

Town of Strafford, Vermont
2016 Local Hazard Mitigation Plan

***Prepared by the Two Rivers-Ottawaquechee Regional Commission and
the Town of Strafford***

Date of Town Adoption: January 11, 2017

Date of Final Approval by FEMA: February 3, 2017

Funded in part by a Municipal Planning Grant from the Department of Housing and Community Development.



FEMA

FEB 23 2017

Lauren Oates
State Hazard Mitigation Officer
Vermont Department of Public Safety
45 State Drive
Waterbury, Vermont 05671-1300

Dear Ms. Oates:

We would like to congratulate the Town of Strafford and the State of Vermont for their dedication and commitment to mitigation planning. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I Mitigation Planning Team has completed its review of the Town of Strafford, Vermont 2016 Local Hazard Mitigation Plan and determined it meets the requirements of 44 C.F.R. Pt. 201.

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

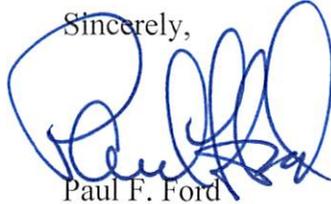
Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at <http://www.fema.gov/national-flood-insurance-program-community-rating-system>, or through your local floodplain administrator.

The Town of Strafford, Vermont 2016 Local Hazard Mitigation Plan must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of February 3, 2017** in order to maintain eligibility for mitigation grant funding. We encourage the Town to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

Lauren Oates
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Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,



Paul F. Ford

Acting Regional Administrator

PFF: ms

cc: Ben Rose, Recovery and Mitigation Section Chief, VT DEMHS
Stephanie Smith, Hazard Mitigation Planner, VT DEMHS

Enclosure

CERTIFICATE OF ADOPTION
January 11, 2016
TOWN OF Strafford, Vermont Selectboard
A RESOLUTION ADOPTING THE Strafford, Vermont 2016 Local Hazard Mitigation Plan

WHEREAS, the Town of Strafford has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **Strafford, Vermont 2016 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 Strafford has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its **Strafford, Vermont 2016 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 Strafford; and

WHEREAS, the **Plan** recommends several hazard mitigation actions (projects) that will provide mitigation for specific natural hazards that impact the Town of Strafford 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 Strafford eligible for funding to alleviate the impacts of future hazards; now therefore be it

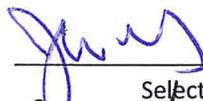
RESOLVED by Town of Strafford Selectboard:

1. The **Strafford, Vermont 2016 Local Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of Strafford;
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.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Strafford this 11 day of Jan 2017

ATTEST

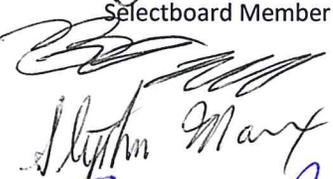

Town Clerk



Selectboard Chair



Selectboard Member


Stephen Mary


Toni M. Pappas

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I. Introduction

Natural and human-caused hazards may affect a community at any time. They are not usually avoidable; 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 Strafford 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 or land treatment, (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.

II. Purpose of the Plan

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

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

The 2016 Strafford Local Hazard Mitigation Plan is the first stand-alone mitigation plan drafted for the Town. Previously, the Town had a town-specific 2009 Annex in the Regional Pre-Disaster Mitigation Plan. This new Plan has been reorganized and new sections have been added:

- 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 Strafford town officials and residents who will implement the hazard mitigation strategies in the future.

III. Community Profile

Strafford, comprising 28,278 acres, is located in the southeasterly portion of Orange County. The west branch of the Ompompanoosuc River is the principal stream and winds its way through the town from its source in Vershire. In the southeast corner of Strafford lies the Elizabeth Mine, which has played a significant role in Strafford's history and, as a hazardous waste site, will continue to be a preoccupation of the Town.

As of 2010, there were 586 housing units (i.e., residences) in Strafford, an increase of 8.1% over the previous decennial census. The age of housing structures in Strafford is divided, roughly, into thirds: 26% were built during or before 1939; 38% were built between 1940 and 1979; and 36% were built between 1980 and 1999.

Green Mountain Power (GMP) supplies all of Strafford's electricity with the exception of .348 miles of overhead line serving four permanent and one seasonal residence provided by Washington Electric Cooperative.

Fire protection for the town is provided by the Strafford Firemen's Association. The firehouse in Strafford Village has two bays with an area of approximately 650 square feet and a hose-drying tower. A second three-bay sub-station completed in 1976 is located on Rte. 132 a half-mile east of South Strafford which contains a 2001 American Eagle E1 Rescue Pumper, 1997 Equipment Truck, 1990 Ford Middlesex 1,000 gpm pump with 1,000 gallon water capacity, and 1980 White Western Star with a 1,500 gallon portable tank. Strafford is a member of the Upper Valley Mutual Aid System, instituted to provide more comprehensive fire protection for member townships.

Strafford's membership in the Upper Valley Ambulance Service, tied into the Dispatch Center in Hanover, provides high-quality emergency ambulance service for Strafford residents. The Strafford First Aid Squad, or FAST Squad is also summoned by the Dispatch Center in Hanover to assist ambulance personnel at accidents and other medical emergencies. The closest hospital is Dartmouth Hitchcock located in Lebanon, NH. Medivac services are available by the DHART helicopter.

A First and Second Constable, appointed annually by the Board of Selectmen, constitute the resident law enforcement in Strafford. The Vermont State Police, Troop "D", headquartered in Royalton, are on call when needed, along with the Orange County Sheriff's Office in Chelsea. Strafford contracts annually with the Orange County Sheriff's office for law enforcement services.

IV. The Planning Process

A. Plan Developers

Samantha Holcomb, Ellie Ray, Land Use Planners at the Two Rivers-Ottauquechee Regional Commission (TRORC), initially assisted the Town of Strafford with updating its Local Hazard Mitigation Plan. Michael Storace, a land use planner at TRORC, completed work on the plan with Local Hazard Mitigation Plan Committee. Committee 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
Brian Johnson	Member, Strafford Selectboard	<p>On 12/12/2014, Samantha Holcomb (TRORC) reached out to the Strafford Selectboard Chair, John Freitag, offering assistance in updating and developing their new Local Hazard Mitigation Plan. TRORC staff coordinated with Strafford town officials to set up an introductory meeting. The first meeting was scheduled for 04/30/2015. A committee was established to update and develop this Local Hazard Mitigation Plan. See below for more meeting-specific details.</p>
Steve Willbanks	Member, Conservation Commission	
Steve Campbell	Chair, Strafford Planning Commission	
John Echeverria	Member, Strafford Planning Commission	
Bill Burden	Strafford Emergency Management Director	
Lee Vormelker	Strafford Deputy Emergency Management Director	
Jon MacKinnon	Strafford Road Foreman	
Chuck Sherman	Strafford Conservation Commission	
Greg Bognato	Newton School	

B. Plan Development Process

The 2009 Strafford 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 Strafford 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 Strafford 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.

This Plan has been reconstructed now as a single jurisdiction, stand-alone Strafford Local Hazard Mitigation Plan that will be submitted for individual approval to FEMA. As such, several sections have been added or updated to include all necessary information.

The 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**
 - Flash Flood/Flood/Fluvial Erosion remains on the list of “top hazards,” which reflect the local officials’ belief that the Town is still vulnerable to these hazards;
 - Severe Summer Weather, Hurricanes/Tropical Storms, Extreme Cold/Snow/Ice Storms and Invasive Species/Infestation have been added to the list of “top hazards,” which reflects the intention/priorities of local officials to expand their analysis of hazards that the Town is or may be vulnerable to in the next five years;
 - Hazardous Material Spills and Structure Fires have 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 Strafford depicting critical facilities, town infrastructure, and the NFIP designated floodway and 100-year floodplain has been added.

The following represent the avenues taken to draft the Strafford Local Hazard Mitigation Plan:

- **Activities**
 - 04/30/2015: TRORC staff met with Strafford LHMP committee members to introduce the update/plan development process, to review Strafford’s existing Hazard Mitigation Plan (adopted in April 2009) and to consider the status of various mitigation actions,

potential hazards, and the data collection/research process. During this meeting, the Strafford committee also discussed and ranked hazards to determine the “Top Hazards” in the Town. TRORC staff then explained to the committee the next steps in the process and scheduled a meeting for a mapping activity. This meeting was open to the public. All meetings follow the protocol established in Vermont’s Open Meeting Law. No public comments were received.

- 6/23/2015: TRORC staff met with members of the Strafford LHMP committee for a map-based activity. Vulnerable or issue areas for each “top hazard” were discussed and identified on a map of the town. This meeting was open to the public. All meetings follow the protocol established in Vermont’s Open Meeting Law. No public comments were received.
- 1/14/2016: TRORC staff held a Public Forum to work on Hazard Mitigation Plan, raise awareness about Town’s sheltering capacity, to hand out emergency preparedness handbooks, and to discuss winter safety tips. TRORC and LHMP committee reviewed draft Hazard Mitigation Plan in detail, with TRORC staff making note of comments or errors. LHMP committee also developed list of hazard mitigation actions to address Town’s top hazards, as determined during hazard ranking exercise on 4/30/2015. This meeting was open to the public. All meetings follow the protocol established in Vermont’s Open Meeting Law. No public comments were received.
- 3/22/2016: TRORC staff met with members of the Strafford Conservation Commission, and a few members of the Strafford LHMP committee were present. Strafford Conservation Commission and TRORC staff developed mitigation strategies to address invasive species hazards in Town. All meetings were open to the public and follow the protocol established in Vermont’s Open Meeting Law. No public comments were received.
- **Public participation and involvement (44 CFR 201.6(b)(1))**
 - Posted a notice in four local papers alerting the public to the hazard mitigation planning process that was taking place. Contact information was provided in the notice to allow those interested in Strafford’s efforts to receive more information and how to find out about upcoming meetings. No comments were received.
 - Valley News—ran 01/15/2015
 - The Herald of Randolph— ran 01/15/2015
 - Journal Opinion— ran 01/15/2015
 - Vermont Standard— ran 01/15/2015
 - February 2015: A notice was placed in the Two Rivers-Ottawaquechee Regional Planning Commission Newsletter alerting recipients that Strafford was engaging in hazard mitigation planning and updating their Local Hazard Mitigation Plan. Contact information was provided in the notice to allow those interested in Strafford’s efforts to receive more information and how to find out about upcoming meetings. No comments were received.

