surrounding Towns.

2021 Planning Process and Changes:

- **General**
 - Data updates: new hazard incidents, new federal emergency declarations, and census data.
 - Reevaluation of hazards using a hazard ranking system.
- **Hazard Analysis**
 - An initial public meeting was held on August 3rd, 2021 where TRORC staff met with the LHM Planning Team and interested members of the public to identify and evaluate hazards within Chelsea. The meeting was a hybrid of a virtual meeting with a physical location at Chelsea Town Hall. No citizens were in attendance at the meeting, thus no public comments were received. Notification was placed on the Chelsea town website, the TRORC website, and physically around Chelsea Town Hall.
 - Meeting attendees participated in a hazard ranking exercise and identified a set of top five hazards to be the main focus of this hazard mitigation plan.

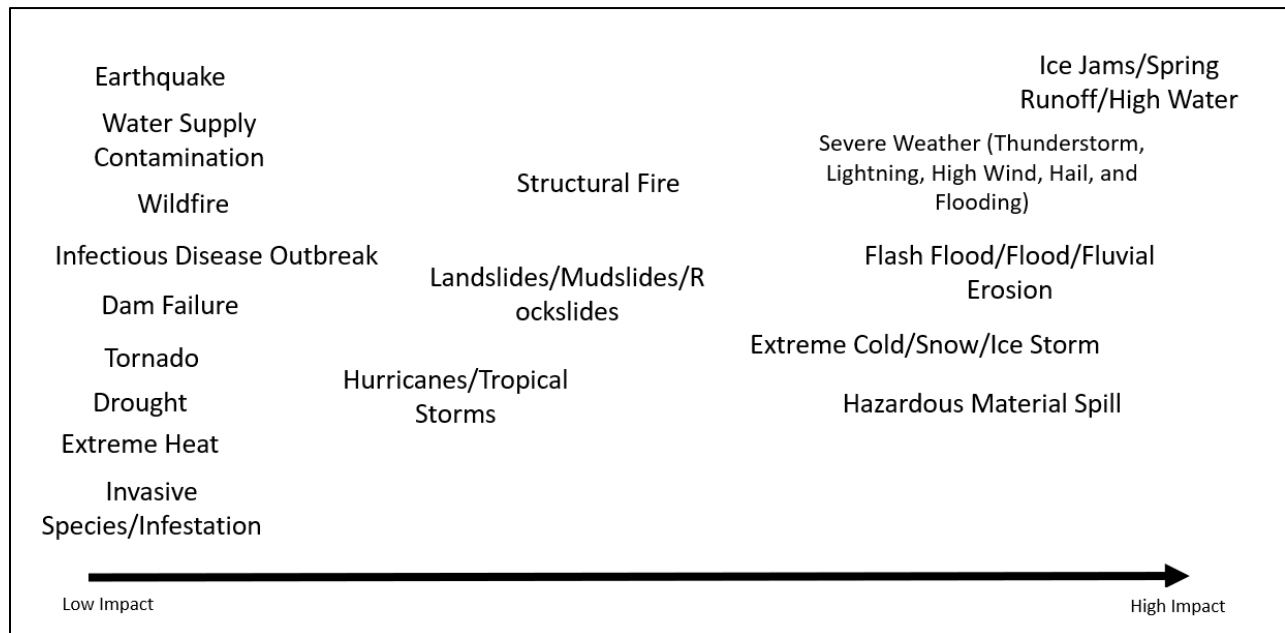


Figure 4. 2021 LHMP Hazard Ranking Exercise

- **Mitigation Strategies**

- A public meeting was held at Chelsea Town Hall on September 7th, 2021 where TRORC staff met with the LHM Planning team and the public to review the status of hazard mitigation actions developed in the 2015 Chelsea LHMP.
- One member of the public was present, who had questions regarding the nature of flooding in Chelsea. The LHM Planning Team provided the citizen with information on the nature of flooding in Chelsea. The issue of flooding is also explained throughout the Hazard Profiles Section of this LHMP and are addressed in the Mitigation Actions proposed. The meeting notice was posted at the Chelsea Town Hall, the Chelsea Town Website, the TRORC Website, and the Randolph Herald.



Figure 5. Flyer for Second Chelsea LHMP Meeting.

- New mitigation strategies were developed for the top five hazards in this plan. Several incomplete mitigation actions from the 2015 were revisited by the LHM Planning Team and reintroduced in the Mitigation Strategies Table in Section VI.C of this Plan.

- **Review**

- A draft of the LHMP was sent to the LHM Planning Team and Selectboard September 10th for initial review. Revisions of the draft LHMP were later sent to the Team and Selectboard on September 28th and October 5th, prior to the third public meeting.
- A third public meeting was held with the Chelsea Selectboard in the Chelsea Town Office, for comment, on October 5th, 2021. The meeting notice was posted at the Chelsea Town Office, the Chelsea Town Website, the TRORC Website, and the Randolph Herald. There was no public comment regarding the LHMP. At the meeting, members of the Selectboard indicated that they wished for additional time to review the plan and scheduled to put the LHMP on the October 19th Selectboard Meeting agenda. The Selectboard also wished to investigate the Emerald Ash Borer as an issue in Chelsea, and

they wished to obtain more detailed information on some of the bridges proposed for replacement on the Mitigation Action Table.

- A fourth meeting was held with the Chelsea Selectboard and TRORC staff on October 19th, to give the selectboard the opportunity to review the plan further. There were no members of the public present who provided any comment at this meeting. Members of the Selectboard voted to move forward with the plan, with stipulation that a comment stating that “the Town is not in agreement with the assessment that this Court Street Bridge is undersized” be removed since there was not substantial evidence of this. The Selectboard Meeting was not warned by TRORC, but it was added as an agenda item and posted to the Town of Chelsea website.

- **Review of existing plans, studies, reports, and technical information**

- State of Vermont Hazard Mitigation Plan, 2018
- Chelsea Hazard Mitigation Plan (Adopted November 3, 2015)
 - This plan was referenced extensively during the update / development process, especially in regard to the worst threats and mitigation action strategies identified in 2015.
- Vermont Housing Data: Community Profile for Chelsea
- Chelsea Town Plan (Adopted November 16, 2015)
 - This plan provided TRORC’s staff with background information on the community, as well as more detail on their emergency services.
- Chelsea’s Local Emergency Management Plan (LEMP) (Last Adopted April 20, 2021)
 - This Plan was referenced for general information about Royalton’s emergency operations.
- Additional data sources are mentioned in the *Hazard Identification* section of this Plan.
 - For Ice Jams/Spring Runoff/High Water: information was collected from the National Centers for Environmental Information.
 - For Extreme Cold/Snow/Ice Storms: information was collected from the National Centers for Environmental Information.
 - For Severe Weather: information was collected from the National Centers for Environmental Information.
 - For Hazardous Material Spills: information was collected from the Vermont Department of Environmental Conservation’s Spill List
 - For Flash Flooding/Flooding/Fluvial Erosion: information was collected from FEMA Database of Declared Disasters and the National Centers for Environmental Information.

This section of the Plan satisfies 44 CFR 201.6(b)(3) (or, A4.a and A4.b of FEMA’s Local Mitigation Plan Review Guide, 2011).

C. Changes in Priorities Since the 2015 Plan

The 2021 Local Hazard Mitigation Plan represents little change in the town’s priorities since 2015. The town’s population has remained mostly stagnant between 2010 and 2020. As one change to the 2021

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plan, the Town included Severe Weather (Thunderstorm, Lightning, High Wind, Hail, and Flooding) as a top hazard due to its high frequency of occurrence in town.

Both this plan and the previous LHMP have focused on upgrading bridges and culverts in order to reduce ice jams along the rivers. The Town completed with three property buyouts identified in the 2015 LHMP; however, the Town has not currently identified any new properties in need of buyout.

D. Status Update on Mitigation Actions Identified in 2015

The following table outlines the mitigation actions that were proposed in the 2015 Local Hazard Mitigation Plan for the Town of Chelsea (adopted on November 3rd, 2015).

This section of the Plan satisfies the requirements of 44 CFR 201.6(d)(3).

Participants in the new Plan update process reviewed these actions and reported on the status of each:

Mitigation and Preparedness Actions	Local Leadership	Prioritization(Mitigation Plan Status)**	Possible Resources*	Time Frame	2021 Status of Mitigation Action
All Hazards					
<i>Ensure that Chelsea's Local Emergency Operations Plan (LEOP) is kept up-to-date and identifies vulnerable areas and references this Plan.</i>	Emergency Management Director, Selectboard	High	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); TRORC; local resources	1 year from date of Plan Approval	<input checked="" type="checkbox"/> Completed. The LEOP has been replaced by the Local Emergency Management Plan (LEMP). Last updated and approved on 4/20/2021.
<i>Provide information at Town Meeting about VT Alert and encourage residents to sign up.</i>	Town Clerk	High	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); VT Alert; local resources	1 year from date of Plan Approval	<input checked="" type="checkbox"/> Completed
<i>Develop a methodology to consistently document infrastructure damage after weather events.</i>	Road Foreman/ Town Administrator	Medium	TRORC; local resources; National Weather Service; VTrans	2 years from date of Plan Approval	<input checked="" type="checkbox"/> Completed

Mitigation and Preparedness Actions	Local Leadership	Prioritization(Mitigation Plan Status)**	Possible Resources*	Time Frame	2021 Status of Mitigation Action
Hazardous Material Spill					
<i>Ensure that all emergency response and management personnel continue to receive HAZMAT Awareness training at a minimum.</i>	Chelsea Fire Department	High	Vermont Fire Academy; Chelsea Fire Department resources	1 year from date of Plan Approval	<input checked="" type="checkbox"/> Completed
<i>Continuously stock gear to help contain small spills when they occur (booms, absorbent materials, etc.).</i>	Chelsea Fire Department	High	Chelsea Fire Department resources	1 year from date of Plan Approval/ as needed	<input checked="" type="checkbox"/> Completed
Ice Jams/Flash Flood/Flood/ Fluvial Erosion					
<i>Upgrade the South Village Bridge (B9) to improve the structure's ability to pass ice and flood waters. This is a state-owned structure. (Mitigation)</i>	Selectboard	High (new)	VTrans; local resources	January to December 2017	<input checked="" type="checkbox"/> Completed
<i>Update box culvert (B10) through which Jail Brook flows to improve the structure's ability to pass ice and flood waters. This is a state-owned structure.(Mitigation)</i>	Selectboard	High (3 rd and 4 th priority of 7 natural hazard mitigation projects in 2009 Plan)	VTrans; local resources	5 years from date of Plan Approval	Incomplete. Is still considered a high priority item. Incorporated as an action in the 2021 LHMP.
Flash Flood/ Flood/ Fluvial Erosion					
<i>Develop a schedule and capital budgeting program to replace undersized culverts. (Mitigation)</i>	Selectboard/ Road Foreman	High (1 st priority of 7 natural hazard mitigation projects in 2009 Plan)	TRORC; local resources	1-2 years from date of Plan Approval	<input checked="" type="checkbox"/> Completed
<i>Upgrade the North Village Bridge (B11), which is undersized and contributes to the risk and severity of flooding. This is a state-owned structure. (Mitigation)</i>	Selectboard	High (new)	VTrans; local resources	January to December 2017	<input checked="" type="checkbox"/> Completed

Mitigation and Preparedness Actions	Local Leadership	Prioritization(Mitigation Plan Status)**	Possible Resources*	Time Frame	2021 Status of Mitigation Action
<i>Update Chelsea's flood hazard area regulations to ensure that they are compliant and consistent with state and federal guidelines and statutes. (Mitigation)</i>	Planning Commission	High (2 nd priority of 7 natural hazard mitigation projects in 2009 Plan)	Municipal Planning Grant; TRORC; local resources	1 year from date of Plan Approval	☑ Completed. Approved by public vote 11/7/2017
<i>Complete an up-to-date geo-referenced culvert inventory, which will identify priority upgrade projects. (Mitigation)</i>	Road Foreman/ Selectboard	Medium (1 st priority of 7 natural hazard mitigation projects in 2009 Plan)	Better Backroads grants; TRORC; local resources	2-3 years from date of Plan Approval	☑ Completed
<i>Upgrade the town-owned Court Street Bridge, as it is undersized. (Mitigation)</i>	Selectboard	Low (new)	VTrans Structures grants; FEMA HMGP/PDM grants; local resources	5 years from date of Plan Approval	Incomplete. Some members of the LHM Planning Team did not wish to incorporate this action in the 2021 LHMP.
<i>Upgrade the town-owned Maple Avenue Bridge, as it is undersized. (Mitigation)</i>	Selectboard	Low(5 th priority of 7 natural hazard mitigation projects in 2009 Plan)	VTrans Structures grants; FEMA HMGP/PDM grants; local resources	5 years from date of Plan Approval	Incomplete. The Town is in the process of applying for a grant to accomplish this. This action is incorporated into the 2021 LHMP.
Flash Flood/ Flood/ Fluvial Erosion					
<i>Support projects to protect or restore, including riparian planting, strategic areas of floodplain to provide areas for flood storage, which will help alleviate peak flood flows. (Mitigation)</i>	Selectboard/ Planning Commission	Medium (new)	White River Partnership; Chelsea Fish and Game Club; local resources	1-5 years from date of Plan Approval	Ongoing. There has been some riparian planting along the First Branch of the White River. Incorporated as an action in the 2021 LHMP.