- January 14, 2016: TRORC hosted Public Forum at the Morrill Homestead in Strafford where Hazard Preparedness strategies were discussed and hazard mitigation strategies were proposed. Advertisements were posted in four local newspapers. No comments were received.
 - Valley News—ran 01/5/2016
 - The Herald of Randolph— ran 01/5/2016
 - Journal Opinion— ran 01/5/2016
 - Vermont Standard— ran 01/5/2016
- **Governmental participation and involvement (44 CFR 201.6(b)(2))**
 - Sent revised draft to the Selectboard Chair, John Freitag, and provided contact information for receiving comments via email—4/6/2016. No comments were received
 - Sent revised draft to the Planning Commission Chair, Steve Campbell, and provided contact information for receiving comments via email— 4/6/2016. No comments were received.
 - Sent revised draft to Division of Emergency Management and Homeland Security— 4/20/2016. Comments were received, and Plan was revised to reflect these comments.
 - Note: Town officials were given the opportunity to review, provide feedback and approve the changes that were made through the Plan revision and FEMA review process. No public comments were received.
- **Neighboring community participation and involvement (44 CFR 201.6(b)(2))**
 - Posted a notice in four local papers alerting the public to the hazard mitigation planning process that was taking place. Contact information was provided in the notice to allow those interested in Strafford’s efforts to receive more information and how to find out about upcoming meetings. No comments were received.
 - Valley News—ran 01/15/2015
 - The Herald of Randolph— ran 01/15/2015
 - Journal Opinion— ran 01/15/2015
 - Vermont Standard— ran 01/15/2015
 - January 14, 2016: TRORC hosted Public Forum at the Morrill Homestead in Strafford where Hazard Preparedness strategies were discussed and hazard mitigation strategies were proposed. Advertisements were posted in four local newspapers. No public comments were received
 - Valley News—ran 01/5/2016
 - The Herald of Randolph— ran 01/5/2016
 - Journal Opinion— ran 01/5/2016
 - Vermont Standard— ran 01/5/2016
 - February 2015: A notice was placed in the Two Rivers-Ottauquechee Regional Planning Commission Newsletter alerting recipients that Strafford was engaging in hazard mitigation planning and updating their Local Hazard Mitigation Plan. Contact information was provided in the notice to allow those interested in Strafford’s efforts to

receive more information and how to find out about upcoming meetings. No comments were received.

- April 6, 2016: Sent revised draft to neighboring towns' Selectboards for comment and provided contact information for receiving comments via hard copy— No comments were received
 - Towns of: Tunbridge, Sharon, Thetford, Vershire, and West Fairlee.

- **Review of existing plans, studies, reports, and technical information (44 CFR 201.6(b)(3))**

- State of Vermont Hazard Mitigation Plan, 2013
 - This Plan was referenced for knowledge of the state's hazard mitigation planning processes and description of top hazards for the State of Vermont.
- Strafford Hazard Mitigation Plan (Adopted 04/22/2009)
 - This Plan was referenced extensively during the plan development process, especially in regard to the worst threats and mitigation action strategies identified in 2009.
- Strafford Town Plan (Adopted 08/10/2011)
 - The Town Plan provided TRORC's staff with background information on the community, as well as more detail on their emergency services.
- Strafford Unified Bylaw (As of 04/15/2013)
 - The Unified Bylaw was referenced for general knowledge of Strafford's zoning regulations.
- Flood Insurance Study: Town of Strafford, Vermont, Orange County (February 3, 1993)
 - The Flood Insurance Study was referenced for general knowledge of the West Branch of the Ompompanoosuc River and Tunbridge Branch, and for peak discharge information.
 - Relevant peak discharge information for the West Branch of the Ompompanoosuc River and Tunbridge Branch can be found on page 3.
 - This information has been integrated into the Flash Flood/Flood/Fluvial Erosion, Hurricane/Tropical Storm and Severe Summer Weather hazard profiles.

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. Status Update on Mitigation Actions Identified in 2009

The following table outlines the mitigation actions that were proposed in the 2009 All-Hazard Pre-Disaster Mitigation Plan for the Town of Strafford (adopted on April 22, 2009 as an appendix to the Two Rivers-Ottawaquechee Regional Commission’s multi-jurisdictional Pre-Disaster Mitigation Plan).

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 (in order of 2009 priority). Actions related to long-term mitigation of natural hazards are so noted:

Mitigation Action	Who (Leadership)	When (Timeframe)	How (Funding/Support)	2015 – Status of Mitigation Actions
<u>ALL HAZARDS</u> 1. Ensure that the Rapid Response Plan (RRP) is current.	Selectboard	Yearly	With TRORC assistance	The newest iteration of the RRP is the Local Emergency Operations Plan (LEOP). The Strafford LEOP undergoes an annual update of this document and it was last updated and approved on 05/13/2015.
2. Re-write and update existing Emergency Operations Plan.	Emergency Management Director	Yearly	With TRORC assistance	The Strafford LEOP undergoes an annual update and it was last updated and approved on 05/13/2015.
3. Provide emergency response training/ICS course for municipal officials.	Emergency Management Director, Fire Chief, Road Foreman	Ongoing	Local resources	Currently, a Selectboard member, the Emergency Management Director, the Deputy Emergency Management Director, and the Road Foreman all have emergency response and ICS training. Local officials believed it would be useful and helpful in an emergency to have more local officials trained.
4. Educate citizens on emergency preparedness and extended power outages through town newsletter.	Emergency Management Director	Ongoing	Local resources	Information is placed in the Town’s newsletter, listserv and website, but it is often done after-the-fact. Local officials would like more information to be distributed.
<u>FLASH FLOOD</u> 4. Continue the planned road maintenance program and update existing culvert inventory. Upgrade culverts and	Highway Department	Ongoing	Local resources	This action is on-going. Most culverts were updated after Tropical Storm Irene, and six bridges were also repaired and upgraded. The most recent

Mitigation Action	Who (Leadership)	When (Timeframe)	How (Funding/Support)	2015 – Status of Mitigation Actions
ditching. (Mitigation)				culvert inventory was completed in 2013. A culvert on Maple Hill Road was upgraded to allow for fish passage. This action has been carried over into the 2016 Plan.
5. Raise the base of both Alger Brook and Maple Hill Roads. Add ditching and culverts. (Mitigation)	Road Foreman	2012	Local resources	This action has been fully completed for Maple Hill Road. Alger Brook Road has been upgraded and ditching has been installed.
6. Revise flood hazard regulations. (Mitigation)	Selectboard	2009	Local resources and TRORC assistance	This action has not been completed. The Town's flood hazard regulations have not been changed since they were adopted. This action has been carried over into the 2016 Plan.
7. Consider adopting Fluvial Erosion Hazard regulations. (Mitigation)	Planning Commission and Selectboard	2009	Local resources, TRORC assistance	This action is not complete, but some language has been added to the draft of the Town's unified bylaw. FEH areas are now called River Corridors. This action has been carried over into the 2016 Plan.
<u>HAZMAT</u> 8. Ensure adequate HAZMAT awareness for Fire Department.	Fire Department	2009	Funded by Fire Service Training Academy	Fire Department members receive Level 1 HAZMAT training.
<u>FIRE</u> 9. Develop additional dry hydrant sites in priority rural locations, such as Van Dyke Road, Mine Road, and Turnpike Road.	Fire Department	Ongoing	Local resources, George Aiken RC&D	Additional dry hydrants sites have been developed on Van Dyke Road. To date, there have been no additional dry hydrant sites developed on Mine Road or Turnpike Road. This action has been carried over into the 2016 Plan.

The 2016 Strafford Local Hazard Mitigation Plan reflects several changes to the Town of Strafford's vulnerabilities to hazards and addresses the Town's changes in priorities to different hazards. These priorities and vulnerabilities have changed in large part due to the implementation of mitigation actions that were listed in the 2009 Plan. The implementation of several of these mitigation actions has reduced

the Town's vulnerability to specific hazards. However, several new hazards were addressed in detail in this 2016 Plan that were omitted on the previous 2009 Plan that currently pose a risk to the Town. The 2009 Plan includes addresses Flash Flood, Hazardous Material Spills, and Fire. In the 2016 Plan, the Flash Flood hazard was expanded to include Flooding and fluvial erosion. Strafford community members also included Severe Weather, Hurricanes, and Tropical Storms as a hazard that is likely/highly likely to occur in the future and that which could have a major effect on the Town. Strafford community members also determined that Extreme Cold/Snow/Ice Storm was a hazard that is highly likely to occur in the future and that poses a risk to the Town. The 2009 Plan included Hazardous Material Spills as a hazard of Medium High/High risk. However, Strafford does not have any interstates or state highways, so traffic the likelihood of hazardous material spills to occur is less than other hazards that were detailed in this 2016 Plan. The Strafford Hazard Mitigation Committee also decided to remove Fire, both structural fire and wildfire, from detailed consideration in this 2016 Plan because it was determined that the those hazards would have, at worst, only a minor impact on the Town.

Overall, there is very little development activity in the Town of Strafford. Altogether, in the past 7 years since the 2009 Plan was adopted, there have only been 7 building permits issued in the Town. The Town's Flood Hazard Area Zoning Ordinance prohibits new development and construction of new buildings in the Town's mapped floodways and Special Flood Hazard Areas, which are the areas in the Town that are most vulnerable to sever weather/hurricanes/tropical storms, flooding, and fluvial erosion. No new building permits were issued for locations within the Town's Special Flood Hazard Areas. No new development is or will be permitted in mapped flood hazard areas, which are specifically vulnerable to flooding. Structures located outside the SFHA are also vulnerable to flood hazards if they are located near a steep, upland stream. Structures in these areas are vulnerable to fluvial erosion as opposed to inundation hazard. Due to the terrain and steep valleys in the Town of Strafford, future new development may be vulnerable to either flood hazards or fluvial erosion hazards. The vulnerability of any new growth would be dependent on its location near a Special Flood Hazard Area (SFHA), near a small stream, or on a steep hill. Overall, new development in Strafford since the 2009 Plan has caused no change in Town's vulnerabilities.

D. Town Capabilities for Implementing Mitigation Strategy

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

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

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
Community Preparedness Activities	Program—Annual update of Strafford’s Local Emergency Operations Plan (LEOP). Last updated and approved on 05/13/2015.	Volunteer time from the Selectboard//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. There is no need to expand on this program at this time.
	Completed Action—Red Cross Shelter Designation Shelters designated at Barrett Hall, the Newton School, the Rosa Tyson Gym, and the United Church of Strafford.	Staff time from the Town Clerk, volunteer time from Selectboard, Emergency Management Director. Funding from American Red Cross.	This is a one-time action, so there is no need to expand or improve on it.
	Program—attendance/participation at Local Emergency Planning Commission (LEPC) #12 meetings	Volunteer time from the Strafford Emergency Management Director. Funding from Vermont DEMHS.	No need to expand or improve on attendance, as attendance is satisfactory.
Insurance Programs	Authority/ Program— participation in National Flood Insurance Program (NFIP) The Town of Strafford participates in and is compliant with the NFIP by enforcing its most currently adopted Flood Hazard Area Zoning Bylaw (Last amended March 2, 1993). The Town enforces the Flood Hazard Area Regulations based on the 02/03/1993 FIRMs. [Note: This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii).]	The Town’s Zoning Administrator, Brian Johnson, serves as the NFIP administrator. Assistance from TRORC and Vermont ANR. Funding from local resources—annual budget.	The Town’s initial Flood Hazard Boundary Map (FHBM) was dated 03/28/1975. The Town’s initial Flood Insurance Rate Map (FIRM) was dated 09/27/1985. The Town of Strafford, Vermont Flood Insurance Study (FIS) is dated 02/03/1993. The Town’s current Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) have not been updated since 1993, and the current effective date for the Town’s FIRMs is 02/03/1993.

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
Land Use Planning	Policy/Program— Strafford Town Plan (Adopted 08/10/2011).	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. The Planning Commission will begin reviewing and updating their Town Plan in 2016.
	Authority—Strafford, Vermont Zoning Ordinance (As of 01/10/2007) Includes the Town’s Subdivision Regulations which were last updated 6/15/1995.	Volunteer time from Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Strafford Zoning Ordinance is also reviewed and updated if needed, and also to reflect any changes made in the Town Plan.
	Authority—Strafford Flood Hazard Area Zoning Ordinance Last amended March 2, 1993 Part of the Town’s Unified Bylaw	Volunteer time from the Planning Commission, and assistance from TRORC and Vermont ANR. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Flood Hazard Area Bylaw are also reviewed and updated if needed. The Town’s Flood Hazard Area Zoning Ordinance has not been updated since it was adopted, but the Planning Commission is working on revising it.
Hazard Control & Protection of Critical Infrastructure & Facilities	Completed Action— Culvert inventory with TRORC assistance in 2013.	Staff time from the Road Foreman; with assistance from TRORC. Funding from VTrans.	The Town is currently using the culvert inventory to further its culvert improvement program, but the inventory could be improved upon by completing an update with georeferenced culvert locations.
	Authority— Town Road and Bridge Standards (Adopted 04/24/2013) Certificate of Compliance issued 01/05/2014	Adopted by the Selectboard, implemented by the Road Foreman, assistance from TRORC. Funding from VTrans and the local budget to implement.	Specifies minimum construction standards for roadway, ditches, culverts and bridges and guardrails. VTrans updates the Town Road and Bridge Standards on a fairly regular basis. The Town has the authority to require above-and-beyond what is written in the policy.
	Authority—Strafford Flood Hazard Area Zoning Ordinance Last amended January 10, 2007	Volunteer time from the Planning Commission, and assistance from TRORC and Vermont ANR. Funding from	During the Town Plan review/update period, the Flood Hazard Area Bylaw are also reviewed and updated if needed. The Town’s Flood Hazard Area Zoning Ordinance was last amended in 2007.

		Municipal Planning Grants.	
	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
	Policy/Program—Strafford Winter Road Maintenance Policy (Adopted 02/09/2011)	Staff time from the Town Road Foreman, volunteer time from the Town Selectboard. Funding from local budgets to implement.	This policy outlines how the town’s road network will be maintained during the winter months, and ultimately places the safety of winter travel on the “traveling public.” This policy may be revised and/or updated at the discretion of the town’s Selectboard.
	Policy/Program—Strafford Hazard Mitigation Plan (Adopted on 04/22/2009)	Volunteer time from Town officials; assistance from TRORC and Vermont DEMHS. Funding from FEMA; Vermont DEMHS; TRORC.	The 2016 Strafford Local Hazard Mitigation Plan will replace the 2009 Plan. The 2016 LHMP has evolved from the 2009 Plan and has greatly expanded and improved upon it. Future iterations of the Town’s LHMP will be updated by the Town at least every five years.
Education/ Public Outreach	Ongoing Action— Education/Communication to community regarding structure fire prevention or important information.	Time from the Volunteer Fire Department and funding from Fire Department budget.	This is an ongoing action, and there is no need to expand or improve on this action.
	Ongoing Action—The Town of Strafford has a website and listserv, where important information is posted.	Time from the Town Office. Funding from local budgets.	There is no need to expand or improve on this action.

E. Plan Maintenance

This Plan (the Strafford 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. This update and evaluation will occur annually at an April Selectboard meeting along with the annual review of the Local Emergency Operations Plan (LEOP). At this meeting, the Selectboard will monitor the implementation of the hazard mitigation and preparedness strategies outlined in this Plan by noting those that have been completed, and identifying the next steps required to implement the Plan's remaining strategies. 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. Evaluation of the Local Hazard Mitigation Plan will consist of a thorough analysis of the status of mitigation and preparedness strategies and whether they are being implemented according to the time frames included in tables in this Plan. The Town of Strafford will evaluate the status of mitigation strategies to assess that goals of the Local Hazard Mitigation Plan are being met. Adherence to the mitigation, preparedness, and ongoing strategy implementation tables included in this Plan will constitute the degree of effectiveness of the Plan. The Town will also evaluate the status of vulnerabilities detailed in this Plan to evaluate their validity. The update of the Plan will bring up to date materials that have become outdated due to the passage of time. Strafford's Emergency Management Director will be the principal point of contact and will take primary responsibility for the monitoring, evaluation, and update process described here. He or she will bring the Plan's maintenance activities to the Selectboard's agenda and discussions.

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 Strafford. The Town will monitor, evaluate and update this Local Hazard Mitigation Plan at every April Selectboard meeting and after every federally declared disaster according to the graphic in Appendix C. The Town shall reference the Local Hazard Mitigation Plan when working on Town Plan amendments or changes to the Town's bylaws.

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).
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At least one year before the Plan expires, the update process will begin (though annual updates, monitoring of progress and evaluation will occur at the April Selectboard meeting). For this next Plan update, the Two Rivers-Ottawaquechee Regional Commission (TRORC) will help with Plan updates if assistance is requested by the Town of Strafford and if funding is available. If TRORC is unable to assist the Town, then Strafford'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. Ultimately, it will be the Town's responsibility to update their Local Hazard Mitigation Plan.

The process of evaluating and updating the Plan will include continued public participation through public notices posted on the municipal website, notice within the municipal building, notice in The Valley News, the Herald of Randolph, the Vermont Standard, the Journal Opinion and the TRORC newsletter, inviting the public to the scheduled Selectboard (or specially scheduled) meeting. The public will be given the opportunity to comment during these public meetings. Additional stakeholders should be invited to the meeting, including: local business and civic/non-profit organizations, Upper Valley Ambulance, Inc., and the Vermont Agency of Natural Resources (VT ANR). VT ANR will be invited because they can provide assistance with NFIP outreach activities in the community, models for stricter floodplain zoning regulations, delineation of river corridor 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 effectiveness in reducing town's vulnerabilities and meeting plan goal. If new actions are identified in the interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings.

The Town of Strafford shall also incorporate mitigation planning into their long-term land use and development planning documents. 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/ river corridor bylaws when they are reviewed in 2016. The Strafford Planning Commission will incorporate mitigation strategies directly into goals, policies, and recommendations in future updates to the Strafford Town Plan. 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.

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?