Mitigation and Preparedness Actions	Local Leadership	Prioritization(Mitigation Plan Status)**	Possible Resources*	Time Frame	2021 Status of Mitigation Action
<i>Elevate property located at 285 Vermont Route 110. (Mitigation)</i>	Selectboard/ Town Clerk	Medium-High (new)	FEMA HMGP grants; Vermont DEMHS; TRORC; local resources	1-3 years from date of Plan Approval	Incomplete. The property owner has had difficulty with finding a contractor to undertake this project. The town is no longer incorporating this as a priority this into the 2021 LHMP.
<i>Elevation property located at 307 Vermont Route 110. (Mitigation)</i>	Selectboard/ Town Clerk	Medium-High (new)	FEMA HMGP grants; Vermont DEMHS; TRORC; local resources	1-3 years from date of Plan Approval	Incomplete. The bottom floor of the property is now being used for storage by the owner. No longer being considered in the 2021 LHMP.
<i>Acquire/buyout property located at 12 Maple Avenue. (Mitigation)</i>	Selectboard/ Town Clerk	Medium-High (new)	FEMA HMGP grants; Vermont DEMHS; TRORC; local resources	1-3 years from date of Plan Approval	<input checked="" type="checkbox"/> Completed
<i>Acquire/buyout property located at 266 Vermont Route 110. (Mitigation)</i>	Selectboard/ Town Clerk	Medium-High (new)	FEMA HMGP grants; Vermont DEMHS; TRORC; local resources	1-3 years from date of Plan Approval	<input checked="" type="checkbox"/> Completed
<i>Acquire/buyout property located at 349 Vermont Route 110. (Mitigation)</i>	Selectboard/ Town Clerk	Medium-High (new)	FEMA HMGP grants; Vermont DEMHS; TRORC; local resources	1-3 years from date of Plan Approval	<input checked="" type="checkbox"/> Completed

Mitigation and Preparedness Actions	Local Leadership	Prioritization(Mitigation Plan Status)**	Possible Resources*	Time Frame	2021 Status of Mitigation Action
<i>Acquire/buyout property located at 361 Vermont Route 110. (Mitigation)</i>	Selectboard/ Town Clerk	Medium-High (new)	FEMA HMGP grants; Vermont DEMHS; TRORC; local resources	1-3 years from date of Plan Approval	Incomplete. Property was sold to a private party. This action is not being incorporated into the 2021 LHMP
<i>Acquire/buyout the Town Garage located 287 Vermont Route 110. (Mitigation)</i>	Selectboard/ Town Clerk	Medium-High (new)	FEMA HMGP grants; Vermont DEMHS; TRORC; local resources	1-3 years from date of Plan Approval	Property is already owned by the Town and is not being demolished. The town has not expressed any interest in incorporating this action in the 2021 LHMP.
<i>Support town or conservation organization assistance to landowner(s) of property(ies) in Chelsea on the NFIP's repetitive and severe repetitive loss list to reduce flood damages, through elevation, floodproofing, acquisition or relocation, or an infrastructure project if one is found to address the source of flooding. (Mitigation)</i>	Selectboard	Low (new)	FEMA HMGP/PDM grants; local resources	5 years from date of Plan Approval	In progress. Incorporated as an action in the 2021 LHMP.
Extreme Cold/Snow/ Ice Storm					
<i>Develop a program to plan for, budget and maintain roads for safe winter travel. (Mitigation)</i>	Selectboard	High (new)	Local resources	1 year from date of Plan Approval	<input checked="" type="checkbox"/> Completed

Mitigation and Preparedness Actions	Local Leadership	Prioritization(Mitigation Plan Status)**	Possible Resources*	Time Frame	2021 Status of Mitigation Action
<i>Develop a periodic program to clear tree limbs and maintain town road rights-of-way, and work with local utilities to ensure that utility corridors are cleared and maintained. (Mitigation)</i>	Selectboard	High (new)	Green Mountain Power; Washington Electric; local resources	1 year from date of Plan Approval	<input checked="" type="checkbox"/> Completed
<i>Identify populations that are vulnerable to extreme cold and create a plan to assist them, if necessary, in the event that it occurs.</i>	Chelsea Fire Department/ First Branch Ambulance	High	Chelsea Fire Department resources; First Branch Ambulance resources	1 year from date of Plan Approval	<input checked="" type="checkbox"/> Completed

Figure 6. Status of Mitigation Actions Identified in 2015

E. Status of Development in Chelsea

There is relatively minimal development occurring in the Town of Chelsea. The number of permits issued after 2015 are as follows: 21 in 2016, 28 in 2017, 20 in 2018, 15 in 2019, 20 in 2020, and 10 as of August 17th of 2021. Many of the permits have been for smaller, accessory projects, signs, renovations etc. Since 2015, 15 additional residential buildings and no additional commercial buildings had been issued permits in the Town of Chelsea. Some of the “larger” development projects in the Town of Chelsea include the conversion of a store to a church on Route 110 in 2016 and a change of use for commercial building to add an expansion and sell used cars, which included a Letter of Map Amendment for a portion of the property. Smaller projects within Flood Hazard Areas involved the repair of a covered bridge, erosion repair on riverbanks, and the installation of fences, pole sheds and playground structures. The development pattern for commercial development trend to be within the Village or along the Route 110 corridor outside of the Village. There are no plans for large scale development on the horizon.

Depending on the location, new development in the Town of Chelsea may be vulnerable to flood or fluvial erosion hazards or to landslides, mudslides, or rockslides; fortunately, the town’s slow growth rate and interest in pursuing options for reducing flood risks help reduce these risks. The Town’s Zoning Bylaw, which includes the Flood Hazard Overlay District, regulates new development within the Special Flood Hazard Area, which would help reduce threats to structures built near flood hazards. However, the areas vulnerable to flood hazards and fluvial erosion hazards are not necessarily analogous; therefore, the Town’s Flood Hazard Overlay District may not protect new development from fluvial erosion hazards. The desire to focus development and growth within the Village of Chelsea in the face of vulnerability to flooding represents not only a land use challenge, but also design and character challenge as this area is also a historic district. These challenges are currently being experienced in towns throughout Vermont. The Town of Chelsea is currently in the review/approval process for Hazard Mitigation Grant Program funds to acquire some properties in the Village and elevate others. The Chelsea Planning Commission also

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plans to revise the Zoning Bylaw and Flood Hazard Overlay District to help provide some clarity on these issues.

F. Town Capabilities for Implementing the Mitigation Strategy (Existing Hazard Mitigation Programs, Projects & Activities)

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3).

The Town of Chelsea is currently engaged in the following hazard mitigation programs, projects and activities:

Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability to Expand/Improve on
Community Preparedness Activities		
Program—Annual update of Chelsea’s Local Emergency Management Plan (LEMP). Last updated and approved on 4/20/2021.	Volunteer time from the Emergency Management Director; assistance from TRORC. Funding from Vermont DEMHS.	This document is reviewed and updated each year to ensure that the contact information of emergency response personnel is up-to-date. This information is then sent to Vermont Emergency Management for their records. Current program works well, no need to expand or improve on.
Program—Participation in LEPC #12	Volunteer time from Emergency Management Director and sometimes the Fire Chief. Funding from LEPC #12 and assistance from TRORC.	The Town’s current participation in the LEPC #12 is satisfactory. Therefore, there is currently no need to expand or improve on this program.
Participation in Citizens’ Emergency Response Team (CERT)	Staff time from the Town Clerk	The Town feels that this would be a beneficial if there were enough people interested.
Action— Designation of Red Cross Shelter Training in 2001.	Staff/volunteer time from the Town Clerk, Emergency Management Director. Funding from American Red Cross.	This is a one-time action. However, the training was in 2001, and Town officials would like to complete a refresher training.
Insurance Programs		
Authority/ Program— participation in National Flood Insurance Program (NFIP) [Note: This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii).]	The Chelsea Zoning Administrator serves as the NFIP Administrator. Assistance from TRORC and Vermont ANR. Funding from local resources— annual town budget.	Chelsea’s initial Flood Insurance Rate Map (FIRM) was dated 08/15/80. The Town’s current Flood Insurance Rate Map (FIRM) was dated 08/05/91. The Town continues its participation in the NFIP by administering and enforcing its “Flood Hazard Overlay” zoning district. The Town of Chelsea adopted its most current Zoning Bylaw (which includes its “Flood Hazard Overlay District”) on 11/07/2017. This zoning district regulates new construction in the Special Flood Hazard Area. The Town employs an NFIP Administrator to enforce the “Flood Hazard Overlay District” based on the 08/05/1991 FIRMs. The Town would like to request map revisions from FEMA. The town has the authority and intends to consider strengthening the Flood Bylaw in the next planning cycle.

Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability to Expand/Improve on
Land Use Planning		
Policy/Program— Chelsea Town Plan Adopted on 11/16/2015, includes a “Flood Hazard Area” discussion within the “Land Use Plan” element’s “Future Land Use” section.	Volunteer time from Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	The Town Plan is updated every five years, as required by statute. The Planning Commission may expand or improve on any section it deems necessary, or that is required by changes in state statute.
Completed Authority— Chelsea Vermont Zoning Bylaw Adopted on 11/07/2017, includes a “Flood Hazard Overlay District” zoning district	Volunteer time from the Planning Commission, and assistance from TRORC. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Zoning Ordinance is also reviewed and updated if needed. The Planning Commission intends to work on the Zoning Bylaw after the Flood Bylaw is updated.
Hazard Control & Protection of Critical Infrastructure & Facilities		
Policy/Program—Chelsea Hazard Mitigation Plan Adopted on 11/03/2015.	Volunteer time from Town officials; assistance from TRORC and Vermont DEMHS. Funding from FEMA; Vermont DEMHS; TRORC.	The 2021 Chelsea Local Hazard Mitigation Plan will replace the 2015 LHMP. The 2021 LHMP has evolved from the 2015 Plan and has expanded and improved upon it. Future iterations of the Town’s LHMP will be updated by the Town at least every five years.
Program—Town-wide Class III road inventory and capital budget planning Completed in 2012	Staff time from the Town Road Foreman; and assistance from TRORC. Funding from VTran’s Better Backroad grant program.	The Town is currently using the road inventory to improve its class III roads, and seeking funding through the Better Backroads grant program for implementation projects.
Program— Culvert inventory completed with TRORC assistance in 2006.	Staff time from Town Road Foreman; assistance from TRORC. Funding from VTrans; local personnel time and funding.	The Town is currently using the culvert inventory to further its culvert improvement program, and seeking funding through for implementation projects. However, a full update to the culvert inventory, with georeferenced culvert locations and a prioritized list of mitigation improvement projects, would be beneficial to the Town.
Education/ Public Outreach		
Action— Designation of Red Cross Shelter Training in 2001.	Staff/volunteer time from the Town Clerk, Emergency Management Director. Funding from American Red Cross.	This is a one-time action. However, the training was in 2001, and Town officials would like to complete a refresher training.
Ongoing Action— the Fire Department distributes fire prevention fliers at the school	Time from the Volunteer Fire Department and funding from Fire Department budget.	This is an ongoing action and there is no need to expand upon it at this time.

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Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability to Expand/Improve on
Ongoing Action— the Town places emergency-related information in the Annual Report and on the Town's website (when active)	Staff time from Town Office personnel and funding from the Town's budget.	This is an ongoing action and there is no need to expand upon it at this time.

Figure 7. Existing Hazard Mitigation Programs, Projects, and Activities

G. Plan Maintenance

The Chelsea Local Hazard Mitigation Plan will be updated and evaluated, by discussing its effectiveness and making note to incorporate any necessary revisions in the update process, annually at an April Selectboard meeting, along with the review of their Local Emergency Management Plan (LEMP). At this meeting, the Selectboard will monitor the implementation of the hazard mitigation strategies outlined in this Plan, by noting those that have been completed and any comments from local officials and the public will be incorporated when relevant. This meeting will constitute an opportunity for the public and other town officials to hear about the town's progress in implementing mitigation strategies and to give input on future activities and Plan revisions. The public will be given the opportunity to comment at this meeting.

This section of the Plan satisfies 44 CFR and 201.6(c)(4)(i), 201.6(c)(4)(ii), and 201.6(c)(4)(iii).

The local Emergency Coordinator/Director will lead in monitoring and updating this plan. Updates and evaluation of this Plan by the Selectboard and the local Emergency Director will also occur within three months after every federal disaster declaration directly impacting the Town of Chelsea. The Town will monitor, evaluate and update this Local Hazard Mitigation Plan at an April Selectboard meeting and after every federally declared disaster directly impacting the Town. The Town shall reference the Local Hazard Mitigation Plan when working on Town Plan amendments or changes to the Town's bylaws.

The Chelsea LHMP will expire within five years from plan adoption. By keeping an up-to-date LHMP in effect, the town shall be able to maintain eligibility for FEMA and VEM assistance and improve their ERAF rate (discussed in Chapter II). Within two to three years prior to the LHMP expiration, Chelsea should seek funding through VEM for assistance with updating the plan.

At least one year before the Plan expires, the update process will begin (through annual updates, monitoring of progress and evaluation that will occur at the April Selectboard meeting). The town may seek outside consultation to assist in the next plan update by sending out a request for proposals that meets federal procurement standards. Two Rivers-Ottawaquechee Regional Commission (TRORC) may be an available source to help with Plan updates if assistance is requested by the Town of Chelsea and if funding is available. If an outside consultant is unable to assist the Town, then Chelsea's Town Clerk, Administrative Assistant, or Selectboard will update the Plan, or the Selectboard may appoint a committee of interested citizens (including the current local Emergency Director) to draft changes.

The process of evaluating and updating the plan will include continued public participation through public notices posted on the municipal website (if active), notice within the municipal building, and notice in The Herald of Randolph and the TRORC newsletter and blog, inviting the public to the scheduled Selectboard (or specially scheduled) meeting. The public will be given the opportunity to comment during this process. Additional stakeholders may be invited to the meeting these include: First Branch Ambulance, VTrans, and the Vermont Agency of Natural Resources (VT ANR). VT ANR may be invited because they can provide assistance with NFIP outreach activities in the community, models for stricter floodplain zoning

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regulations, delineation of fluvial erosion hazard areas, and other applicable initiatives. These efforts will be coordinated by the Town Clerk.

Updates will address changes in community mitigation strategies; new town bylaws, zoning and planning strategies if appropriate; progress on the implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities including overall effectiveness of plan goals and actions in reducing vulnerabilities. If new actions are identified in the interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings.

Chelsea shall also incorporate mitigation planning into their long-term land use and development planning documents. The 2015 Chelsea Town Plan makes reference to the 2015 Chelsea LHMP. The 2013 Vermont Legislature passed a law requiring all towns to incorporate flood resiliency elements into their town plans as of July 2014. To do so, flood hazard and fluvial erosion hazards will be identified, and strategies and recommendations will be provided to mitigate risks to public safety, critical infrastructure, historic structures and public investments. This Local Hazard Mitigation Plan will help the town to comply with the new community flood resiliency requirement for town plans adopted after July 2014.

It is also recommended that the process work both ways and the Town review and incorporate elements of the Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/ fluvial erosion hazards (FEH) bylaws. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas.

Town compliance with the NFIP is enforced by the Zoning Administrator and the Development Review Board, as outlined in Chelsea's Flood Hazard Area Regulations and Zoning Bylaw. A permit is required for all construction and development in special flood hazard areas. Certain activities within the special flood hazard area, such as not enclosed accessory structures and open fences, may be approved administratively by the Zoning Administrator. Conditional uses and activities in the flood hazard area require approval from the Development Review Board, such as fills or excavations, grading, and substantial improvements to existing buildings.

V. Community Vulnerability by Hazard

A. Hazard Identification

Mitigation efforts must be grounded in the rational evaluation of hazards to the area and the risks these hazards pose. This is done through a process, which in essence asks and answers three basic questions:

- What bad things can happen, given the town's vulnerabilities?
- How likely are they to occur?
- How bad could they be?

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This process, which is laid out in the table below, is an attempt to inventory the known hazards, establish the likelihood of them occurring in the future, and then assess the community's potential vulnerability to each. In performing this analysis, we are then able to prioritize actions that are designed to mitigate the effects of each of these disaster types and ultimately make Chelsea a safer place.

It is important that we learn from the past in order to avoid the same disasters and their outcomes. Disasters that have occurred within the Town of Chelsea, the larger region, and the State of Vermont can give us good information about what types of disasters we can expect in the future and what kinds of damage they might cause. However, while this historical data can inform our perspective of what might happen in the future, it is by no means a prophecy. While Chelsea might not have been impacted by a specific hazard in the past, this does not necessarily mean it will never be affected in the future. Indeed, the advance of climate change means that old weather patterns may not hold. For instance, in recent years, Vermonters have seen an increase in the number and severity of storms, especially rainfall events. Armed with historical data and a healthy respect for climate change and the unknown, we have tried our best to identify hazards and prepare for the future.

The prior rankings from 2015 were determined by frequency of occurrence, warning time, and potential impact. In the 2021 Plan, it was decided to model the hazard ranking to the 2018 Vermont State Hazard Mitigation Plan to simplify the process. The table below shows the ranking criteria that was used.