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 Strafford 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 Strafford, 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 the Town of Strafford 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 remain consistent. For instance, in recent years, Vermonters have seen an increase in the number and severity of storms, especially high intensity 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 following table reflects the hazards that we believe can be expected, or are at least possible, in the central Vermont area. We have considered factors such as frequency of occurrence, warning time and potential community impact to rank each and determine which hazards pose the greatest threats to life and property in Strafford.¹ The worst threats (bolded in the table, below) are then followed-up with discussion and mitigation strategies throughout the rest of this Plan.² It should be noted that hazards

¹ The ranking methodology used in this Plan (see Appendix A) is closely modeled on that which is used by the Vermont Division of Emergency Management & Homeland Security (VDEMHS). The only changes made were intended to reflect the more limited geographical scope of this analysis, which is focused on a small, rural town rather than the entire State of Vermont (which is the focus of VDEMHS). Those hazards which were not found to pose the greatest threats to Strafford – including Drought, Avalanche, Radon, Extreme Heat, Tornadoes, Hail Storms, Hazardous Materials Spills, Wildfire, Ice Jams, Landslides/Mudslides/Rockslides, and Earthquakes – were not addressed in this Plan due to low probability of impact and scarce community resources (time and money). For these hazards, please review the Vermont State Hazard Mitigation Plan.

² It’s important to note that those hazards which were not found to pose the greatest threats may still occur in Strafford’s future; however, they are not the focus of this Plan.

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	Frequency of Occurrence	Warning Time	Potential Impact	Hazard Score
Flash Flood/Flood/Fluvial Erosion	Highly Likely	6-12 hours	Moderate	9
Extreme Cold/Snow/Ice Storm	Highly Likely	6-12 hours	Minor-Moderate	8.5
Severe Weather (Thunderstorm, Lightning, High Wind, Hail and Flooding) <i>*Note: We have defined "Severe Weather" to include two or more of the above hazards.*</i>	Highly Likely	6-12 hours	Minor-Moderate	8.5
Hurricanes/Tropical Storms	Likely	12+ hours	Moderate-Major	7.5
Hazardous Material Spill	Occasionally	None	Negligible-Minor	7.5
Structure Fire	Occasionally	None	Negligible-Minor	7.5
Wildfire	Occasionally	None	Negligible-Minor	7.5
Hail Storms	Likely	3-6 hours	Negligible	7
Ice Jams	Occasionally	3-6 hours	Minor	7
Landslides/Mudslides/Rockslides	Occasionally	None	Negligible	7
Invasive Species/Infestation	Highly Likely	12+ hours	Negligible	6
Tornado (Due to the topography of Strafford, tornados are not likely to form in the Town.)	Unlikely	None	Minor	N/A
Dam Failure (There are no major dams in Strafford that make the Town vulnerable to this hazard.)	Unlikely	None	Negligible	N/A
Drought (While a drought may occur occasionally, the committee decided to remove this hazard from further analysis due to the relatively large volume of precipitation the Town receives each year.)	Occasionally	12+ hours	Minor	N/A
Earthquake (While an earthquake may occur occasionally, the committee decided to remove this hazard from further analysis due to the very low magnitude earthquakes that have occurred in the Town in the past.)	Occasionally	None	Negligible	N/A
Extreme Heat (While extreme heat does occur occasionally, the committee discussed past occurrences of extreme heat and determined that a reprieve from the heat often comes before serious issues result, and therefore decided to remove it from further analysis.)	Occasionally	12+ hours	Negligible	N/A

The Strafford LHMP committee discussed the results of the hazard ranking activity and decided to focus on hazards that had the potential to have a *Minor and/or Moderate impact* or, as in the case of invasive

species, *Negligible* potential impact, but are *Likely* or *Highly Likely* to occur. While hail storm events also meet these criteria, the committee decided not to include this hazard in the “top hazards” analysis since this hazard does not tend to occur much, if at all, as a standalone event. Rather, it is most commonly accompanied by one or more other hazards associated with the Severe Weather hazard profile. For the purposes of this Plan, Severe Weather and Hurricanes/Tropical Storms will be combined into one hazard profile area for analysis due to their overlapping events and potential impacts to the Town. Due to low probability of impact, small potential impact, and scarce community resources (time and money), the mitigation committee chose not to detail the following hazards in this LHMP: extreme heat, drought, earthquakes, dam failure, tornadoes, landslides/mudslides/rockslides, structural fire, and hazardous materials spills. Refer to Appendix A for definitions of the hazard ranking terms used in the above chart.

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

- Flash Flood/Flood/Fluvial Erosion
- Severe Summer Weather & Hurricanes/Tropical Storms
- Extreme Cold/Snow/Ice Storms
- Invasive Species/Infestation

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 Strafford 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 Strafford LEOP, 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 Strafford. Included in this would be an adequate supply of fuel for these generators.

A further focus that is important to address in this Plan includes the awareness of the population demographics of Strafford. 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 LEOP, 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 (1950-2015), the Spatial Hazard Events and Losses Database for the United States (SHELDUS) 1960-2015, 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, systems, populations, or other assets as defined by the community that are susceptible to damage and loss from hazard events.	Strength or magnitude, and details of a notable event(s).	Dollar value or percentage of damages.	<p><u>Occasionally</u>: 1–10% probability of occurrence per year, or at least one chance in next 100 years</p> <p><u>Likely</u>: >10% but <100% probability per year, at least 1 chance in next 10 years</p> <p><u>Highly Likely</u>: 100% probable in a year</p>

B. Hazard Profiles for “Hazards Posing Highest Vulnerabilities”

1. Flash Flood/Flood/Fluvial Erosion

The most frequent form of flooding in the State of Vermont and the Town of Strafford is riverine flooding, or overbank flooding, which occurs to rivers when they receive more rain or snowmelt from their watershed than they typically experience. Flooding causes the inundation of land that is normally dry. Overbank flooding is experienced more frequently in mountainous and hilly areas where water moves with higher velocities. Flash floods occur when severe storms drop high amounts of rainfall in short periods of time. Flash floods occur more frequently in areas with steep slopes and narrow stream valleys. Riverine erosion is the gradual wearing away of land masses by rivers and streams. River channels are constantly changing. As rivers flow and water moves downstream, water exerts energy upon riverbanks and causes erosion.

Flooding is one of the worst threats to Strafford’s residents and infrastructure. Past instances of flooding in Strafford 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-

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**.

up of ice or debris, which can contribute to the failure of important infrastructure (such as culverts, bridges, and dams).

The worst flood disaster to hit the Town of Strafford, 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 Strafford received heavy precipitation, seeing roughly 6-7 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 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 Strafford suffered some damage to property and infrastructure during Tropical Storm Irene, although no lives were lost. It is estimated that Tropical Storm Irene dropped 6-7 inches of rain over the Town of Strafford 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 Strafford's roads were damaged by the storm, including parts of Alger Brook Road, Old City Falls Road, Sawyer Mountain Road, Route 132, Tyson Road, and Taylor Valley Road. The county-wide damage for Orange County totaled \$5 million. According to FEMA's PA database, the storm damage for Strafford alone totaled \$2,432,610.17, which is a figure that captures at least 70% of total damage for the Town. No other homes or other structures in the Town were a part of the ensuing TS Irene property buyout process.

According to Strafford LHMP committee members, two of the biggest problems associated with flood events in the town are debris and the erosive washouts of roadways and bank slopes. With respect to debris during flood events, there was a great deal of concern around propane storage tanks floating downstream. Barrett Hall, which was in the evacuation zone and serves as a community shelter, was compromised during TS Irene when an unanchored 1,000 gallon above ground storage tank AST threatened to hit a nearby bridge. The land between the two villages was, and continues to be, especially prone to flood damage, in part due to the topography of where they are situated at lower elevations from steeper terrain and along river and streambanks. The expectation is that damage will continue to be concentrated in lower elevation areas with more inundation flooding, particularly in the lower village (where the stream is very close to the buildings) and areas generally where the waterways and roadways are nearly level.

Unfortunately, flooding is very common across the region, with many events impacting the Town of Strafford. Strafford has been severely affected by other flooding events that pre-date Tropical Storm Irene. As such, flooding is one of the worst threats to Strafford’s residents and infrastructure. The following list indicates the history of occurrence with regard to this hazard in Orange County (given the small population of Strafford, 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. No detailed data was available for fluvial erosion damage in Strafford in terms of numbers of acres lost during each event.

History of Occurrences:

Date	Event	Location	Extent and Impacts
Period from 04/15/2014-04/18/2014 (DR-4178 VT)	Severe Storms and Flooding	County-wide	Heavy rains and melting of late season snowpack caused widespread flooding across central Vermont, with 4-6 inches of water released and many waterways reaching near bankfull conditions. Many state highways in Orange County were closed, and unpaved secondary roads were damaged.
Period from 06/25/2013—07/11/2013 (DR-4140)*	Severe Storms and Flooding	County-wide	Severe storms caused flooding throughout the region, and damaged some infrastructure and facilities. No specific damage was claimed in the Town of Strafford. Strafford received about 9.22 inches of rain over the disaster period. Two power outages occurred during the disaster period in Strafford, but affected only 20 Green Mountain Power customers for less than 2 hours.
08/28/2011 (DR-4022, TS Irene)*	Tropical Storm	Strafford, County-wide	Widespread rainfall amounts of 3-5 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 2,400 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, Strafford received nearly 7” of rain. Alger Brook Road, Old City Falls Road, Sawyer Mountain Road, Route 132, Tyson Road, and Taylor Valley Road were damaged in Strafford during Irene. \$2,432,610.17 in damage occurred for Strafford according to FEMA’s Public Assistance database (captures at least 70% of total damage). Widespread power outages occurred in Strafford affecting more than 500 Green Mountain Power customers, and most outages lasted longer than 48 hours.
05/25/2011-05/27/2011 (DR-4001)	Severe Storms and Flooding	County-wide	Severe storms and flooding struck the region and the state. Orange County was eligible for federal public assistance funding in the wake of the storms. Strafford received about .63 inches of rain in 24 hours. No significant power outages occurred in Strafford.
07/21/2010	Flash Flooding	Strafford; 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. Strafford received about 4.18 inches of precipitation in 72 hours. Power outages in Strafford affected 256 customers and lasted from 5.4 to 10.8 hours.
08/21/2009	Flash Flooding	Strafford; County-wide	Thunderstorms produced torrential downpours in Strafford and surrounding areas. 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 throughout the region. No significant power outages occurred in Strafford.