Score	Frequency of Occurrence: Probability of a plausibly significant event.	Potential Impact: Severity and extent of damage and disruption to population, property, environment and the economy.
1	Unlikely: less than 1% probability of occurrence per year	Negligible: isolated occurrences of minor property and environmental damage, potential for minor injuries, minor economic disruption.
2	Occasionally: 1% through 10% probability of occurrence per year, or at least one chance in next 100 years	Minor: isolated occurrences of moderate to severe property and environmental damage, potential for injuries, minor economic disruption
3	Likely: between 10% to 75% probability per year, at least 1 chance in next 10 years.	Moderate: severe property and environmental damage on a community scale, injuries or fatalities, short-term economic impact
4	Highly Likely: 75% or greater probability in a year	Major: severe property and environmental damage on a community or regional scale, multiple injuries or fatalities, significant economic impact

Figure 8. Hazard Scoring

Using this ranking criteria, the table on the next page shows a list of hazards that may affect Chelsea in the future, along with their ranking on which hazards are most likely to be severe. Out of this table, a list of five hazards that are believed to be the worst threats (bolded in the table, below) are then followed-

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up with discussion and mitigation strategies throughout the rest of this Plan. The hazard score is calculated by multiplying the probability of the hazard occurring by the average of the potential impact that the hazard has on infrastructure, life, the economy, and the environment. It should be noted that hazards assigned with the same “Hazard Score” are not in order and their placement in the table should not be assumed to reflect their potential to create hazards for the town.

Hazard	Probability	Potential Impact					2015 Hazard Score	2021 Hazard Score
		Infrastructure	Life	Economy	Environment	Average		
<i>Ice Jams/Spring Runoff/High Water</i>	4	4	2	2	3	2.75	11	11
<i>Extreme Cold/Snow/Ice Storm</i>	4	3	3	3	2	2.75	9	11
Severe Weather (Thunderstorm, Lightning, High Wind, Hail, and Flooding) *Note: We have defined "Severe Weather" to include two or more of the above hazards	4	2	2	2	2	2	8	8
<i>Flash Flood/Flood/Fluvial Erosion</i>	3	3	2	2	3	2.5	9.5	7.5
<i>Hazardous Material Spill</i>	3	3	2	2	3	2.5	11	7.5
Structural Fire	3	2	2	2	2	2	10	6
Landslides/Mudslides /Rockslides	3	3	1	1	2	1.75	8	5.25
Hurricanes/Tropical Storms	2	3	2	2	3	2.5	7	5
Water Supply Contamination	2	2	3	2	2	2.25	7	4.5
Invasive Species/Infestation	3	1	1	1	2	1.25	7	3.75
Drought	2	1	2	2	2	1.75	4	3.5
Wildfire	2	2	1	1	3	1.75	6	3.5

Hazard	Probability	Potential Impact					2015 Hazard Score	2021 Hazard Score
		Infrastructure	Life	Economy	Environment	Average		
Infectious Disease Outbreak	2	1	2	2	1	1.5	N/A	3
Earthquake	2	2	1	1	2	1.5	8	3
Tornado	1	2	2	2	2	2	6	2
Extreme Heat	1	1	3	1	2	1.75	4	1.75
Dam Failure	1	2	1	2	2	1.75	N/A	1.75

Figure 9. Hazard Identification and Ranking

The Chelsea LHM Planning Team discussed the results of the hazard ranking activity and decided to focus on hazards that had the potential to impact the Town on a town-wide scale and/or had the potential to occur frequently. The Chelsea LHM Planning Team decided to reserve the in-depth discussion of hazards in their Plan to those hazards which could have an impact on a greater scale. Four of the five chosen top five hazards were identified as top hazards in the 2015 Chelsea LHMP. In the 2015 plan, “structural fire” was ranked with the top five hazards; however, the 2015 committee did not wish to explore the hazard in further detail, despite the ranking they gave the hazard, thus no actions were developed for mitigating structural fires. The 2021 committee had decided to include severe weather as a top hazard, worthy of further analysis, due to its likelihood of occurrence.

After engaging in discussions using their best available knowledge, the Town of Chelsea identified the following “top hazards” (based on frequency of occurrence and potential impact) that they believe their community is most vulnerable to:

- Ice Jams
- Extreme Cold/Snow/Ice Storm
- Severe Weather (Thunderstorm, Lightning, High Wind, Hail, and Flooding)
- Hazardous Material Spills
- Flash Flood/Flood/Fluvial Erosion

The impact of a loss of services is a common element of the hazards discussed in this Plan. These include not only large scale services such as the loss of transportation and communication ability, but also the loss of services more directly associated with basic needs such as water, food preparation, and heat. Loss of power for an extended period of time has the potential to greatly impact households who are entirely reliant on a functional power supply in order to prepare food, heat the household, and ensure that the water supply is available. While many residences in Chelsea utilize a variety of methods to ensure these basic needs, it is important to be aware that a number of households rely on electricity alone for all of these functions. In addition to the plans described in the Chelsea LEMP, it is important to reinforce the need for adequate generators in this Plan, so that the town is prepared to ameliorate the effects of a sustained power loss in Chelsea. Included in this would be an adequate supply of fuel for these generators.

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A further focus that is important to address in this Plan includes the awareness of the population demographics of Chelsea. This includes a comprehensive idea regarding the number of individuals in the town who may require assistance in the event of a severe weather incident. Age and ability should be factors taken into account, and as discussed in the LEMP, there should be individuals responsible for creating and updating such a list, including members of the ambulance service, town offices, the health officer, and service officer.

Each of these “top hazards” will be discussed in the following sections. Within each section, previous occurrences of each hazard will be listed, including the County-wide FEMA Disaster Declarations (DR-#), where applicable. Hazards information was gathered from local sources (ex., town history book), the National Climatic Data Center’s (NCDC’s) Storm Events Database (1950-2012 and 2006-2012), the Spatial Hazard Events and Losses Database for the United States (SHELDUS) 1960-2012, and Special Reports produced by the National Weather Service in Burlington, Vermont. This section also includes a description of each “top hazard” and a hazard matrix that will also include the following information (please see each hazard profile for a hazard-specific matrix):

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Type of hazard.	General areas in community that may be vulnerable to the hazard.	Community structures affected by hazard.	The strength or magnitude and details of the most notable event(s).	Dollar value or percentage of damages if available.	<u>Occasionally</u> : 1–10% probability of occurrence per year, or at least one chance in next 100 years <u>Likely</u> : >10% but <75% probability per year, at least 1 chance in next 10 years <u>Highly Likely</u> : 75%-100% probability in a year

Figure 10. Vulnerability Table

B. Hazard Profiles for Hazards Posing Highest Vulnerabilities

1. Ice Jams/Spring Runoff/High Water

Ice jam events, spring runoff, and high water are serious concerns throughout the State of Vermont, owing to the vast number of waterways within the state’s footprint. Such events can occur with little to no warning and quickly escalate into life-threatening situations, thereby increasing the impact of such events when they happen.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Ice Jams**.

Spring runoff or snowmelt occurs as a result of snowpacks and ice melting into the river watershed. Because of frigid ground conditions and dormant plant life, spring runoff has a tendency to expand over the terrain rather than being absorbed into the soil.

Ice jams are most prone to occur when heavy rains and rising temperatures cause rapid snow melt. Consequently, rivers swell, and ice layers begin to break, which then flow downstream and create obstructions around natural and man-made barriers. The majority of ice jams happen between the

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months of January and March, and the lead time for an ice jam or flow can range anywhere from a few hours to only one hour. The flows can cause water to rise by multiple feet per hour or even multiple feet within minutes. This can mean that there is insufficient time to prepare for rising water and ice levels.

While flooding from ice jams is not often major, it has the possibility to be catastrophic, particularly in places that have an historic pattern of growth along waterways. Ice jams can have a disastrous impact on waterways and surrounding structures and infrastructure, and they can cause severe erosional issues along with endangering local fish and wildlife populations. There are no known state buildings or facilities in Chelsea that may be immediately endangered by ice jams; however, basic infrastructure and private property are at high risk.

History of Occurrences:

Date	Event	Location	Extent and Impacts
01/16/2014	Ice Jam	White River, along Route 110	According to the CRREL database, an ice jam formed on the First Branch of the White River along Route 110 in Chelsea south to Route 110 and Route 14 in Royalton. No information available on the amount of damages was provided.
03/09/ 2008	Ice Jam	White River, along Route 110	VT State Highway Dept. reported an ice jam forming along the First Branch of the White River along Route 110 in the S. Royalton, Tunbridge, and Chelsea areas. No reports of flooding confirmed in this instance
03/15/2007	Ice Jam	White River, along Route 110	VEM reported an ice jam formation in a large culvert/bridge on Rt. 110. Ultimately impacted 10 residences, 3 commercial buildings, and mostly caused basement flooding. Fire Dept. was on the scene to pump water out of buildings. Also caused some driveway/sidewalk erosion.
03/21/2003	Ice Jam	First Branch	According to the NWS, a breakup ice jam was reported on the First Branch of the White River just south of Chelsea.
03/04/1999	Ice Jam	First Branch	An ice jam beginning in January of 1999 was packed from Chelsea to the Tunbridge Fairgrounds. On March 4 th and 5 th , Several buildings in Tunbridge were flooded and the Tunbridge Mill Covered Bridge was destroyed. According to CRREL database, Chelsea did not experience significant damage.
03/11/1992— 03/18/1992 (DR-938 VT)	Ice Jam, Flooding	White River	Approximately \$43,000 in damage to Town roads—Town Highways #1-11—caused by heavy rain, ice jams and flooding.

Figure 11. History of Ice Jams in Chelsea

The South Village Bridge (B9) was particularly vulnerable to ice jams because the level of the banks above the bridge were lower than at the bridge itself so their bank full capacity overflowed before it got to the bridge. The South Village Bridge has been updated since the adoption of the 2015 LHMP. Ice jams at the box culvert (B10) over Jail Brook have caused water to overtop VT Route 100. However, no significant property damage has been reported as a result of these overflows.



Figure 12. Box Culvert (B10) over Jail Brook Road. Photograph from the Vermont Agency of Transportation.

Below is a table of potential actions for upgrading the Bridge 10 over Jail Brook, as included in the Chelsea Flood Study developed by DuBois & King Inc. for TRORC in 2016. The bridge is still in need of upgrades.

Alternative	Primary Objective	Major Component	Approximate Construction Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
Do Nothing		No physical improvements; No change in bridge, channel or floodplain dimensions.	None	No construction costs.	No change to existing conditions. Q50 overtops south side of Jail Brook at the entrance to BR10.	Continued ice jam problems. Ice and water flows over the south side of the Jail Brook and then southwesterly back to the First Branch.
Bridge reconstruction	Widen the structure to allow the passage of the 50 year flood event (VTRANS Standard for State Highway). Improve hydraulic capacity.	Replace existing 13.5 ft span bridge (measured normal to stream) with a span of 26 feet (bankfull width).	Expensive – \$900,000 - \$1,100,000	Improved hydraulic capacity. Meets VTRANS hydraulic standard, Q50 with 0.9-ft freeboard.	Highly skewed alignment remains. Skewed alignments have a higher probability of debris and ice deposition. Wider structures potentially could increase frazil ice deposition due to lower winter channel velocities.	Potential for continued ice jam problems.

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Alternative	Primary Objective	Major Component	Approximate Construction Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
					State road with utilities- known sewer line at outlet of BR10.	
Bridge reconstruction with stream realignment downstream of BR10	Improve transport of frazil ice through structure; Improve hydraulic capacity.	Replace existing 13.5 ft span bridge with a span of 26 feet approximately perpendicular to VT Route 100. Create new channel downstream of realigned bridge.	Expensive - \$1,000,000 – 1,200,000	Improved hydraulic capacity; and improved bridge alignment. Meets VTRANS hydraulic standard, Q50 with 1-ft freeboard.	Basketball court would need to be relocated. Possible deed restriction. May not eliminate the potential for frazil ice deposition. State road with utilities- known sewer line at outlet of BR10.	Potential for continued ice jam problems.
Groundwater augmentation	Reduce the amount of frazil ice through mitigation	Augment stream flow with groundwater to increase water temperature to reduce frazil ice formation.	Moderate- \$100,000- \$250,000	Reduced frazil ice formation to reduce blockage at bridge entrance.	Uses a significant amount of groundwater. Ongoing operational costs.	Well yield may not be available; could be implemented independent of bridge reconstruction.
Heat trace	Reduce the amount of frazil ice through mitigation	Heat trace installed in bridge	Moderate \$30,000	Eliminate frazil ice formation along heat trace maintaining open flow path through BR10	Energy intensive. Estimated power required 100 kw-hr per day. Ongoing operational costs.	Can be implemented in existing or newly constructed bridge.

Figure 13. Potential Actions for Upgrading Bridge 10 over Jail Brook. Source: Chelsea Flood Study by DuBois and King, September 16, 2016

In order to prepare for the possibility of ice jams, Town officials monitor the weather conditions that contribute to ice jams. Town officials are also continuing to look into how to lessen ice jam risk on Jail Brook and work with the State of Vermont to address sizing/positioning issues of state-owned structures. As undersized bridges and culverts that contribute to ice jams are replaced, the likelihood of ice jams occurring will be reduced.

Hazard	Location	Vulnerability	Extent	Estimated/Potential Impact	Likelihood/Probability
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Ice Jams	First Branch of the White River, other Town waterways.	All property and infrastructure adjacent to Town waterways	Incident-specific, depends upon how quickly ice breaks up, temperature combined with snow melt/runoff.	Dollar value or percentage of damages not known because of a lack of historical data. Minor damage is anticipated.	Highly Likely
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Figure 14. Chelsea Vulnerability to Ice Jams

2. Extreme Cold/Snow/Ice Storm

Winter storms are a regular occurrence in Vermont. However, severe winter storms can cause serious damage, including collapse of buildings due to overloading with snow or ice, brutal wind chills, downed trees and power lines, and stranded vehicles. People can be at risk of freezing in extended power outages if they lack wood heat or backup power, and individuals shoveling large accumulations of snow can also be at risk from frostbite, hypothermia, and heart attacks caused by cold and overexertion. While snow removal from the transportation system is standard fare in Vermont winters, extreme snow or ice can close rail and road systems, further jeopardizing any stranded persons that are in danger of freezing or needing medical assistance.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Extreme Cold/Snow/Ice Storm**.

Severe winter storms include a blizzard on February 15-17 in 1958, which dumped over 30 inches and resulted in 26 deaths in New England. On December 26-27 in 1969, another blizzard left 18-36 inches of snow in northwestern Vermont and a whopping 45 inches in nearby Waitsfield. A string of storms in March 2001 hit the state, beginning with 15-30 inches on March 5-6th (later declared a federal disaster), 10-30 inches on the 22nd, and 10-20 inches on the 30th. Recent years have seen wet snowstorms that have toppled trees and caused widespread power outages.

One of the worst winter storms in terms of damage to hit the state was not a snowstorm, but an ice storm. In January of 1998, just the right combination of precipitation and temperature led to more than three inches of ice in spots, closing roads, downing power lines, and snapping thousands of trees. This storm was estimated as a 200-500 year event. Power was out up to 10 days in some areas, and 700,000 acres in of forest were damaged in Vermont. Amazingly, there were no fatalities in Vermont, unlike Quebec where 3 million people lost power and 28 were killed. The Town of Chelsea was impacted by this ice storm.

Over the past few winters, Chelsea has received numerous snowstorms that have dropped significant amounts of snow over a day or two-day period. However, the details of these events and the damage they caused are overshadowed by winter weather events of the past. This is not to say such extreme events will not repeat themselves. It should be assumed that extreme winter weather events will occur at some point in the future. The following table documents the occurrence of extreme cold/snow/ice storms in the Town of Chelsea and in Orange County. Data was collection from the National Centers for Environmental Information.

History of Occurrences:

Date	Event	Location	Extent and Impacts
12/17/2020	Winter Storm	County-; region-wide	10 to 18 inches of snowfall was reported in southeast Orange County. No information reported on ice accumulation.
Period from 03/23/2020—03/24/2020	Winter Storm	County-; region-wide	Periods of 2 to 3 inches of snow per hour in Orange County, with total snowfall of 7 to 10 inches . No information reported on ice accumulation.
02/07/2020	Winter Storm	County-; region-wide	6 to 10 inches of snowfall was experienced in Orange County. Ice buildup of up to one quarter of an inch induced vehicle accidents and power outages across the region. Information on the duration of power outages is unavailable.

Date	Event	Location	Extent and Impacts
01/16/2020	Winter Storm	County-; region-wide	Snowfall was experienced across the southern Adirondacks and central Vermont on January 16 th . 6 to 12 inches of snow was reported in Orange County. No information reported on ice accumulation.
Period from 03/22/2019—03/23/2019	Winter Storm	County-; region-wide	Wet snowfall was experienced across Vermont with winds ranging from 15 to 25 mph . Orange County received 7 to 14 inches of heavy snow. No information reported on ice accumulation.
Period from 01/29/2019—01/30/2019	Winter Storm	County-; region-wide	Orange county experienced 5 to 8 inches of snowfall. No information reported on ice accumulation.
Period from 01/19/2019—01/20/2019	Winter Storm	Chelsea; County-; region-wide	10 to 18 inches of snowfall was reported in Orange County, with 15 inches of snowfall occurring in Chelsea. No information reported on ice accumulation.
Period from 01/08/2019—01/10/2019	Winter Storm	County-; region-wide	A combination of rain and snow was experienced in Vermont on January 8 th , which transitioned to accumulating snow after January 9 th . 6 to 10 inches of snowfall was reported in Orange County. No information reported on ice accumulation.
Period from 11/26/2018—11/28/2018	Winter Storm	County-; region-wide	A rain shower evolved into heavy wet snow, leading to power outages in Vermont. Orange County experienced 6 to 12 inches of snow. No information reported on ice accumulation.
Period from 03/13/2018—03/15/2018	Winter Storm	Chelsea; County-; region-wide	Snowfall persisted from the morning of March 13 through March 14 th . 10 to 27 inches of snowfall was experienced in Orange County, with Chelsea receiving approximately 18 inches of snow. No information reported on ice accumulation.
Period from 03/07/2018—03/09/2018	Winter Storm	County-; region-wide	For a portion of a snowstorm that lasted from the middle of March 7 th to March 9 th , Orange County experienced 9 to 15 inches of snowfall. No information reported on ice accumulation.
02/07/2018	Winter Storm	County-; region-wide	6 to 10 inches of snowfall was reported in Orange County. No information reported on ice accumulation.
12/22/2017	Winter Storm	County-; region-wide	A storm moving from across the Ohio River Valley created snowfall in Vermont. Orange County experienced 6 to 10 inches of snowfall. No information reported on ice accumulation.
Period from 12/12/2017—12/13/2017	Winter Storm	County-; region-wide	A storm developed off the coast of Maine, creating heavier snowfall westward. Orange County experienced 6 to 12 inches of snowfall. No information reported on ice accumulation.
Period from 03/31/2017—04/01/2017	Winter Storm	County-; region-wide	6 to 12 inches of snowfall in Orange County. No information reported on ice accumulation.
Period from 03/14/2017—03/15/2017	Winter Storm	County-; region-wide	A nor'easter intensified as it moved from the Virginia Coast to Maine between March 14 th and March 15 th . On the morning of March 14 th , snow in Vermont was 1 to 3 inches per hour. Total snowfall in Orange County ranged from 12 to 18 inches . No information reported on ice accumulation.
Period from 02/12/2017—02/13/2017	Winter Storm	Chelsea; County-; region-wide	Snowfall in Vermont ranged from 6 to 12 inches. 11 inches of snowfall was reported in Chelsea. No information reported on ice accumulation.
Period from 12/29/2016—12/30/2016	Winter Storm	County-; region-wide	Heavy snowfall in northern New England. 6 to 12 inches of snowfall occurred in Orange County. No information reported on ice accumulation.
02/02/2015	Winter Storm	County-; region-wide	A storm from across the Ohio River Valley reached Vermont on February 2 nd . The amount of snowfall in Orange County ranged from 6 to 12 inches . Approximately \$15k in property damage occurred county-wide. No information reported on ice accumulation.

Date	Event	Location	Extent and Impacts
Period from 01/07/2015—01/08/2015	Extreme Cold/Wind Chill	County-; region-wide	Winds from 15 to 30 mph with chills from 25 to 40 degrees below zero traveled across Vermont the evening of January 7 th . Temperatures the following morning ranged from 15 to 25 degrees below zero throughout Orange County. No information reported on ice accumulation.
Period from 12/09/2014—12/12/2014 (DR-4207 VT)	Snow/Winter Storm	Chelsea; County-; region-wide	A powerful prolonged heavy, wet snow event from December 9 th through December 11 th . The snow to liquid ratios ranged from 5 to 7 inches of snow to 1 inch of rain, which lead to the snow sticking to trees and power lines. Approximately 5 to 8 inches in Chelsea, with approximately \$3,000 in overtime for the road crew. No information reported on ice accumulation.
Period from 03/12/2014—03/13/2014	Snow Storm	County-; region-wide	A major snowstorm with near blizzard conditions at times impacted portions of northern New York on March 12 th and lingered into the morning hours of March 13 th . Numerous motor vehicle accidents, school and business closures resulted due to the storm on both March 12 th and 13 th . Snowfall totals across Orange county were generally 15 to 20+ inches . No information reported on ice accumulation.
Period from 02/13/2014—02/14/2014	Winter Storm	County-; region-wide	A Winter storm, responsible for record ice and snow across the southeast United States on February 12 th , moved and redeveloped off the southeast United states coastline on February 13 th . Snowfall across Orange county was 12 to 18 inches . No information reported on ice accumulation.
02/05/2014	Snow Storm	County-; region-wide	Snowfall was at its peak during both the morning and afternoon/evening commutes causing hazardous travel. 8 to 12 inches of snow fell across Orange county. No information reported on ice accumulation.
Period from 12/29/2013—12/30/2013	Winter Storm	County-; region-wide	A wet, heavy 5 to 10 inches of snow fell across Orange county. No information reported on ice accumulation.
Period from 12/14/2013—12/15/2013	Snow Storm	County-; region-wide	The first widespread snowfall of the 2013-14 winter season. The typical impacts associated with this storm were the numerous vehicle accidents, especially being the first storm of the season. A widespread 10 to 15 inches of snow fell across Orange county. No information reported on ice accumulation.
Period from 01/14/2009—01/18/2009	Extreme Cold/Wind Chill	County-; region-wide	A cold front caused temperatures in Vermont to range from 10 to 30 degrees below zero. No information on wind speeds is available. No information reported on ice accumulation.
Period from 02/27/2008—02/28/2008	Snow Storm	Chelsea; County-wide; statewide	Storm totals ranged from 3 to 6 inches in the St. Lawrence River Valley, 5 to 10 inches across northern New York and 6 to 12 inches across Vermont with the heaviest along those favored northwest slopes of the northern Green Mountains as well as some higher elevations in south central Vermont. 10 inches of snowfall reported in Chelsea. No information reported on ice accumulation.
Period from 02/01/2008—02/02/2008	"Mixed" Winter Storm	Chelsea; County-wide; statewide	Snowfall reports were generally 2 to 5 inches with localized amounts up to 7 inches. In addition, one quarter to one half of ice accumulation (accretion) occurred as well. Finally, strong south to southeast winds around 3000 feet and above transferred to a few hilltops along the western slopes and produced wind gusts in excess of 50 mph. Numerous reports of motor vehicle accidents throughout the region. 2 inches of snowfall reported in Chelsea.
12/31/2007	Snow Storm	Chelsea; County-wide; statewide	Snow began to overspread New York and Vermont around Midnight Monday (31st) with snowfall rates rapidly increasing to near an inch per hour at times, but this was a quick-hit storm with steady accumulating snowfall ending across much of Vermont and northern New York by mid-morning. Contributed to Burlington's 4 th snowiest December. 5.5 inches of snow reported in Chelsea. No information reported on ice accumulation.

Date	Event	Location	Extent and Impacts
Period from 12/16/2007—12/17/2007	Snow Storm with Freezing Rain	Chelsea; County-wide; statewide	Snowfall totals from this pre-winter storm ranged from 6 to 12 inches in southern Vermont, where a prolonged period of sleet and/or freezing rain occurred, to a rather uniform 12 to 18 inches across the rest of Vermont and northern New York. 10 inches reported in Chelsea. No information reported on ice accumulation.
Period from 04/15/2007—04/16/2007	Winter/Snow Storm	Chelsea; County-wide; statewide	Snowfall totals were generally 4 to 7 inches in the valleys with locally up to a foot along the east-facing slopes of the higher elevations of the Green mountains. This was a heavy, wet snow that caused numerous power outages, as well as extremely slick and treacherous roads that resulted in numerous vehicle accidents. Information on the duration of power outages is unavailable. 6 inches of snow reported in Chelsea. No information reported on ice accumulation.
Period from 04/04/2007—04/05/2007	Snow Storm	Chelsea; County-wide; statewide	Rain mixed with and then changed to sleet and snow across Vermont during the afternoon of the 4th and continued through midday on the 5th. Combined snow and sleet accumulations ranged from 4 to 12 inches with the higher amounts in the higher elevations. This caused some hazardous travel as well as some scattered power outages due to fallen tree limbs and branches. 8 inches reported in Chelsea. No information reported on ice accumulation.
Period from 03/16/2007—03/17/2007	Snow Storm	Chelsea; County-wide; statewide	Heavy snow started in southern Vermont by late evening and reached the rest of the region by Midnight Saturday (17th) with snowfall rates of 1 to 2 inches per hour at times. 10 inches reported in Chelsea. No information reported on ice accumulation.
03/06/2007	Extreme Cold/Wind Chill	Chelsea; County-wide; statewide	Extremely cold temperatures with winds ranging from 15 to 30 miles per hour reported throughout Vermont. The temperature in Chelsea dropped to -12 degrees . No information reported on ice accumulation.
02/14/2007	Snow Storm	Chelsea; County-wide; statewide	19.0 inches reported in Chelsea. No information reported on ice accumulation.
Period from 01/25/2007—01/26/2007	Extreme Cold/Wind Chill	County-wide; statewide	Winds ranging from 10 to 15 miles per hour caused wind chill values of -25 to -40 degrees in Vermont. Temperatures as low as -5 to -20 degrees were reported throughout the state. No information reported on ice accumulation.
12/15/2003	Snow Storm	Chelsea; County-wide; statewide	Snow developed Sunday afternoon, December 14th, and became heavy Sunday night into Monday morning, December 15th. 11 inches of snow reported in Chelsea. No information reported on ice accumulation.
Period from 01/06/1998—01/09/1998	Ice Storm	County-; state-wide	An ice storm occurred in Vermont. Icing was restricted between 1500 and 2500 foot level. Accumulation during this event was at maximum ¾ of an inch in Vermont. There were downed trees and power lines caused by the weight of the ice. Improper use of generators during power outages caused carbon monoxide poisoning to some residents. Duration of the power outage was not reported.

Figure 15. History of Extreme Cold/Snow/Ice Storms in Chelsea

The Town of Chelsea is no stranger to winter weather and the hazards that it brings. Depending on the event, though especially with heavy, wet snow or ice, and sometimes in combination with high winds, electricity may be knocked out for a few hours or days. The utility company currently serving the Town of Chelsea, Green Mountain Power and Washington Electric Coop, have followed a regular tree-trimming schedule. Chelsea town officials believe this is satisfactory to mitigate damage and the power outages caused by downed trees and tree limbs during a heavy, wet snow or ice event. In the event of an extended

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power outage, the Town would open its emergency shelter. More often, those without power would seek accommodations with friends or relatives.

Another complication of falling utility poles is the potential loss of the telephone line. If the landlines are impacted, the possibility presents itself that there is no reliable means of communication in the affected parts of Town as cell reception can be spotty. If the power is out, an internet connection is unlikely to be available.

Heavy, wet snow or large quantities of snow may also leave structures vulnerable to roof collapse. Roof collapse occurs when the structural components of a roof can no longer hold the weight of snow. Flat roofs are most vulnerable to collapse because they do not drain well and the snow on the roof soaks up water like a sponge, increasing the weight that the roof must bear. More common, it seems, is the collapse of barns commonly used for livestock sheltering and other agricultural purposes. Unfortunately, livestock in the barn are often killed, and equipment stored in the barn may be damaged or ruined. It is difficult to determine whether a residential structure or a barn would be rebuilt after a roof collapse because the decision to rebuild would likely depend on the extent of damage. The collapse of a barn roof is likely to be a total loss, and the collapse of a house roof may be a 50% loss.

In general, winter weather is most hazardous to travelers. Icy and snow-covered roads present multiple examples of dangerous driving conditions and situations. In Chelsea, the mountainous terrain, steep slopes, and remoteness of some roads further complicate travel. The Town relies on Travel Advisories issued by the State of Vermont Department of Emergency Management Homeland Security and the National Weather Service to alert residents of dangerous travel weather. Despite this, it is difficult to prohibit people from driving during winter weather events. As a result, emergency services personnel must always be prepared to provide assistance to stranded drivers or to those who have been in an accident.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Extreme Cold/ Snow/ Ice Storm	Town wide	The entire Town is vulnerable, including road infrastructure, town and privately owned buildings, utility infrastructure.	Snow fall has varied, from a few inches to over a foot or more. Heavy snow and wind downed trees and power lines. Snow/ice contributed to hazardous driving conditions.	From DR-4207; approximately \$3,000 in overtime costs for the Town of Chelsea, with potential additional costs for debris removal. For car crashes due to poor driving conditions: minimal damage to vehicle to totaled vehicle. Health impacts could vary significantly.	Highly likely

Figure 16. Chelsea Vulnerability to Extreme Cold/Snow/Ice Storms

3. Severe Weather (Thunderstorm, Lightning, High Wind, Hail, and Flooding)

In Chelsea, severe weather is quite common, typically in the late spring and summer months when the region experiences high temperatures. Severe thunderstorms tend to bring other hazards such as high winds, hail, lightning, and flooding, and these hazards are often experienced in combinations that create many unique weather and emergency management situations.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Severe Weather**.

Thunderstorms/Lightning

More common than hurricanes or tropical storms are severe thunderstorms (usually in the summer), which can cause flooding, and be associated with lightning, high winds, hail and tornadoes.