Date	Event	Location	Extent and Impacts
08/07/2008* (Part of DR-1790 VT)	Flash Flooding	Strafford; County-wide	Thunderstorms with heavy rainfall in a moist atmosphere moved through central and southern Vermont during the afternoon and evening hours. Flash flooding resulted in portions of Aimes, Carpenter Hill, Clover Hill, and Brook Roads being washed out. Approximately \$25,000 in damage occurred to Town roads and embankment slides. Strafford received 2.83 inches of rain in 48 hours. No significant power outages occurred in Strafford.
07/11/2007 (DR-1715 VT)	Flash Flood	County-wide	Tropical-like showers and thunderstorms struck east-central Vermont, with localized rainfall amounts exceeding 3 inches in a 2 hour period. No significant power outages occurred in Strafford.
06/27/1998 (Part of DR-1228 VT)	Flash Flood	County-wide	Heavy rains brought 4-8 inches or rainfall to the county, with many homes and businesses flooded and/or losing power. National Guard members were sent in to aid with relief. Power outage time data for this event are not known.
01/1998 (DR-1201 VT)	Flooding	County-wide	An average of 3.5 inches of rainfall throughout the region early in the month was exacerbated by ensuing bad weather, causing flood damage throughout the region. Power outage time data for this event are not known.
01/19/1996- 01/20/1996	Flood	County-wide	A deadly storm caused strong winds and flooding throughout the state. Many roads washed out, numerous power outages were reported, and \$250K in damage were reported for Orange County. More detailed rainfall data was unavailable for Strafford. Power outage time data for this event are not known.
03/1992 (DR-938 VT)	Flooding	County-wide	Heavy rain and ice jams during the winter season prompted flooding throughout the state, including Orange County. More detailed rainfall data was unavailable for Strafford. Power outage time data for this event are not known.
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. 3 deaths occurred and resulted in \$64 million in damage. Power outage time data for this event are not known.
11/02/1927— 11/04/1927 ("Flood of 1927")	Flooding	County-wide	Considered to 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 4-9" statewide, following a month with 150% the normal amount of rain. Power outage time data for this event are not known.

The Town of Strafford has standalone flood hazard regulations that were last amended in 1993, which are referenced within the Town's zoning regulations. Development in the floodway is prohibited unless a proposed development has been certified by a qualified engineer that can demonstrate that a project will not result in any increase in flood levels within the floodway during an event. The flood hazard regulations also place restriction on development in "fringe areas," although these areas are not fully defined in the regulations. However, structures in the fringe areas of the Town shall be designed to minimize flood damage and maintain the integrity of waterways.

There are 26 residential (24 single family dwellings and 2 campsites) and 3 commercial/industrial/public structures (one town government building, one public gathering site, and one church) in the 500-year floodplain, which would equal \$7,844,470 if all properties were damaged/destroyed in a severe flooding event. There are no public water supply wells or waste treatment facilities located in Strafford that could be adversely impacted by a flood event; however, private wells and septic could be impacted by flood waters. Disruption of the critical services in the 500-year floodplain could drastically hamper future response and relief efforts in the Town, and could cause major disruption to business continuity

of operations. Putting such an event into context, the flooding that occurred as a result of Tropical Storm Irene is considered to be greater than a 100-year flood event, and likely closer to a 500-year flood.

Across Vermont, most child and elder care facilities are not registered with the State. Most child day care is private in-home care in Strafford, but there is also one licensed childcare facility in the Town. There are no elder care facilities in the Town of Strafford. Finally, low income housing is not registered with the State, and there are currently no mobile home parks located in Strafford that are registered with the State.

Recent studies have shown that the majority of flooding in Vermont occurs 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. 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, which indicates that Strafford will experience high intensity rainfall and flooding events in the future. Due to Strafford's topography of steep slopes and narrow river valleys, fluvial erosion also has a high probability of future occurrence.

Strafford maintains an up-to-date list of culverts and culvert condition, and has engaged in culvert upgrading since the 2009 Strafford Annex was drafted. The Town's most recent comprehensive, town-wide culvert inventory was completed with Two Rivers-Ottawaquechee Regional Commission assistance in 2013, and the process of upgrading culverts is ongoing (and funding permitting). No development projects are planned in Strafford in areas that would be vulnerable to flooding. There is one repetitive loss property in the Town of Strafford. This property is characterized as a single family residence, for which there are three claims attached to the property.

Finally, in an effort to help reduce the Town's vulnerabilities to flooding and protect structures and road infrastructure, it is important to restore floodplain and increase the number of areas for retention wherever possible. Equally important to reducing flood vulnerabilities is the process of stabilizing river banks in areas that are vulnerable to slides and/or have the potential to damage critical or important infrastructure.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Flood/ Flash Flood/ Fluvial Erosion	All roadways and properties adjacent to waterways.	Culverts, bridges, road infrastructure. There are 26 residential (24 single family homes, 2 campsites) and 3 commercial/industrial/public structures in the 500-year floodplain. Vulnerable commercial and public structures include Coburn’s General Store, the South Strafford Post Office, The Our Lady of Light Church, The Strafford and South Strafford Volunteer Fire Departments, which are within the mapped Vermont River Corridor.	Tropical Storm Irene- 5-7” across county (6-7” in Strafford). No detailed data was available for fluvial erosion damage in Strafford in terms of numbers of acres lost during each event.	From TS Irene: \$2,432,610.17 for Strafford, per FEMA’s Public Assistance database (captures at least 70% of total damage).	Highly Likely

2. Severe Summer Weather & Hurricanes/Tropical Storms

Severe weather consists of thunderstorms, lightning, hail, and intense winds. Often it consists of multiple events that combine to create hazardous conditions that pose a threat to communities in the State of Vermont and the Town of Strafford. Severe weather can be incredibly unpredictable. More common than hurricanes or tropical storms are severe thunderstorms (usually in the summer), which can cause flooding, as noted above, and are associated with

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 Summer Weather**.

lightning, high winds, hail and tornadoes. 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. Between 1950 and 2013, there were 698 hail events recorded in the state of Vermont, making hail an annual occurrence in some part of the state. Most of these events had hail measuring .75 inches, but many had hail at least 1.5 inches in size. The largest hail during the period was 3-inch hail that fell in Chittenden County in 1968 (NCDC). Tennis ball-sized hail was reported in the town of Chittenden during a storm in the summer of 2001. Thunderstorms can generate high winds, such as the event that hit Bethel in the summer of 2014 that produced straight-line winds which leveled trees in large swathes.

In Strafford, 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 which create many unique weather and emergency management situations. Over the years, Strafford 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 data is sometimes difficult to find, nevertheless, the

“Remarks” section of NCDC Database helps to illuminate the impact strong winds can have on Strafford. Sizeable hail has also accompanied storms moving through the Town and region.

While hurricanes (storms with sustained winds greater than 74 mph) and tropical storms rarely reach as far inland as Vermont, they can be as or more destructive than a more commonly occurring severe weather event. Typically, they will manifest themselves in Vermont as tropical storms. In either case, the high winds, heavy rains, and large affected areas from hurricane or tropical storms can make these rare events major disasters. The most infamous example of this was the disastrous hurricane of 1938. On September 21, 1938 a very fast moving hurricane hit Vermont in the early evening, but was moving so fast that wind damage was more severe than damage from rain in places. However, there was severe flooding, as over 4 inches of rain accompanied the storm and followed upon the heels of preceding storms that had saturated the ground and raised river levels. Buildings were lost, power lines were downed, and many trees were felled. Tropical Storm Floyd in September 1999 caused flooding and wind damage in parts of Vermont, as well as one fatality, and resulted in a federal disaster declaration.

The most recent flood that devastated Vermont, Orange County, and Strafford 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, and millions of dollars of home, road and infrastructure damage. Due to the strong winds, 50,000 were without power initially, and many did not have power restored 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 following list indicates the history of occurrence with regard to this hazard in Orange County (given that small population of Strafford, town-specific data is limited); an asterisk “*” denotes the 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.

Beaufort Wind Chart – Estimating Winds Speeds

Beaufort Number	MPH		Terminology	Description
	Range	Average		
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	22	Fresh breeze	Smaller trees sway.
6	25-31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32-38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	42	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	50	Severe gale	Light structure damage.
10	55-63	60	Storm	Trees uprooted. Considerable structural damage.
11	64-73	70	Violent storm	Widespread structural damage.
12	74-95	90	Hurricane	Considerable and widespread damage to structures.



Webpage: <http://www.weather.gov/iwx>

Twitter: @nwsiwx

Facebook: NWSNorthernIndiana



History of Occurrences:

Severe Weather/ Hurricane/Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
07/23/2014	✓			✓		County-wide	Severe summer storms rocked the Central Vermont region, including Strafford. More detailed rainfall data was unavailable for Strafford. 2 customers lost power in Strafford for 6.7 hours.
10/07/2013	✓			✓		County-wide	Scattered wind gusts of 50 mph or greater, registering a 9 on the Beaufort Wind Scale, across portions of Vermont produced numerous downed trees or tree limbs on utility lines resulting in more than 25,000 customers without power at the peak. Specific power outage time data in Strafford for this event were unavailable. Strafford experienced about 1 inch of rain in 48 hours.
09/11/2013	✓			✓		County-wide	A series of thunderstorms moved across Vermont during the late afternoon and evening. Some of these thunderstorms produced damaging winds that downed trees and utility lines. Strafford received 1.85 inches of rain in 72 hours. 3 customers lost power in Strafford for 26-30 hours.
Period from 6/25/2013— 07/11/2013 (DR-4140 VT)	✓	✓	✓	✓	✓	County-wide	Showers and thunderstorms developed on a near daily basis in the summertime heat, and rainfall rates as high as two to three inches in an hour were observed at times. Flash flooding occurred in several areas where storms remained stationary or repeatedly moved across the same area. High water from flash flooding closed some of the region's roads or washed them out completely. Two power outages occurred during the disaster period in Strafford, but affected only 20 Green Mountain Power customers for less than 2 hours.