Thunderstorms can also generate high winds, such as that which hit the region on July 6, 1999, downing hundreds of large trees in a few minutes. Over the years, Chelsea has been hit with high winds that have downed and uprooted numerous trees and knocked out electricity to residents in the Town. Town specific wind damage data could not be found for every event, but the “Remarks” section of the NCEI Database helps to illuminate the impact strong winds can have on Chelsea.

High Wind

Generally speaking, wind is the result of differences in atmospheric pressure, and moves from an area of high pressure to an area of lower pressure. Slight or moderate winds are unlikely to be dangerous, and often have beneficial effects. However, severe wind may pose a threat to lives, property, and critical utility infrastructure. Light construction, such as manufactured homes, are often the most damaged by high wind events. High winds typically occur as a result of various weather events, such as severe storms, tropical storms or hurricanes. Storm events severe enough to generate wind shears, small cyclones and microbursts appear to be occurring with greater frequency in recent years, but associated damage tends to be highly localized. One of the strongest and most damaging types of high winds are straight-line winds. Unlike tornadoes, which demonstrate a rotational damage pattern, damage caused by straight-line winds tends to be very linear. This type of wind can be very strong, producing wind speeds as high as 80 to 90 mph, and can last twenty minutes or more. They often occur at the gust front of a thunderstorm or originate with a downburst from a thunderstorm. Straight-line winds are notorious for downing forest stands in linear swaths.

Another extremely dangerous weather event that produces high winds is a derecho. Derechos are widespread, long-lived windstorms that are associated with a fast-moving band of severe thunderstorms. They are also capable of producing very high, straight-line winds and even tornadic winds. They are considered a warm weather phenomenon, as they occur most often in the summer months—spring through early fall in the Northern Hemisphere. According to a National Weather Service map, the state of Vermont, the northern half of New York State and

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the rest of New England, derechos have a frequency of occurring about once every four years. There have been a few derechos that have occurred in Vermont in the last 15 years: on July 14-15 of 1995 (“the Adirondacks/Ontario Derecho”), on September 7, 1998 (“the Syracuse Derecho of Labor Day 1998”), on July 4-5 1999 (“the Boundary Waters-Canadian Derecho”) and most recently on July 15, 2005. It is thought that the worst derecho to hit Vermont was the “Boundary Waters-Canadian Derecho,” killing one camper in the Northeast Kingdom.

Despite the threat of straight-line winds and derechos, the most common type of high winds, are strong, sustained winds or wind gusts or gales. These high wind events can still damage critical infrastructure or down trees, which can knock out electricity, block roads and cause bodily harm.

Hail

Many hailstorms have occurred in Vermont, usually during the summer months. While local in nature, these storms are especially significant to area farmers, who can lose entire fields of crops in a single hailstorm. Large hail is also capable of property damage. 782 hail events were recorded between 1950 and 2019 in the state, making hail an annual occurrence in some part of the state. Most of these events had hail measuring between 0.75 and 1 inch, but 171 events had hail over 1 inch in size. The largest hail during the period was 3.3-inch hail that fell in Chittenden County in 2009 (NCEI). Sizeable hail has accompanied storms moving through Chelsea and the broader region.

Flooding

According to the 2018 State Hazard Mitigation Plan, fluvial erosion is the number one hazard that threatens Vermont. Many incidents of flooding have occurred in conjunction with other forms of severe weather, such as thunderstorms/lightning or high winds. The history of flooding is further discussed in the Flash Flood/Flood/Fluvial Erosion subsection of this LHMP.

The following list indicates the history of occurrence with regard to this hazard in Orange County (given the small population of Chelsea, Town-specific data is limited); an asterisk “*” denotes those instances in which Town-specific data is available, and federal disaster numbers are listed when appropriate. In an attempt to capture the individual hazards that may arise, and the different circumstances caused by the hazards in concert, the separate hazards are documented in the table below.

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
08/04/2020	✓			✓		County-wide	Orange County experienced 45 to 50 mph winds brought from Tropical Storm Isaias. Trees were damaged and power outages were reported in Orange County. Information on the

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
							duration of power outages is unavailable.
11/1/2019	✓			✓		County-wide	Downed trees, power outages, and structural damage over a wide area. Information on the duration of power outages is unavailable. Wind gusts over 45 mph at times. Approximately \$25k in wind-related property damage County-wide.
06/29/2019 *	✓			✓		Chelsea; County-wide	Several thunderstorms traveled from New York into Vermont. Winds around 55-60 mph downed trees in Chelsea.
04/15/2019 (DR-4445 VT)	✓	✓				County-wide	Severe storms caused flooding throughout the region, causing damage to some infrastructure and facilities. Specific information was not available for the Town of Chelsea. No available data on the size of the land area that was impacted.
10/29/2017 – 10/30/2017 (DR-4356 VT)	✓	✓		✓		County-wide	Measured wind gust of 40 to 50 mph , scattered tree damage and power outages. No available data on the size of the land area that was impacted.
07/19/2015 *	✓		✓			Chelsea; County-wide	Thunderstorms were experienced throughout Vermont with incidents of hail and heavy winds in certain areas. 1-inch hail was reported in Chelsea.
07/10/2013 *	✓	✓					Thunderstorms were reported with 2 to 3 inches of rainfall an hour. \$20k in damage was reported in Chelsea.
08/28/2011 (DR-4022, TS Irene)*	✓	✓		✓		Chelsea; County-wide	Widespread rainfall amounts of 3 to 5 inches occurred across Vermont with 5 to 7+ inches across much of southern, central Vermont. Devastating flash flooding occurred across much of central and southern Vermont mountain valleys with substantial and some record breaking flood stages on larger rivers. This flood event will likely rank second to the November 1927 flood in the scope of meteorological and hydrological conditions/impacts as well as loss of life (84 in 1927), but likely first in monetary damage ((approx. \$500. million statewide vs

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
							\$350. million (1927 in 2010 dollars)). There were nearly 2400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene. According to spotter's reports, Chelsea received over 5 inches of rain. Routes 110 and 113 were damaged in Chelsea during Irene. Wind gusts of 35 to 50 mph were reported in Orange County, uprooting trees. \$6,540.17 in damage total for Chelsea according to FEMA's Public Assistance database (captures at least 70% of total damage)—three roads damaged and embankment damage.
07/21/2010 *	✓		✓	✓		Chelsea; County-wide	Thunderstorms hit the area along with 60-65 mph winds developing into supercells that caused widespread damage to trees, power poles and structures throughout Chelsea. 1¾ inch hail reported. A metal sheeting roof was torn from a house located at the corner of Route 110 and Upper Village/Corinth Road.
08/21/2009 *	✓	✓		✓		Chelsea; County-wide	Rainfall and thunderstorms were reported across Vermont on August 21 st . Winds approximately 55 to 60 mph caused downed powerlines and trees in Chelsea. An official NWS Cooperative Observer reported 2.79 inches of rainfall. Flash flooding occurred in Chelsea, with significant flooding reported in the town center. Local roads, culverts, and bridges were damaged or destroyed in this event. The First Branch of the White River caused flooding onto Vermont Route 110. Route 113 east of Chelsea was also closed near Densmore road due to high water. Flooding from Jail Brook required evacuation of the Orange County Sheriff Office. A portion of West Corinth Road was destroyed by flooding from Cookeville Brook.

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
5/31/2009	✓		✓	✓		County-wide	40 to 55 mph wind gusts and hail caused fallen trees and power outages in the region. ¼ inch hail was reported in the region.
08/07/2008 *	✓		✓			Chelsea; County-wide	Thunderstorms were reported in Vermont. Approximately .88 inch hail was reported around Chelsea, causing minor damage to vehicles.
08/25/2007 *	✓		✓	✓	✓	Chelsea; County-wide	A series of severe thunderstorms in New York intensified as they traveled east into Vermont. High wind and hail was reported; however, there is no numerical data available. It was, however, reported that a hay barn in Chelsea was destroyed after being struck by lightning during the storm.
07/09/2007-07/11/2007 (DR-1715 VT)	✓	✓		✓		County-wide	Severe storms and flooding impacted Orange and surrounding counties. No available data on wind speed or the size of the land area that was impacted.
06/19/2006 *	✓			✓		Chelsea; County-wide	Intensifying storms traveled east across Vermont. 55 to 60 mph winds knocked down powerlines and trees in Chelsea.
07/21/2003-08/18/2003 (DR-1488 VT)	✓	✓		✓		County-wide	Severe storms and flooding impacted Orange and surrounding counties. No available data on the size of the land area that was impacted.
7/4/2002	✓			✓		County-wide	No available data on wind speed.
7/10/2001*	✓		✓	✓		Chelsea; County-wide	.88 inch hail reported in Chelsea. No available data on wind speed.
07/14/2000-07/18/2000 (DR-1336 VT)	✓	✓		✓		County-wide	Severe storms and flooding impacted Orange and surrounding counties. No available data on wind speed or the size of the land area that was impacted.
9/16/1999-9/21/1999 (DR-1307 VT)	✓	✓		✓		County-wide	Tropical Storm Floyd's rains and winds caused road and culvert washouts. No available data on wind speed or the size of the land area that was impacted.
1/19/1996 – 2/2/1996 (DR 1101 VT)		✓		✓		County wide	No available data on wind speed or the size of the land area that was impacted. Approximately \$250,000 in property damage county-wide.

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
8/6/1989	✓			✓		County-wide	No available data on wind speed or the size of the land area that was impacted.
6/6/1984 – 6/8/1984 (DR 712 VT)	✓	✓				County-wide	No available data on the size of the land area that was impacted.
8/5/1976 (DR 518 VT)	✓	✓		✓		County-wide	No available data on wind speed or the size of the land area that was impacted.
7/6/1973 (DR-397 VT)		✓		✓		County-wide	One of the largest flood events of the 20 th century in VT. Landslides reported in the region. No available data on wind speed or the size of the land area that was impacted.
11/3/1927	✓	✓				County-wide	“Great Flood of 1927.” Worst recorded flood in VT. White River crested at a record of 29.30 feet. No available data on the size of the land area that was impacted.

Figure 17. History of severe weather in Chelsea

As demonstrated in the table of previous occurrences above, high winds have caused damage in Orange County and in the Town of Chelsea specifically. Damage caused by high winds has included downed trees and power lines, and, as a result, power outages. Power outages can be particularly serious for “power critical customers” that do not have the luxury of having a generator. However, in general, high winds cause relatively minor damage on a town-wide scale.

Severe weather events are highly likely to occur in the future in Chelsea. Precipitation trend analysis suggests that intense, local storms are occurring more frequently and will continue to do so in the future. More localized severe weather storms in Chelsea will likely result in increased flooding in the Town.

The Town of Chelsea completed a geo-referenced culvert inventory map update with assistance from Two Rivers-Ottawquechee Regional Commission in 2014. With the culvert inventory complete, the Town plans to maintain it in-house. The Town of Chelsea’s work to upgrade culverts remains in process, and the culvert inventory has helped the Town plan and prioritize culvert upgrade/improvement projects.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood/Probability
Severe Weather	Town wide for wind, hail, high winds, lightning and thunderstorm impacts. The following areas are regularly or sometimes impacted	Town and private buildings and utilities; culverts, bridges, road infrastructure.	Tropical Storm Irene 5-7” across county (over 5” of rain in Chelsea).	Varied depending on the severity of the event.	Highly Likely

	by flooding: Areas along Jail Brook, First Branch of the White River				
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Figure 18. Chelsea Vulnerability to Severe Weather

4. Hazardous Material Spill

Based on available VT Tier II data, there are seven sites in town that have sufficient types and/or quantities of hazardous materials to require reporting. Chelsea's Village is predominantly located along Vermont Routes 110 and 113 along the First Branch of the White River and Jail Brook. No major, functioning interstate highways or railways run through or near the Town. There are 311 residential and 51 commercial, industrial or public buildings within 1,000 feet of a potential HAZMAT spill on major roads, such as Routes 110 and 113. This includes the Town Clerk's Office, the Town Hall, the Fire Department, the Chelsea Public School, the Orange County Sheriff, and the Orange County Superior Court.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Hazardous Materials Spill**.

It should also be noted that the State of Vermont currently has one fully-trained HAZMAT response team, with vehicles located in Essex Junction, Brandon, and Windsor. The HAZMAT crew chief is available within minutes of a call for the team but on-scene response would be a matter of hours. In the event of a serious accident in Town, there would be little time for evacuation and response would be difficult.

The following data was retrieved from the Vermont Department of Environmental Conservation's Spill List and by searching the archives of local newspapers. The table above is used to illustrate the ease with which trucks and the day-to-day activities in the Town have the potential to create a hazardous material spill and dangerous conditions for emergency responders and town residents.

History of Occurrences:

Date	Event	Location	Extent and Impacts
09/03/2020	Fuel Oil Spill	349 VT Route 110	An abandoned tank was punctured during excavation work, causing the release of 50-75 gallons of oil.
12/18/2017	Hydraulic Oil Spill	Near Chelsea Substation	A broken hose released less than 2 gallons of hydraulic oil, which sprayed approximately 30 feet in two directions.
07/03/2017	Transmission Oil Spill	Chelsea School	A PTO on a fuel delivery truck blew and leaked 3 gallons of transmission oil onto the pavement.
02/26/2015	Fuel Oil Spill	85 Town Farm Rd	Less than half a gallon of oil leaked from a tank at the glass sight gauge onto the concrete.
07/01/2011	Diesel Spill	VT Route 110	Delivery truck ruptured diesel tank upon entering driveway. Approximately 35 gallons of diesel released. 39 tons of contaminated soil was excavated and disposed of.
01/29/2009	Diesel Spill	Hayward Cross Road	An above-ground storage tank was hit during snow removal. Approximately 100 gallons of diesel released.
07/15/2008	Diesel and Milk Spill	East Randolph Road	Milk truck rolled over, released unknown quantity of milk and approximately 70 gallons of diesel fuel. Stream was located 300 feet away from location of spill.

12/30/2008	Propane Spill	Pepper Road	Propane truck rolled over. Spill was originally reported to be diesel, but was later determined to be liquid propane. Hazardous material was flowing into a tributary of the White River.
12/15/2003	Hazardous Material Spill	Route 113 and Densmore Road	Small release from dome covers-- two gallons of oil or diesel released.
12/11/1995	Hazardous Material Spill	Wellspring School	Approximately 400 gallons of fuel (specifics unknown) released due to a line blowing during delivery.

Figure 19. History of Hazardous Material Spills in Chelsea

While only a small number of large hazardous material spills have occurred in the Town of Chelsea, the potential for a major spill exists. Routes 110 and 113, particularly at their point of intersection, pose constant threats to the Town of Chelsea. These routes serve as the main thoroughfares for trucks and other motor vehicles transporting a wide-range of goods, including a wide range of hazardous materials, within the confines of Chelsea. A truck accident and a resulting hazardous material spill could be exceedingly disastrous for the Town and its residents as these two routes intersect in the Village. Route 110 in Chelsea, and in the Village, is located in close proximity to the First Branch of the White River, while Route 113 parallels Jail Brook. As a result, additional water contamination issues could be created if a hazardous material spill were to occur along either of these major routes.

A hazardous material spill in the Village, in addition to impacting residents, businesses and surface waters, may also impact the Village water supply. The Chelsea Water System serves a population of approximately 450 and 200 connections, including residential, a nursing home, a health care facility, two schools, two service stations and a number of businesses in the village. There have been instances of groundwater contamination in the past, with one source being particularly vulnerable to contamination due to its location in a shallow, unconfined aquifer. Contamination of the water sources is possible and discussed in the Chelsea Water System's Source Protection Plan. The potential sources of contamination that are currently located in the Town and that are sedentary—the Chelsea Town Garage, two automotive repair shops, the Chelsea Town Hall and Common, and residential and commercial properties—are evaluated in the Source Protection Plan. Mobile sources of contamination are not addressed in the Source Protection Plan. The Source Protection Plan also includes a management plan for reducing the potential risk of contamination to the Chelsea Water System and a contingency plan for addressing the contamination of the water system.

In order to prepare for hazardous material spills in Chelsea, most members of the Chelsea Fire Department are trained to the HAZMAT Awareness level.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood/Probability
Hazardous Materials Spill	Vermont Routes 110 and 113, and local roads.	Road infrastructure, nearby structures (Town Clerk's Office, the Town Hall, the Fire Department, the Chelsea Public School, the	Initially, local impacts only; but depending on material spilled, extent of damage may spread (ex.	There are 311 residential and 51 commercial, industrial or public buildings within 1,000 feet of a potential HAZMAT spill on	Likely

		Orange County Sheriff, and the Orange County Superior Court) and the First Branch of the White River and Jail Brook.	into groundwater).	major roads (Vermont Routes 110 and 113).	
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Figure 20. Chelsea Vulnerability to Hazardous Material Spills

5. Flash Flood/Flood/Fluvial Erosion

Flooding is one of the worst threats to Chelsea's residents and infrastructure. Past instances of flooding in Chelsea have included rain and/or snowmelt events that cause flooding in the major rivers' floodplains and intense rainstorms over a small area that cause localized flash-flooding. Both kinds of events can be worsened by the build-up of ice or debris, which can contribute to the failure of important infrastructure (such as culverts, bridges, and dams). Please see the separate Ice Jams hazard profile in this Plan for more specific information on ice jams in the Town of Chelsea.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Flash Flood/Flood/Fluvial Erosion**.

Flash floods typically occurs after severe storms, in which a large amount of precipitation is amassed over a short period of time. According to the National Weather Service, flash floods usually occur within a period of six hours. Flash Floods and Floods from tropical storms and heavy rain events result in fluvial erosion, which can damage adjacent roads and properties. Fluvial erosion occurs when soils and other sediment are removed from river and stream banks. In the 2018 State Hazard Mitigation Plan, fluvial erosion is the number one hazard that threatens Vermont.

The worst flood disaster to hit the Town of Chelsea, as well as the overarching region and the State of Vermont, occurred on November 3, 1927. This event was caused by up to 10 inches of heavy rain from the remnants of a tropical storm that fell on frozen ground. Eighty-four Vermonters, including the Lieutenant Governor, were killed. The flooding in the White River valley was particularly violent, with an estimated 120,000 to 140,000 cubic feet/second (cfs) flowing out of the White River at West Hartford, Vermont. Like many towns in the region, the Town of Chelsea received heavy precipitation, seeing roughly 7-8 inches of rainfall over the storm period.

A more recent flooding event that devastated the region and the state was the result of Tropical Storm Irene, which occurred on August 28, 2011. Record flooding was reported across the state and was responsible for several deaths, as well as hundreds of millions of dollars of home, road and infrastructure damage. Due to the strong winds, 50,000 Vermont residents were initially without power, and many did not have electricity restored to their homes and businesses for over a week. Despite the damage wrought, the flooding caused by Tropical Storm Irene is considered to be the second greatest natural disaster in 20th and 21st century Vermont, second only to the Flood of 1927.

The Town of Chelsea suffered some damage to property and infrastructure during Tropical Storm Irene, and no lives were lost. It is estimated that Tropical Storm Irene dropped 5-6 inches of rain over the Town of Chelsea in a very short span of time, some of the highest precipitation totals in Orange County (which averaged 5-7+ inches over its land area). A few of Chelsea's roads were damaged by the storm, including

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parts of: Vermont Routes 110 and 113. The county-wide damage for Orange County totaled \$5 million. As luck would have it, the Town of Chelsea received little damage during Tropical Storm Irene (approximately \$6,500 according to FEMA's PA database). However, this was likely due in large part to localized variability of rainfall and the path of the tropical storm than the Town's invulnerability to flooding.

Since the 2015, there have been at least three buyouts of properties susceptible to flooding. According to FEMA's NFIP list there is one repetitive loss property in the Town of Chelsea, which is classified as residential.

Unfortunately, flooding is very common across the region, with many events impacting the Town of Chelsea specifically, and Chelsea has been hit hard by other flooding events that pre-date Tropical Storm Irene. As such, flooding is one of the worst threats to Chelsea's residents and infrastructure. The following list indicates the history of occurrences with regards to this hazard in Orange County (given the small population of Chelsea, town-specific data is limited); an asterisk "*" denotes the instances in which town-specific data is available, and federal disaster numbers are listed where appropriate.

Extent of fluvial erosion for these incidents is not available, as the data is not collected immediately after flooding events in the Town. A member of the LHM Planning team mentioned that erosion was an issue along the First Branch of the of the White River near the cemetery; however, details on the amount of erosion are not available. Erosion typically occurs along river corridors, especially where roadways are present.

History of Occurrences:

Date	Event	Location	Extent and Impacts
08/22/2021 (3567-EM-VT)	Tropical Storm Henri	County-; region-wide	No available data on the size of the land area that was impacted.
Period from 10/31/2019-11/01/2019 (DR-4474-VT)	Severe Storms and Flooding	County-; region-wide	Rainfall ranging from 1.5 to 2 inches reported throughout Vermont. The storm resulted in more than 100,000 power outages; the precise duration of these power outages were not available. No available data on the size of the land area that was impacted.
04/15/2019 (DR-4445-VT)	Severe Storms and Flooding	County-; region-wide	Severe storms caused flooding throughout the region, causing damage to some infrastructure and facilities. No available data on the size of the land area that was impacted.
10/29/2017 - 10/30/2017 (DR-4356 VT)	Severe Storms and Flooding	County-; region-wide	No available data on the size of the land area that was impacted.
6/29/2017-7/1/2017 (DR-4330-VT)	Severe Storms and Flooding	County-; region-wide	No available data on the size of the land area that was impacted.
Period from 04/15/2014-04/18/2014	Severe Storms	Chelsea, County-wide	Heavy rainfall and snow melting caused flooding throughout Orange County. Route 110 in Chelsea was flooded and several local roads were damaged. Specific monetary

Date	Event	Location	Extent and Impacts
	and Flooding		estimates for the Town of Chelsea were not available. No available data on the size of the land area that was impacted.
Period from 06/25/2013—07/11/2013 (DR-4140)*	Severe Storms and Flooding	County-; region-wide	Severe storms caused flooding throughout the region, causing damage to some infrastructure and facilities. No damage was claimed in the Town of Chelsea. No available data on the size of the land area that was impacted.
08/28/2011 (DR-4022, TS Irene)*	Tropical Storm Irene	Chelsea, County-wide	Widespread rainfall amounts of 3 to 5 inches occurred across Vermont with 5 to 7+ inches across much of southern, central Vermont. Devastating flash flooding occurred across much of central and southern Vermont mountain valleys with substantial and some record breaking flood stages on larger rivers. This flood event will likely rank second to the November 1927 flood in the scope of meteorological and hydrological conditions/impacts as well as loss of life (84 in 1927), but likely first in monetary damage ((approx. \$500. million statewide vs \$350. million (1927 in 2010 dollars)). There were nearly 2400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene. According to spotter's reports, Chelsea received over 5 inches of rain. Routes 110 and 113 were damaged in Chelsea during Irene. \$6,540.17 in damage total for Chelsea according to FEMA's Public Assistance database (captures at least 70% of total damage)—three roads damaged and embankment damage. No available data on the size of the land area that was impacted.
07/21/2010*	Flash Flooding	Chelsea; County-wide	Several storms strengthened into super cells that produced widespread wind damage to trees, power poles and structures as well as large hail in excess of golf ball size in diameter. Very heavy localized rains caused some temporary problems in many communities. In Chelsea, the second in a series of severe thunderstorms with torrential rains washed out several culverts, lower portions of Kennedy Drive and partial shoulder washouts along Upper Village road. Approximately \$100,000 in damage. No available data on the size of the land area that was impacted or the amount of rain in inches.
08/21/2009*	Flash Flooding	Chelsea; County-wide	Thunderstorms produced torrential downpours in Chelsea. An official NWS Cooperative Observer reported a rainfall total of 2.79 inches , and other unofficial reports of 4 inches of rain within 2 hours were common. Flash Flooding resulted, and the town center of Chelsea was the hardest hit. The First Branch of the White left its banks and rushed down Route 110 in the middle of the Village. Route 113 east of Chelsea was also closed near Densmore road due to high water. Jail Brook forced the evacuation of the Orange Co. Sheriff office. Approx. \$280,000 in damage in Chelsea. No available data on the size of the land area that was impacted.
08/07/2008* (Part of DR-1790 VT)	Flash Flooding	Chelsea; County-wide	Thunderstorms with heavy rainfall in a moist atmosphere moved through central and southern Vermont during the afternoon and evening hours. Flash flooding in Chelsea reported on Route 110 north of Chelsea Village. Approximately \$93,000 in damage to Town roads and embankment slides. No available data on the size of the land area that was impacted or the amount of rain in inches.
01/1998* (DR-1201 VT)	Flooding	Chelsea; County-wide	Approximately \$20,000 in damage to Town roads. No available data on the size of the land area that was impacted.
03/1992* (DR-938 VT)	Flooding	Chelsea; County-wide	Approximately \$43,000 in damage to Town roads—Town Highways #1-11—caused by heavy rain, ice jams and flooding. No available data on the size of the land area that was impacted.

Date	Event	Location	Extent and Impacts
10/02/1989* (DR-840 VT)	Flooding	Chelsea, County- wide	Approximately \$33,000 in damage to Town roads. No available data on the size of the land area that was impacted.
06/28/1973— 06/30/1973 (DR-397)	Flooding	County- wide	Rainfall as much as 6 inches in 24 hours in some locations. State declared disaster area. Deaths, 3; damage, \$64 million. No available data on the size of the land area that was impacted.
11/02/1927— 11/04/1927 ("Flood of 1927")	Flooding	County- wide	Considered to be one of VT's most devastating events, the flood took out 1285 bridges, miles of roads and railways, and countless homes and buildings. 84 people were killed, including Lt. Gov. S. Hollister Jackson. Rainfall totaled 4 to 9 inches statewide, following a month with 150% the normal amount of rain. No available data on the size of the land area that was impacted.

Figure 21. History of Flooding in Chelsea

The Town of Chelsea has standalone flood hazard regulations; the flood hazard regulations are not included within the Town's Zoning Ordinance and the applicant is required to receive a separate flood permit for any proposed development in the Chelsea Flood Hazard Overlay District. Development in the floodway is prohibited and restrictions are placed on development in the "areas of special flood hazard." The Chelsea Flood Hazard Area Regulations were most recently approved by public vote in 2017.

According to Flood Ready Vermont, there are currently 70 buildings in the Special Flood Hazard Area (SFHA) in Chelsea. 14% of these properties have flood insurance in effect.

Across Vermont, most child and elder care facilities are not registered with the State. Most child day care in Chelsea is likely private in-home care, but there are also two licensed childcare providers and three registered childcare homes. Due to their location, two of these facilities are at moderate risk of flood damage. There is one elder care facility in the Town of Chelsea. This facility is at risk for flood damage. There is also senior housing facility that is accessed only by Maple Avenue and it would be isolated if the Maple Avenue Bridge was flooded/washed out. Finally, low income housing is not registered with the State. There are currently no mobile home parks located in Chelsea that are registered with the state, but there is a low income housing unit north of the village.

Recent studies have shown that the majority of flooding in Vermont is occurring along upland streams, as well as along road drainage systems that fail to convey the amount of water they are receiving. These areas are often not recognized as being flood prone, and property owners in these areas are not typically required to have flood insurance (DHCA, 1998). It should be noted that, while small, mountainous streams may not be mapped by FEMA in NFIP FIRMs (Flood Insurance Rate Maps), flooding along these streams is possible, and should be expected and planned for. Flash flooding in these reaches can be extremely erosive, causing damage to road infrastructure and to topographic features including stream beds and the sides of hills and mountains. The presence of undersized or blocked culverts can lead to further erosion and stream bank/mountainside undercutting. Furthermore, precipitation trend analysis suggests that intense, local storms are occurring more frequently.

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Three bridges are on VT Route 110, and are the responsibility of the state. These include the South Village Bridge (B9) over the First Branch, a box culvert (B10) over Jail Brook in the center of the village, and the North Village Bridge (B11) over the First Branch. The Vermont Agency of Transportation (VTrans) has replaced the deck of the South and North Village bridges in 2017. The replacement of the South Village Bridge (B9) addressed hydraulics by making the beams on the new bridge shallower and changing the I-Beam



Figure 22. Maple Avenue Bridge (B45) over the First Branch of the White River. Photograph from the Vermont Agency of Transportation.

construction to a different Beam construction so debris would have nothing to “catch” on. This helped minimize the potential for debris to cause inundation flooding issues upstream of the bridge. Additionally, the Town maintains the Maple Avenue Bridge (B45) over First Branch and the Court Street Bridge (B43) over Jail Brook. Ice jams at the box culvert (B10) over Jail Brook have caused water to overtop VT Route 100. However, no significant property damage has been reported as a result of these overflows. Below is a table of potential actions for upgrading the Maple Avenue Bridge, as included in the Chelsea Flood Study developed by DuBois & King Inc. for TRORC in 2016. The bridge is still in need of upgrades.

Alternative	Primary Objective	Major Component	Approximate Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
Do Nothing		No physical improvements; No change in bridge, channel of floodplain dimensions.	None	No municipal costs.	Bridge and narrow stream width in the walled section will continue to be channel constrictions.	No change in private homeowner flood related damage costs.
Widen and elevate Bridge	Improve span to provide additional hydraulic capacity. Replace existing bridge in poor condition.	Replace existing 26 foot bridge with span of 36 feet. Raise low steel approx. 1 foot.	High - \$800,000 to \$1,000,000	Improved hydraulic capacity; minor reduction in backwater depth from 0.5 feet to 1.7 feet depending upon the flood event. Wider structure opening	Maple Avenue still flooded at Q10, Q25, Q50 and Q100 event. Reduction in channel velocity and shear stress may impact the debris and ice transport through the bridge. 12-inch water line located in	Span can only be 36 feet before it exceeds average channel width upstream and downstream. In addition, span is limited by adjacent infrastructure. Bankfull width based on regional curves is 61 feet.