Severe Weather/ Hurricane/Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
05/29/2012	✓		✓	✓		County-wide	A warm front moved across Vermont during the morning hours of May 29th, which lead to numerous thunderstorms with heavy rain, damaging lightning and some isolated large hail and strong winds. Some of these thunderstorms deposited up to 2 inches of rainfall in portions of north-central and northeast Vermont. Strafford did not experience significant power outages.
08/28/2011 (DR-4022, TS Irene)*	✓	✓		✓		Strafford/ County-wide	Widespread rainfall amounts of 3-5 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. There were nearly 2,400 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, Strafford received nearly 7" of rain. Alger Brook Road, Old City Falls Road, Sawyer Mountain Road, Route 132, Tyson Road, and Taylor Valley Road were damaged in Strafford during Irene. \$2,432,610.17 in damage total for Strafford according to FEMA's Public Assistance database (captures at least 70% of total damage). Widespread power outages affected more than 500 customers in Strafford and lasted between 48-53 hours.
08/21/2011	✓		✓	✓		County-wide	Numerous showers and thunderstorms developed during the afternoon with some containing large hail and damaging winds. This storm also produced a microburst with straight line winds estimated, by a NWS Storm Damage team, between 70 and 90 mph. This event registered hurricane level winds according to the Beaufort Wind Scale. Strafford received 1.12 inches of rain in 24 hours. No significant power outages occurred in Strafford.

Severe Weather/ Hurricane/Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
07/06/2011*	✓			✓	✓	Strafford/ County- wide	Wind damage as well as lightning strikes resulted in more than 15,000 customers in Vermont losing power. Strafford had 8 residents lose power for 7.6 hours. There were numerous reports of trees down in Strafford. Approximately \$10,000 in damages occurred.
10/01/2010	✓	✓		✓		County- wide	Heavy rain, including moisture associated with the dissipated remnants of Tropical Storm Nicole, spread into Vermont and produced four to five inches of rain. Severe storms and flooding in Addison, Caledonia, Essex, Lamoille, Orange, Washington, and Windsor Counties. FEMA disaster declaration with 1.9 million dollars of public assistance. No significant power outages occurred in Strafford.
07/21/2010*	✓		✓	✓		Strafford/ County- wide	Supercell thunderstorms spread across the region, causing widespread damage to trees, power poles, structures, and infrastructure. Numerous trees were down between Strafford and Vershire along Route 113 and numerous backroads, totaling \$25,000 in damage. 2 inches of rain fell in Strafford on 7/20 and another 1.9 inches fell on 7/22. 276 total customers in Strafford lost power, and power outages lasted between 5.4 and 10.8 hours.
5/31/2009	✓		✓	✓		County- wide	40-55mph wind gusts and hail caused fallen trees and power outages in the region. This event registered as an 8-9 on the Beaufort Wind Scale. 89 power customers were affected in Strafford, and power outages lasted 7.8 hours.
7/21/2008— 8/12/2008 (DR 1790 VT)	✓			✓		County- wide	Severe storms and flooding impacted Orange and surrounding counties. 10.29 inches of rain fell in Strafford during the disaster period. On 7/24, 55 people in Strafford lost power for 3.2 hours.

Severe Weather/ Hurricane/Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
06/10/2008	✓			✓		County-wide	Severe storms caused damage to hundreds to thousands of trees, downing power lines and causing structural damage to numerous buildings and vehicles. Tens of thousands of Vermonters lost power due to the storms, with some outages that lasted several days. Power outages in Strafford affected 101 people and lasted 8 hours. .57 inches of rain fell in Strafford in 24 hours.
08/25/2007*	✓			✓		Strafford, County-wide	Numerous reports of tree and power line damage across the region. In Strafford, there was extensive tree damage, and winds were reported at approximately 60mph. Damage was estimated at \$10,000. Over two days, 435 people in Strafford lost power, and power outages lasted from 4 hours for some people to 24 hours for others. Strafford experienced .42 inches of rain in 24 hours.
07/11/2007 (DR 1715 VT)	✓	✓				County-wide	Localized heavy rainfall exceeded 3 inches within a two hour time frame with some localized storm totals approaching 6 inches across a very hilly or mountainous terrain, which resulted in flash flooding of several communities. Storm damage overall totaled over \$3 million in affected counties.
06/10/2005*	✓				✓	Strafford, County-wide	Severe thunderstorms settled over the region. Lightning strikes killed 17 cows in Strafford, and caused a total of \$50,000 in damage. More detailed rainfall data was unavailable for Strafford. Only 5 customers were affected by power outages that lasted from 1.4-4.8 hours.

Severe Weather/ Hurricane/Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
9/16/1999— 9/21/1999 (DR 1306 VT)	✓	✓		✓		County- wide	Tropical Storm Floyd brought high winds and heavy rainfall of 3-6 inches to Southern Vermont. The rain produced significant flooding across the region, which proved destructive. The combination of the wind and very saturated ground produced widespread downing of trees and power lines across much of Southern Vermont, and as many as 2,000 people lost power. Detailed power outage information for Strafford is unknown.
06/22/1997*	✓			✓		Strafford, County- wide	Severe thunderstorms and high winds were reported, causing \$5,000 in damage to Strafford. Detailed rainfall and power outage data for this event are unknown.
08/09/1976	✓	✓		✓		County- wide	Hurricane Belle brought intense rains to much of State. Detailed rainfall and power outage data for this event are unknown.
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. The South Strafford (Tyson) Dam overtopped, washing out at its right abutment. No damage was reported.
09/21/1938 ("The Great New England Hurricane")	✓			✓		County- wide	Hit Vermont as a Category 1 storm. High winds severely damaged trees, buildings, power lines. Detailed rainfall and power outage data for this event are unknown.
11/3/1927	✓	✓				County- wide	"Great Flood of 1927." Worst recorded flood in VT. White River crested at a record of 29.30 feet.

As demonstrated in the table of previous occurrences above, high winds have caused damage in Orange County and in the Town of Strafford specifically. Damage caused by high winds has included downed trees and power lines, and, as a result, power outages during or after severe weather, hurricane or tropical storm events. Power outages can be particularly serious for "power critical customers" that do not have the luxury of having a generator, particularly vulnerable population segments (i.e., the elderly or disabled). However, in general, high winds cause relatively minor damage on a town-wide scale.

One of the main hazards caused by severe weather, hurricanes, and tropical storms throughout the Town is flooding. A recent flooding event occurred over three weeks in late June and early to mid-July in 2013. The flooding was widespread and severe enough for a Federal Disaster Declaration, DR-4140, to

be issued for Orange and other counties in Vermont. As part of the Town’s LHMP writing process, Committee members completed a mapping exercise, that identified the following areas as especially prone to severe storm and flooding impacts and create choke points along waterways: Bird Hill Road, Justin Morrill Memorial Highway, Old City Falls, Brook Road, Route 132 (especially at Tyson Road), and Tognacci Road.

By the end of the fall 2013, the Town of Strafford had completed a geo-referenced culvert inventory with assistance from Two Rivers-Ottawaquechee Regional Commission. The Town plans to maintain the new culvert inventory in-house, and use it as a way to plan and prioritize culvert and road upgrade projects. The Town of Strafford’s work to upgrade culverts remains in process. A considerable number of culverts have been upgraded in the Town of Strafford as part of the Town’s recovery from Tropical Storm Irene.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Severe Summer Weather// Hurricanes /Tropical Storms	Town wide for wind, hail, high winds, lightning and thunderstorm impacts. Generally speaking, the entire Town is vulnerable to flooding, but “hot spots” include the following roads/areas: Bird Hill Road, Justin Morrill Memorial Highway, Old City Falls, Brook Road, Route 132 (especially at Tyson Road), and Tognacci Road.	Town and private buildings, and utilities; culverts, bridges, road infrastructure. Vulnerable commercial and public structures include Coburn’s General Store, the South Strafford Post Office, The Our Lady of Light Church, The Strafford and South Strafford Volunteer Fire Departments, which are within the mapped Vermont River Corridor.	Tropical Storm Irene- 5-7” across county (6-7” in Strafford). Damage can be wide-ranging depending on the type of storm, varying from \$5,000 or less (6/22/1997) to over \$2 million (TS Irene).	For TS Irene in Strafford: \$2,432,610.17 from the FEMA Public Assistance database. In addition, severe weather on 07/11/2007 caused approximately \$50,000 in damage in Strafford.	Highly likely/ Likely

****Note:** The main hazard caused by severe weather is typically flooding (though not always). In addition, flooding is often the most expensive hazard caused by severe weather. Therefore, the Extent and Impact categories for Severe Summer Weather will reflect the data reported in the Flash Flood/Flood/Fluvial Erosion, as it represents the higher limits of damage caused by severe weather.

3. 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.

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 snow storms that have toppled trees and caused widespread power outages.

The worst winter storm in terms of damage to hit the state recently was not a snow storm, 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, meaning they have a .5%-.2% chance of occurring annually. 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 Strafford was impacted by this ice storm.