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Alternative	Primary Objective	Major Component	Approximate Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
				reduces channel velocity and shear stress. Bridge replacement is likely needed regardless of change in hydraulic capacity.	the First Branch upstream of BR45	Bridge only access to residential area and elderly housing.
Remove Constriction at RS 6172 (In walled section of the First Branch)	Provide additional hydraulic capacity.	Reconstruct existing west retaining wall (22 feet wide) to a width of 36 feet for approximately 100 feet.	Moderate - \$100,000	Improved hydraulic capacity; minor reduction in backwater depth from 0.1 feet to 1.0 feet depending upon the flood event. Wider structure opening reduces channel velocity and shear stress.	Doesn't appreciably change flood stages.	Would require landowner permission.
Widen Bridge and Remove Constriction at RS 6172	Improve span and channel width to provide additional hydraulic capacity.	Replace bridge with 36 foot span and rebuild constricted walled section with wider channel width (36 feet).	High – \$900,000 to \$1,100,000	Improved hydraulic capacity and reduced channel velocities and shear stress. By removing the constriction the channel is reconnected to floodplain for a short distance.	Maple Avenue still flooded at Q10, Q25, Q50 and Q100 event. Reduction in channel velocity and shear stress may impact the debris and ice transport through the bridge.	Would require landowner permission.

Figure 23. Potential Actions for Upgrading Maple Avenue Bridge (B45). Source: Chelsea Flood Study by DuBois and King, September 16, 2016

Chelsea has engaged in culvert upgrading since the 2009 Chelsea Annex was drafted, and the Town is continuously upgrading culverts to allow additional floodwaters to pass through the structure. Approximately 29 culverts have been upgraded town-wide since Tropical Storm Irene occurred in 2011.

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In addition, the Town's last comprehensive culvert inventory was completed in 2006, but a Class III road inventory was completed in 2013 which included upgrade projects.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/ Probability
Flash Flood/ Flood/ Fluvial Erosion	Chelsea Village; properties along the First Branch of the White River; Route 110 and 113.	Culverts, bridges, road infrastructure, public and private infrastructure. There are 96 residential (including 83 single family dwellings, 5 multi-family dwellings, and 5 mobile homes) and 38 commercial/industrial/public structures in the 500-year floodplain.	Tropical Storm Irene—4-7" across county (5+" in Chelsea).	\$6,540.17 in damage total for Chelsea according to FEMA's Public Assistance database (captures at least 70% of total damage). The storms that occurred on 07/21/2010 and 08/21/2009, while exact figures are not clear, caused significantly more damage in Chelsea.	Likely

Figure 24. Chelsea Vulnerability to Flooding

C. Vulnerability Summary

As a result of the above profile of hazards, the town believes the following vulnerabilities to be of highest concern because of their potentially severe consequences and potential likelihood:

1. **Ice Jams/Spring Runoff/High Water**: A major jam on Jail Brook could be catastrophic to the village. Inadequate bridge design contributes to the threat.
2. **Extreme Cold/Snow/Ice Storm**: Another threat to the town is from heavy snow loads that can down power lines, communications, and collapse roofs. Prolonged power outages can interrupt public and business services. Chelsea's high elderly population is also particularly vulnerable in instances of this hazard.
3. **Severe Weather (Thunderstorm, Lightning, High Wind, Hail, and Flooding)**: Severe weather events, primarily those events involving high wind and thunderstorms, have caused downed trees and powerlines in Chelsea, while events involving flooding have caused damage to roads and culverts.
4. **Flash Flood/Flood/Fluvial Erosion**: One of the worst threats, flooding impacts roads and the village, especially facilities for children, elders, and low income housing. Under-sized bridges and culverts factor into the threat, as do outdated flood hazard mapping. Furthermore, flood hazard mapping (Special Flood Hazard Areas) does not adequately encompass all areas that could be flooded, thus potentially making some residents too complacent in regard to the threat. In addition, the town's current flood bylaw does not address fluvial erosion that is a threat at higher elevations, especially along roadways. In addition, the fire station and three wells in the floodplain could be impaired by a major flood event.
5. **Hazardous Material Spill**: A truck traffic accident on Routes 110 and 113, especially at their intersection, could cause a major spill. This could threaten the village water supply and contaminate the White River and/or Jail Brook. Storage of hazardous materials in the basements of Chelsea's residences increases the Town's vulnerability of hazardous material spills and leaks.

The Town of Chelsea has identified the following hazards of being of lower, and thus they are not explored in detail through this LHMP:

6. **Structural Fire**: According to the 2015 LHMP, the Fire Department makes attempts to develop additional dry hydrants sites, but it is difficult due to the Town's terrain. Three to four dry hydrants were installed between 2009 and 2015. While structural fire is still considered a serious issue in the Town of Chelsea, the LHM Planning Team has decided not to prioritize this hazard due to the difficulty with mitigating it.
7. **Landslides/Mudslides/Rockslides**: Landslides and mudslides can occur in Chelsea; however, the impact of this hazard is not significant enough to warrant additional mitigation planning.
8. **Hurricanes/Tropical Storms**: Vermont is a landlock state, making it less vulnerable to hurricanes and tropical storms. Towns, such as Chelsea, can still prepare for flooding and the severe weather caused by Hurricanes and Tropical Storms.

9. **Water Supply Contamination:** There are three public groundwater source wells in Chelsea, which could potentially experience contamination; however, there is not a high likelihood of this occurring.
10. **Invasive Species/Infestation:** This is seen as a minor issue in Chelsea. The Emerald Ash Borer, specifically, is present in Orange County; however, Chelsea does not have a significant population of Ash trees present for the Emerald Ash Borer to be viewed as a major threat.
11. **Drought:** While a drought has the possibility of occurring in Chelsea, the Town does not see this as a significant threat. The lack of agricultural activity in the town further deprioritizes drought as a hazard.
12. **Wildfire:** Wildfires (which consists of grass fires and forest fires) is not considered to be a significant threat to the Town of Chelsea.
13. **Infectious Disease Outbreak:** The Town of Chelsea does not see infectious disease outbreak as being a significant threat. Chelsea's small population makes the town less vulnerable compared to other communities in the country.
14. **Earthquake:** The Town of Chelsea is in a location that can experience earthquakes; however, the impact of these earthquakes is not significant enough to warrant investment in mitigation actions.
15. **Tornado:** Tornadoes are not a common occurrence in the Town of Chelsea.
16. **Extreme Heat:** There have been instances of extreme heat in Chelsea; however, like most of Vermont, the occurrence of extreme heat is rare.
17. **Dam Failure:** There are dams in Chelsea, including the Keyser Dam, thus dam failure is a possible hazard; however, the lack of dams along major rivers makes dam failure less detrimental to the Town.

VI. Mitigation

A. Mitigation Goals

- To reduce long-term impacts and losses of the natural hazard of ice jams.
- To reduce long-term impacts and losses of the natural hazard of extreme cold/snow/ice storms.
- To reduce long-term impacts and losses of the natural hazard of severe weather.
- To reduce long-term impacts and losses of the hazard of hazardous material spill(s).
- To reduce long-term impacts and losses of the natural hazard of flash flooding, flooding and fluvial erosion.

B. Excerpted Town Plan Goals & Objectives Supporting Local Hazard Mitigation

- It is the policy of the Town to provide for reasonable zoning standards enabling home occupations and home businesses to be developed or to continue (page 16).
- It is the policy of the town to work with the Two Rivers-Ottawaquechee Regional Commission to properly plan for hazard events (page 48).

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- The Selectboard should adopt a Hazard Mitigation Plan with assistance from the Two Rivers-Ottawaquechee Regional Commission (page 48).
- It is the policy of the Town that preservation of the natural state of streams should be encouraged by protection of mapped wetlands and maintenance of existing stream bank and buffer vegetation including trees (page 50).
- To enhance and maintain use of flood hazard areas as open space, greenways, non-commercial recreation and/or agricultural land (page 56).
- It is the policy of the Town that new or replacement utilities or facilities serving existing development (e.g. water lines, electrical service, waste disposal systems, roads, and bridges) may be located within these areas only when off-site options are not feasible and provided that these utilities or facilities meet the flood proofing requirements in Chelsea's Unified Bylaw (page 56).
- To protect the citizens of Chelsea by using good planning practices within designated Flood Hazard Areas and Fluvial Erosion Hazard Areas (page 72).
- To provide and maintain a safe, energy efficient, and cost effective transportation system integrating all modes of travel (auto, pedestrian, bicycle, and mass transit) and meeting the needs of the public in a manner consistent with the other goals, policies and recommendations of this Town Plan (page 80).

The Chelsea Municipal Plan was updated and adopted on 11/16/2015, and has an 8 year lifespan.

C. Hazard Mitigation Strategies: Programs, Projects & Activities

Vermont's Division of Emergency Management & Homeland Security encourages a collaborative approach to achieving mitigation at the local level through partnerships with Vermont Agency of Natural Resources, VTrans, Vermont Agency of Commerce and Community Development, Regional Planning Commissions, FEMA Region 1 and others. That said, these agencies and organizations can work together to provide assistance and resources to towns interested in pursuing hazard mitigation projects.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii), 201.6(c)(3)(iii) and 201.6(c)(3)(iv).

With each mitigation strategy, general details about the following are provided: local leadership, possible resources, implementation tools, and prioritization. The prioritization category is based upon the economic impact of the action, Chelsea's need to address the issue, the cost of implementing the strategy, and the availability of potential funding. The cost of the strategy was evaluated in relation to its benefit as outlined in the STAPLEE guidelines (includes economic, political, environmental, technical, social, administrative, and legal criteria). A range of mitigation strategies was vetted by the committee, and those that were determined to be feasible are included in the table below.

Strategies given a "High" prioritization indicate they are either critical or potential funding is readily available, and should have a timeframe of implementation of less than two years. A "Medium" prioritization indicates that a strategy is less critical or that the potential funding is not readily available and has a timeframe for implementation of more than two years. A "Low" prioritization indicates that

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the timeframe for implementation of the action, given the action's cost, availability of funding, and the community's need to address the issue, is more than four years.

The Town of Chelsea understands that, in order to apply for FEMA funding for mitigation projects, a project must meet more formal FEMA benefit cost criteria. A project seeking FEMA funds would undergo a full benefit-cost assessment in the FEMA-approved format. The Town must have a FEMA-approved Local Hazard Mitigation Plan as well.

The following strategies will be incorporated into the Town of Chelsea's long-term land use and development planning documents. In addition, the Town will review and incorporate elements of this Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/ fluvial erosion hazards (FEH) bylaws. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas. Individuals and organizations bolded in the following are primarily responsible for each corresponding action, followed by other individuals and organizations with supporting roles.

Mitigation and Preparedness Actions	Local Leadership	Prioritization (Mitigation Plan Status)**	Possible Resources*	Time Frame
All Hazards				
<i>Ensure that Chelsea's Local Emergency Management Plan (LEMP) is kept up-to-date and identifies vulnerable areas and references this Plan. (Mitigation/Preparedness)</i>	Emergency Management Director with Selectboard	High (Repeating)	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); TRORC; local resources	1 year from date of Plan Approval
<i>Provide information at Town Meeting about VT Alert and encourage residents to sign up. (Mitigation/Preparedness)</i>	Town Clerk	High (2015)	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); VT Alert; local resources	1 year from date of Plan Approval
<i>Refine methodology to consistently document infrastructure damage after weather events. (Mitigation)</i>	Road Foreman with Town Administrator	Medium (2015)	TRORC; local resources; National Weather Service; VTrans	3 years from date of Plan Approval
Ice Jams/Spring Runoff/High Water				

Mitigation and Preparedness Actions	Local Leadership	Prioritization (Mitigation Plan Status)**	Possible Resources*	Time Frame
<i>Improve banks along Jail Brook and update and increase size of box culvert (B10) through which Jail Brook flows to improve the structure's ability to pass ice and flood waters. This is a state-owned structure. (Mitigation)</i>	Selectboard	High (2015)	VTrans; local resources	2 years from date of Plan Approval
<i>Update and increase size of the opening on Jenkins Brook Bridge. (Mitigation)</i>	Selectboard	High (New)	VTrans; Local Resources	2 years from date of Plan Approval
<i>Remove gravel behind Quik Stop stream bed to allow improved ice and water flow and reduce erosion on the cemetery site of the First Branch. (Mitigation)</i>	Selectboard	Medium (New)	Local Resources	3 years from date of plan approval
Extreme Cold/Snow/Ice Storm				
<i>Identify populations that are vulnerable to extreme cold and create a plan to assist them, if necessary, in the event that it occurs. (Mitigation/Preparedness)</i>	Chelsea Fire Department/ First Branch Ambulance	High (2015)	Chelsea Fire Department resources; First Branch Ambulance resources; Washington Electric Co-Op; Green Mountain Power	1 year from date of Plan Approval
<i>Develop a plan for communicating shelter information to residents and especially to populations that are vulnerable to extreme temperatures. (Mitigation/Preparedness)</i>	EMD; American Red Cross	High (New)	Local resources; VEM	1 year from date of Plan Approval
Severe Weather (Thunderstorm, Lightning, High Wind, Hail, and Flooding)				
<i>Explore funding sources to purchase backup generators for municipally owned buildings. (Mitigation)</i>	Selectboard; Fire Department; EMD	High (New)	Local resources; FEMA	2 years from date of Plan Approval

Mitigation and Preparedness Actions	Local Leadership	Prioritization (Mitigation Plan Status)**	Possible Resources*	Time Frame
<i>Work with Green Mountain Power and Washington Electric Co-Op to identify vulnerable power lines and other infrastructure in Chelsea. (Mitigation)</i>	Road Foreman; Tree Warden	High (New)	Local resources; Washington Electric Co-Op; Green Mountain Power	2 years from date of Plan Approval
Hazardous Material Spill				
<i>Work with Tier II Facilities in Chelsea to properly plan for hazardous material incidents. (Mitigation)</i>	Chelsea Fire Department	High (New)	Local resources	1 year from date of Plan Approval
<i>Determine areas of Chelsea that have a high volume of hazardous materials (such as transportation routes such as Vermont Route 113 or Tier II facilities) and plan for potential incidents. (Mitigation)</i>	Chelsea Fire Department	Medium (New)	Local resources	3 years from date of Plan Approval
Flash Flood/Flood/Fluvial Erosion				
<i>Upgrade the town-owned Maple Avenue Bridge (B45), as it is undersized. (Mitigation)</i>	Selectboard	High (2015)	VTrans Structures grants; FEMA HMGP/PDM grants; local resources	2 years from date of Plan Approval
<i>Explore possibilities for floodplain restoration along the First branch of the White River (Mitigation)</i>	Selectboard	Medium (New)	FEMA	4 years from date of Plan Approval
<i>Support town or conservation organization assistance to landowner(s) of property(ies) in Chelsea on the NFIP's repetitive and severe repetitive loss list to reduce flood damages, through elevation, floodproofing, acquisition or relocation, or an infrastructure project if one is found to address the source of flooding. (Mitigation)</i>	Selectboard	Low (2015)	FEMA HMGP/PDM grants; local resources	5 years from date of Plan Approval

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Figure 25. Mitigation Strategies for the Town of Chelsea

*Depending on the mitigation action, local resources may include the following: personnel/staff time; volunteer time; budget line items, donations, cash from capital campaigns, among others.

** The 2009 project to stabilize stream banks along Corinth Road is only partially complete (priority #6 in former plan). The town has installed a box culvert but has no current plan to stabilize streambanks further at this time, being a lesser priority to the current slate of projects.

Appendices

Appendix A: Hazard Ranking Methodology

Score	Frequency of Occurrence: Probability of a plausibly significant event.	Potential Impact: Severity and extent of damage and disruption to population, property, environment and the economy.
1	Unlikely: less than 1% probability of occurrence per year	Negligible: isolated occurrences of minor property and environmental damage, potential for minor injuries, minor economic disruption.
2	Occasionally: 1% through 10% probability of occurrence per year, or at least one chance in next 100 years	Minor: isolated occurrences of moderate to severe property and environmental damage, potential for injuries, minor economic disruption
3	Likely: between 10% to 75% probability per year, at least 1 chance in next 10 years.	Moderate: severe property and environmental damage on a community scale, injuries or fatalities, short-term economic impact
4	Highly Likely: 75% or greater probability in a year	Major: severe property and environmental damage on a community or regional scale, multiple injuries or fatalities, significant economic impact

Appendix B: Critical Stream Crossings

Critical crossings group one includes stream crossing structures on town highways that cross third order streams or larger. Headwater streams generally include first through third order. Third order was included as these headwater streams will have larger drainage areas and may have larger structures that are more difficult to replace and have a larger impact on the road network. Most of these are bridges.

road_descr	town_highw	local_id	latitude	longitude	culvert_ty	culvert_ma	height	width	length
BOBBINSHOP RD	4	29	44.00608791530	-72.46852077170	Round	Concrete Sectional	36	36	50
CORINTH RD	22	6	44.01440350790	-72.42468039210	Round	Steel Corrugated	48	48	30
BEACON HL	43	1	43.99473937150	-72.48811824780	Round	Steel Corrugated	144	144	60
BROOK RD	3	1	43.97122945330	-72.47989557890	Round	Steel Corrugated	120	120	50
BROOK RD	3	39	44.00249358740	-72.49075485670	Round	Steel Corrugated	72	72	40
BROOK RD	3	30	43.99616263910	-72.48879831590	Round	Steel Corrugated	120	120	30
BLACKHAWK RD	26	2	43.99421675120	-72.42807740770	Round	Steel Corrugated	36	36	25
HALL RD	58	1	43.97111273370	-72.43251805980	Round	Steel Corrugated	144	144	30
CORINTH RD	22	13	44.01256682760	-72.41725302580	Round	Steel Corrugated	48	48	35
E RANDOLPH RD	1	4	43.96330444780	-72.47223172040	Round	Steel Corrugated	120	120	80
E RANDOLPH RD	1	13	43.97137863290	-72.48234686790	Round	Steel Corrugated	72	72	80
WASHINGTON TPKE	15	9	44.01665935190	-72.44146845110	Round	Pipe, Metal	48	48	25
UPPER VILLAGE RD	2	13	44.00711702220	-72.43766157620	Round	Steel Corrugated	144	144	60
DOYLE RD	15	3	44.03158371540	-72.45605667240	Round	Pipe, Metal	48	48	20
HOLT HILL RD	70	5	43.94960092440	-72.44505661030	Round	Steel Corrugated	36	36	15

Critical crossings group two includes significantly undersized structures, usually culverts, were identified from the ANR-DEC stream geomorphic assessment survey with openness ratios less than 50%. This measure refers to when structure's width is less than half of the stream bankfull width. Several of these

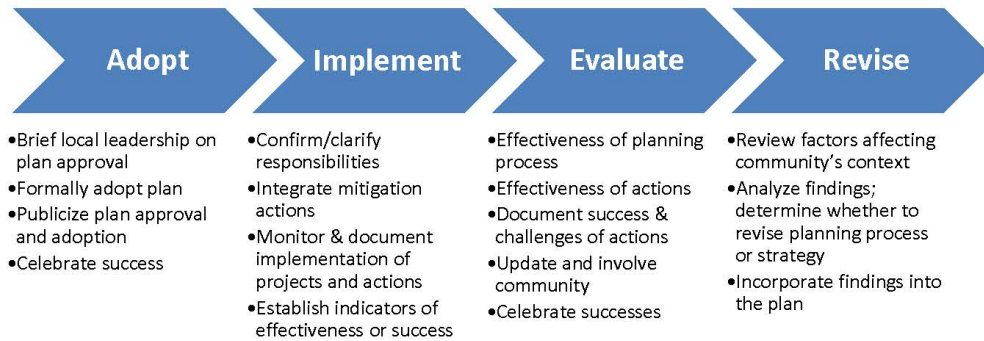
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structures may have been damaged during TS Irene or other events and may have been replaced. The town, at some point, should look at these sites and assess their status and need for repair/upgrades.

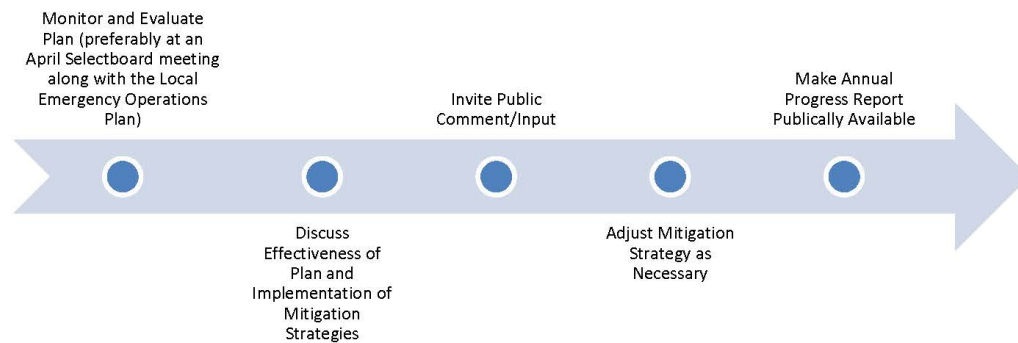
Latitude	Longitude	CATEGORY	RDFLNAME	GNIS_NAME	ChannelWid	CUL_LEN	CUL_HEIGHT	CUL_WIDTH	GROUP_TWO
43.990310	-72.463250	C	BEACON HILL		6.000000	31.000000	1.500000	1.583333	Y
44.049820	-72.517620	C	WILLIAMSTOWN RD	Tributary to First Branch	10.000000	53.000000	1.916667	3.000000	Y
44.024850	-72.494130	C	DODGE RD		5.000000	33.000000	1.916667	2.083333	Y
44.037830	-72.481650	C	EDWARDS RD	Tributary to First Branch	6.000000	44.000000	2.500000	2.500000	Y
44.009000	-72.489750	C	PENT RD		6.000000	37.000000	2.666667	2.000000	Y
43.988720	-72.462190	C	BEACON HILL		3.000000	25.000000	2.000000	2.000000	Y
44.003810	-72.445970	C	BARAW HILL RD	Tributary to First Branch	6.000000	33.000000	2.833333	3.000000	Y
43.986160	-72.462520	C	BEACON HILL		6.000000	29.000000	3.083333	2.666667	Y
43.963230	-72.470850	C	E RANDOLPH RD		3.000000	36.000000	3.666667	3.500000	Y
43.994160	-72.428070	C	BLACKHAWK RD		11.000000	29.000000	2.916667	4.000000	Y
44.012650	-72.506670	C	BROOK RD		8.000000	30.000000	3.666667	3.333333	Y
44.033170	-72.454960	C	DOYLE RD	Hart Hollow	8.000000	24.000000	3.000000	3.583333	Y
43.971860	-72.501390	C	E RANDOLPH RD		13.000000	76.000000	5.833333	6.000000	Y
44.007330	-72.499330	C	BROOK RD		4.000000	51.000000	4.166667	5.833333	Y
44.004480	-72.494680	C	BROOK RD	Cram Brook	17.000000	50.000000	4.000000	6.000000	Y

Appendix C: Five-Year Review and Maintenance Plan

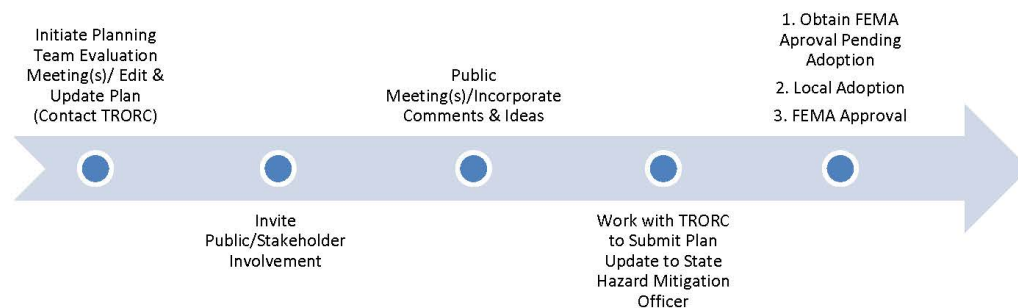
Five-Year Local Hazard Mitigation Plan Review/Maintenance



After Plan Adoption—Annually Implement & Evaluate



Fifth Year, and After a Major or Federally Declared Disaster Directly Impacting the Town Evaluate & Revise



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Appendix D: Sample Email to Neighboring Community

9/20/21, 2:13 PM

Mail - Jake Palant - Outlook

Chelsea LHMP Draft

Jake Palant <jpalant@trorc.org>

Wed 9/15/2021 2:48 PM

To: selectboard@straffordvt.org <selectboard@straffordvt.org>

1 attachments (1 MB)

Chelsea LHMP 9-15-2021.docx

Good afternoon. I am assisting the Town of Chelsea with updating their Local Hazard Mitigation Plan. As part of the planning process, FEMA requires that I send a copy of the draft plan to all communities neighboring Chelsea for feedback. The flood maps for this plan have not yet been completed; however, I can send them to you when they are finished, if you are interested. Meanwhile, would you please review the attached plan and email to me any comments or concerns that you may have by the end of next Friday, September 24th?

Thank you,

Jake M. Palant, AICP | Regional Planner



128 King Farm Road | Woodstock, VT 06091

802-467-3888 x3010

trorc.org | [facebook](https://www.facebook.com/trorcvt) | [youtube](https://www.youtube.com/channel/UCqZvYjg2ZGmzNTUwNABGAAAAAFkNHuHwoDRo2IDypAy32...)

This email is not a legal opinion and is part of the public domain.

<https://outlook.office.com/mail/id/AAMkADMwODUzZWYxLTgzNDUjNDQjMjYjg2ZGmzNTUwNABGAAAAAFkNHuHwoDRo2IDypAy32...> 1/1

Appendix E: Bridge 10 (VT Route 110 – Jail Brook) – Alternatives

Alternative	Primary Objective	Major Component	Approximate Construction Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
Do Nothing		No physical improvements; No change in bridge, channel or floodplain dimensions.	None	No construction costs.	No change to existing conditions. Q50 overtops south side of Jail Brook at the entrance to BR10.	Continued ice jam problems. Ice and water flows over the south side of the Jail Brook and then southwesterly back to the First Branch.
Bridge reconstruction	Widen the structure to allow the passage of the 50 year flood event (VTRANS Standard for State Highway). Improve hydraulic capacity.	Replace existing 13.5 ft span bridge (measured normal to stream) with a span of 26 feet (bankfull width).	Expensive – \$900,000 - \$1,100,000	Improved hydraulic capacity. Meets VTRANS hydraulic standard, Q50 with 0.9-ft freeboard.	Highly skewed alignment remains. Skewed alignments have a higher probability of debris and ice deposition. Wider structures potentially could increase frazil ice deposition due to lower winter channel velocities. State road with utilities- known sewer line at outlet of BR10.	Potential for continued ice jam problems.
Bridge reconstruction with stream realignment downstream of BR10	Improve transport of frazil ice through structure; Improve hydraulic capacity.	Replace existing 13.5 ft span bridge with a span of 26 feet approximately perpendicular to VT Route 100. Create new channel downstream of realigned bridge.	Expensive - \$1,000,000 – 1,200,000	Improved hydraulic capacity; and improved bridge alignment. Meets VTRANS hydraulic standard, Q50 with 1-ft freeboard.	Basketball court would need to be relocated. Possible deed restriction. May not eliminate the potential for frazil ice deposition. State road with utilities- known sewer line at outlet of BR10.	Potential for continued ice jam problems.
Groundwater augmentation	Reduce the amount	Augment stream flow	Moderate- \$100,000- \$250,000	Reduced frazil ice formation	Uses a significant	Well yield may not be

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Alternative	Primary Objective	Major Component	Approximate Construction Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
	of frazil ice through mitigation	with groundwater to increase water temperature to reduce frazil ice formation.		to reduce blockage at bridge entrance.	amount of groundwater. Ongoing operational costs.	available; could be implemented independent of bridge reconstruction.
Heat trace	Reduce the amount of frazil ice through mitigation	Heat trace installed in bridge	Moderate \$30,000	Eliminate frazil ice formation along heat trace maintaining open flow path through BR10	Energy intensive. Estimated power required 100 kw-hr per day. Ongoing operational costs.	Can be implemented in existing or newly constructed bridge.

Source: Chelsea Flood Study by DuBois and King, September 16, 2016

Appendix F: Bridge 45 (Maple Avenue) - Alternatives

Alternative	Primary Objective	Major Component	Approximate Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
Do Nothing		No physical improvements; No change in bridge, channel of floodplain dimensions.	None	No municipal costs.	Bridge and narrow stream width in the walled section will continue to be channel constrictions.	No change in private homeowner flood related damage costs.
Widen and elevate Bridge	Improve span to provide additional hydraulic capacity. Replace existing bridge in poor condition.	Replace existing 26 foot bridge with span of 36 feet. Raise low steel approx. 1 foot.	High - \$800,000 to \$1,000,000	Improved hydraulic capacity; minor reduction in backwater depth from 0.5 feet to 1.7 feet depending upon the flood event. Wider structure opening reduces channel velocity and shear stress. Bridge replacement is likely needed regardless of change in hydraulic capacity.	Maple Avenue still flooded at Q10, Q25, Q50 and Q100 event. Reduction in channel velocity and shear stress may impact the debris and ice transport through the bridge. 12-inch water line located in the First Branch upstream of BR45	Span can only be 36 feet before it exceeds average channel width upstream and downstream. In addition, span is limited by adjacent infrastructure. Bankfull width based on regional curves is 61 feet. Bridge only access to residential area and elderly housing.
Remove Constriction at RS 6172 (In walled section of the First Branch)	Provide additional hydraulic capacity.	Reconstruct existing west retaining wall (22 feet wide) to a width of 36 feet for approximately 100 feet.	Moderate - \$100,000	Improved hydraulic capacity; minor reduction in backwater depth from 0.1 feet to 1.0 feet depending upon the flood event. Wider structure opening reduces channel velocity and shear stress.	Doesn't appreciably change flood stages.	Would require landowner permission.

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Alternative	Primary Objective	Major Component	Approximate Cost	Primary Benefits	Primary Drawbacks	Additional Considerations
Widen Bridge and Remove Constriction at RS 6172	Improve span and channel width to provide additional hydraulic capacity.	Replace bridge with 36 foot span and rebuild constricted walled section with wider channel width (36 feet).	High – \$900,000 to \$1,100,000	Improved hydraulic capacity and reduced channel velocities and shear stress. By removing the constriction the channel is reconnected to floodplain for a short distance.	Maple Avenue still flooded at Q10, Q25, Q50 and Q100 event. Reduction in channel velocity and shear stress may impact the debris and ice transport through the bridge.	Would require landowner permission.

Source: Chelsea Flood Study by DuBois and King, September 16, 2016

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Attachments

Attachment A: Town of Chelsea Flood Hazards Map

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Attachment B: Town of Chelsea Transportation Map