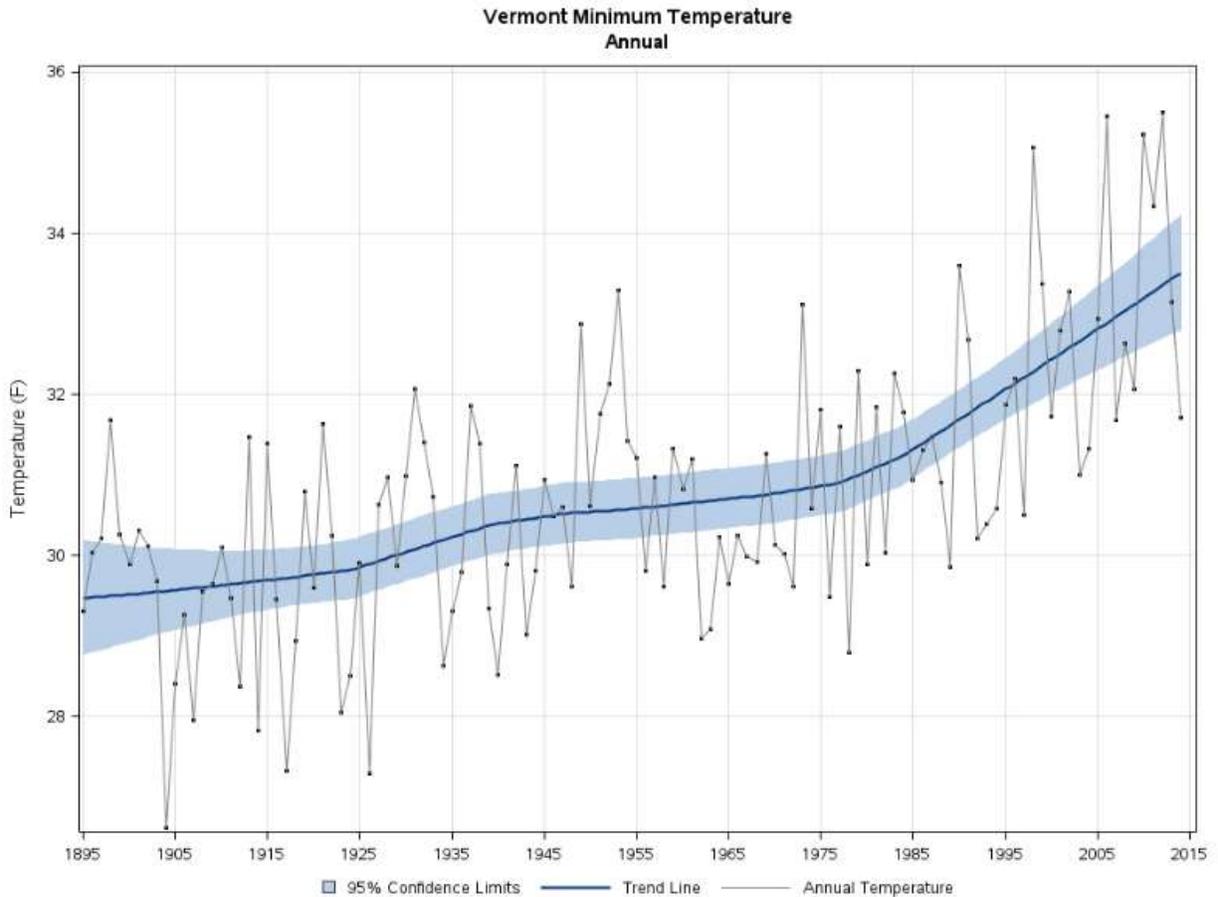
The late 2014 through early 2015 winter season saw a long series of winter storm events from late November 2014 through late March 2015, ranging from a dusting at times to over a foot, sometimes with ice. The heaviest recorded winter precipitation event to hit Vermont recently was between December 9th and December 11th, 2014. During this period of time, much of the state of Vermont was hit with heavy, wet snow that ranged from accumulation totals anywhere from a few inches to almost two feet along parts of the Green Mountains. The heavy, wet snow stuck to tree limbs and power lines which led to widespread power outages and significant damage to the state's power infrastructure. Over 100,000 customers were without power statewide, some for multiple days, and the damage to power infrastructure caused by the storm surpassed that which was incurred as a result of the 1998 ice storm or Tropical Storm Irene. In addition to damage to power infrastructure, towns hit by the storm had significant amounts of debris clean up and removal to contend with in the spring of 2015.

Over the past few winters, Strafford has received numerous snow storms 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 Strafford and in Orange County:

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Sperry-Piltz Ice Accumulation Index (SPIA), 2009).



History of Occurrences:

Date	Event	Location	Extent and Impacts
02/01/2015-02/28/2015	Cold/wind chill	County-; region-wide	Vermont communities experienced the coldest month on record for over 20 years. Many communities recorded 15 to 20+ days below zero and on several days, dangerously cold wind chills of 30 below zero or colder occurred.
Period from 12/09/2014—12/12/2014 (DR-4207 VT)	Snow/Winter Storm	County-; region-wide	A powerful prolonged heavy, wet snow event from December 9th through December 11 th . Snowfall totals ranged from a few inches to almost 2' near Warren, VT. The snow to liquid ratios ranged from 5-7" of snow to 1" of rain, which lead to the snow sticking to trees and power lines. A widespread 10 to 15 inches of snow fell across Orange County.
Period from 03/12/2014—03/13/2014	Snow Storm	County-; region-wide	A major snowstorm with near blizzard conditions at times impacted Vermont towns. Numerous motor vehicle accidents, school and business closures resulted due to the storm on both March 12th and 13th. Snowfall totals across Orange county were generally 15 to 20+ inches.
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 12th, moved and redeveloped off the southeast United states coastline on February 13th. Snowfall across Orange county was 12 to 18 inches.
02/05/2014	Snow Storm	County-; region-wide	Snowfall was at its peak during both the morning and afternoon/evening commutes causing hazardous travel. Eight to twelve inches of snow fell across Orange county.

Date	Event	Location	Extent and Impacts
11/23/2011*	Winter Storm	Strafford, County-wide	Heavy snowfall accounted for numerous vehicle accidents and scattered power outages from tree limbs falling on power lines. Strafford recorded 7 inches of snow accumulation.
02/02/2012	Winter Storm	County-; region-wide	An intense winter storm brought snowfall at rates of up to 2 inches per hour, and dropped 10-15 inches across Orange County.
Period from 12/26/2010-12/27/2010*	Winter Storm	Strafford, County-wide	Heavy snowfall combined with strong winds (15-25mph with gusts up to 40mph) caused blowing and drifting snow that led to accidents and power outages. Strafford recorded 9 inches of snow accumulation.
Period from 02/23/2010-02/25/2010	Winter Storm	County-; region-wide	Heavy wet snow led to accumulations of 6-30 inches across central and southern Vermont, leading to power outages of 50,000 or more residents.
Period from 02/22/2009-02/23/2009	Winter Storm	County-; region-wide	Heavy snow and high winds with gusts as high as 30mph in the region, impacting travel. Around a foot of snow or more fell in towns neighboring Strafford.
Period from 12/19/2008-12/21/2008	Winter Storms	County-; region-wide	Two heavy storms moved through the region over a 2-3 day period, leading to combined snowfall totals in excess of 2 feet. High snowfall totals led to blocked ventilation pipes and some carbon monoxide injuries as well as a few collapsed small farm structures due to the weight of the snow in Orange County.
Period from 02/06/2008—02/07/2008	Winter Storm	County-wide; statewide	Heavy snowfall of 10 to 16 inches fell across Orange County, prompting many school closures and vehicle accidents.
02/01/2008	“Mixed” Winter Storm	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.
02/14/2007*	Snow Storm	Strafford; County-wide; statewide	Snow fell at 2-4 inches per hour at times amidst brisk 15-25mph winds and wind chills of -10F, making many roads virtually impassible. A total of 19 inches was reported in Strafford
Period from 12/06/2003-12/07/2003	Winter Storm	County-; region-wide	Steady snow fell throughout a two day period, producing snow totals around 12-20 inches in Orange County.
Period from 01/06/1998-01/16/1998 (DR-1201 VT)	Ice Storm	County-; state-wide	Ice accumulations of around 3/4 of an inch or less hit the region, causing damage to tens of thousands of trees, downed power lines, road closures due to ice coatings, vehicle accidents, and temporary cessation of milking operations at farms. Indirect injury impacts included carbon monoxide poisoning from improper generator use and hazards from tree limb/other debris.

The Town of Strafford 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 from a few hours to several days. The utility company currently serving the Town of Strafford, Green Mountain Power, has followed a regular tree-trimming schedule. Strafford 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 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 cellular 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 Strafford, 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.	Snowfall has varied, from a few inches to over a foot or more. Heavy snow and wind may down trees and power lines. Snow/ice contributes to hazardous driving conditions.	For roof collapse: monetary damages will depend on each structure but, collapse of barn roof is often a total loss. This does not include the loss of livestock. Collapse of a house roof may be at a 50% loss. For car crashes due to poor driving conditions: minimal damage to vehicle to totaled vehicle and operator injury. Health impacts could vary significantly. Loss of energy or communication capabilities may occur and impede recovery.	Highly likely

4. Invasive Species/Infestation

Invasive species are biota that is non-native to a given area that may cause widespread ecosystem or economic harm to a Town. They may be an organism, plant, insect, or animal that encroaches upon, displaces, diseases, or even kills native species. Invasive species may also pose risks to human health upon contact. Planning for and mitigating the effects of existing invasive species and anticipated encroachment, whether from new forms of plant disease, plant species, insects, or animals, is critical to the future health of our landscapes, our wildlife communities, and our local economies (especially agriculture and silviculture). Managing the impacts of invasive terrestrial plant species, insects, or other forms of disease would necessitate funding that is larger than is currently available to tackle invasive species and infestation issues. However, preparedness through vigilance for the problem species near Vermont’s borders is one tactic that has been effectively employed to combat the rampant spread of known problems outside our borders.

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 **Invasive Species/Infestation**.

The State of Vermont divides invasive species into two camps: Class A and Class B. Class A species are those that are listed on the Federal Noxious Weed List but are not currently known to be present within the confines of Vermont (see 7 C.F.R. 360.200). Class B species, in contrast, are known to occur within state boundaries and are deemed a threat to residents and the environment.³

Invasive species do not, by their nature, have boundaries. This concept was clearly demonstrated during Tropical Storm Irene, when floodwaters uprooted Japanese knotweed plants along Vermont’s waterways. Years later, the fight to eradicate the knotweed has become even more protracted as it spreads along streambanks and areas beyond, choking out native plant communities and destabilizing banks.

What is known is that invasive species are already present in Strafford, although the precise location and extent of proliferation and/or damage is not always easily defined, given not all pockets of infestation are necessarily mapped or otherwise accounted for. For the purposes of this Plan, the LHMP Committee has agreed to focus on the invasive species and infestation hazards that are terrestrial plants or insect pests that the Town of Strafford is most concerned with. Below is a table of species that currently do—or are anticipated to—adversely impact the community’s natural environment, and, by extension, public health, economy, infrastructure, and private property:

³ See http://agriculture.vermont.gov/plant_pest/plant_weed/invasive_noxious_weeds/noxious_weeds_list

Hazard Types

Species	Present in Town?	Extent of Impact	Removal/Prevention Method
Wild Chervil (<i>Anthriscus sylvestris</i>)	✓	Wild chervil is most commonly found along roads, but will spread into fields and their shaded fringes. Seeds are easily spread by mowers and wind over great distances. The plant's sap can burn skin. The plant's white flowers bloom in May and June.	Treatment of this plant is easiest before it establishes a root system. Mowing the plants early prior to the plants going to seed can reduce their spread. Do not mow after June when the plant has seeded, and clean equipment after using to prevent spread. Eradication is difficult, and would likely require grazing, pulling, tilling, or native replanting. Successful herbicide treatments have not yet been determined.
Garlic mustard (<i>Alliaria petiolate</i>)	✓	Garlic mustard is an edible weed that tends to grow along roadsides, particularly in the shade. It spreads when either seeds or plant pieces are sown into the ground. Garlic mustard has not yet been observed in Strafford, but is extensive throughout Vermont.	Because of its methods of spreading, it is not advisable that garlic mustard be mowed. Rather, pulling the plant by hand is best practice. Glyphosate herbicide can also be used (although this may risk watershed contamination).
Wild parsnip (<i>Pastinaca sativa</i>)	✓	Wild parsnip is a heavily toxic plant specimen that has photoreactive sap that causes severe burns to exposed skin. It does not tend to grow well in shaded areas, and also does not tend to grow in dense stands. The plant flowers in late spring to early summer.	Because of the plant's noxious properties, eradication can be a delicate process. Manual pulling should be done with thick gloves and long sleeves. Early mowing before the plant seeds in early July can reduce the spread. Mowing should be repeated once per year for three to five years. Glyphosate chemical foliar low volume spraying can be used as a control in late summer (mid-July).
Giant Hogweed (<i>Heracleum mantegazziam</i>)	✓	Giant hogweed is a noxious weed that has cropped up in some places in the region. Similar to wild parsnip in appearance, it is also a phototoxic plant, causing painful, scarring blisters. The plant flowers in late spring to early summer.	Removal of giant hogweed plants is the same as wild parsnip (see above). Extreme care must be taken with this plant, too, to avoid any contact with skin or risk injury.

Species	Present in Town?	Extent of Impact	Removal/Prevention Method
Japanese Knotweed (<i>Polygonum cuspidatum</i>)	✓	Japanese knotweed is one of the most widely spread invasive species in the region, most commonly cropping up along river edges in direct sunlight. The plant rhizomes root and spread easily, and are hard to eradicate once established. Ditch maintenance and traveling down waterways are two main ways the plant spreads. Its lacy white flowers bloom in August.	Repeated mowing or cutting, using loppers or a lawn mower once per month over the plant's growing season (spring through fall) may be the best way to eradicate knotweed plants. Eradication must continue every year for about five years. A drip technique chemical control, using glyphosate concentrate application on plant stems in August, can be combined with mechanical cutting. Pulled stems should be contained in bags to rot for one year. If bagging is not possible, then plants should be stockpiled and covered with a tarp for decomposition. Do not replant native plant species until knotweed has been fully eradicated.
Goutweed (<i>Aegopodium podagraria</i>)	✓	Goutweed invades fields, river edges, and floodplains. It proliferates quickly by means of underground rhizomes, and has established itself in villages and settled areas in Strafford. The plant's white flowers bloom in July.	New infestations should be treated quickly either before root systems become established or after leaf-out (late summer). Entire plants, including stems, roots, and rhizomes, should be removed and bagged or at least a week before disposing in a landfill. Do not compost plant material because it will reseed. For large infestations, cover with a large plastic tarp and secure edges with sandbags. Glyphosate chemical control can also be used in foliar spraying after plant has leafed out.
Glossy and Common Buckthorn (<i>Frangula alnus</i>) (<i>Rhamnus cathartica</i>)	✓	Buckthorn grows in two similar varieties, and can drastically change the composition of forested areas. Buckthorn has red berries, which are easily visible in fall and act as an innutritious laxative to animals. Buckthorn increases the nitrogen content in soil and has a longer growing season than native plants, which changes habitat suitability for native plant species. Buckthorn has established itself in many forested areas in Strafford, including the Taylor Valley Area.	Mechanical buckthorn control can consist of hand pulling small plants (including roots) or cutting stumps of larger, more woody plants at any time of the year. Glyphosate can also be applied to stumps within one hour. Larger plants may require a weed wrench. Plants may be burned after uprooting.

Species	Present in Town?	Extent of Impact	Removal/Prevention Method
Purple Loosestrife (<i>Lythrum salicaria</i>)	✓	Purple loosestrife proliferates in damp areas, like wet roadsides and swamp/wetland areas. It is a growing concern in fields and roadsides. Once established, it quickly spreads and squeezes out native plants, impacting wildlife habitat in the process.	Smaller infestations of purple loosestrife can be mowed or pulled by hand and burned or disposed of in a landfill. Removing flower heads prior to seeding can help prevent spread. Biocontrol (the use of natural enemies to control an infestation, such as beetles that do not pose harm to agriculture or other key species) has proven a success in many Vermont towns.
Hemlock Woolly Adelgid (HWA) (<i>Adelges tsugae</i>)		HWAs prey on deciduous eastern hemlock trees, and originate from southern Japan. Hemlocks desiccate, lose needles, and fail to generate new growth, severely weakening, if not outright killing, trees. Hemlocks are the third most prevalent tree in Vermont, and are critical for stream bank armoring and serving as a shelter and food source for wildlife.	HWAs have been confirmed in Windham and Bennington Counties (as of 2012, per the USDA). ⁴ As of 2012, they were not present in any counties adjacent to Orange County. No identification has been made in Orange County of the HWA egg sacs that are found on branches and hatch in the spring, feeding on tree sap. Vigilance is needed to keep an eye on HWA spread, and insecticide treatments may help contain it.
Asian Longhorned Beetle (ALB) (<i>Anoplophora glabripennis</i>)		Large stands of deciduous trees are target species of the beetle. These trees are especially critical to the health of our forests, slopes, carbon sequestration, and the local economy (e.g., sugar maples). According to the Forest Service, if ALBs became established across the U.S., they could kill a third of all urban trees at a compensatory cost of \$669 billion and decimate the maple sugaring industry. ⁵	The beetle has been identified in nearby states, namely Massachusetts. Vigilance for signs of presence around hardwood trees (sawdust at base of tree, oozing from bark) can alert their presence in the tree, and can prompt containment efforts. Uninfected host tree species may be treated with insecticide after the winter thaw in a quarantine area to prevent spread.

⁴ See <http://na.fs.fed.us/fhp/hwa/maps/2012.pdf>

⁵ See <http://www.nrs.fs.fed.us/pubs/1983>

Species	Present in Town?	Extent of Impact	Removal/Prevention Method
Emerald Ash Borer (EAB) (<i>Agilus planipennis</i>)		Seven-percent of trees (around 150 million trees) in Vermont are ash, making virtually every community vulnerable to ash stand decline. Damaged trees can pose a hazard, particularly in close proximity to sidewalks, roadways, and private property. EABs generally infiltrate new host areas when they are transported in firewood and other wood products.	EAB colony establishment can take years to be visible on trees, but makes trees brittle and weak. Bare bark exposed by woodpeckers reveals intricate pathways created by the EAB. Infestations are located in all surrounding states and Quebec. Preventing the importation of firewood from outside of Vermont is one key tactic to stop the spread. Quarantine efforts have been met with mixed success, and biological and microbial control agents may prove effective containment methods.

While this Plan does not provide a complete listing of all invasive species—plant, animal, insect or otherwise—those presented are the most prolific and destructive or are areas of major concern to Strafford residents, municipal officials, and Vermont Agency of Natural Resources staff. Inactivity in addressing current invasive species threats will drastically compound the cost and physical effort put toward eradication efforts in the future. With proliferation trends of invasive species being extensive, Strafford residents can expect to see widespread growth of known species and range expansion of insect species that are not yet in the Town but are anticipated.

Invasive species control requires a three pronged approach of vigilance, preventing further spread of a target species, and eradication. Towns, like Strafford, need to be appraised on the invasive species threat that are at their borders so that they can keep an eye out for and work to prevent encroachment. Persistent management of species, such as wild chervil, through practices that prevent the spread of the seeds, rhizomes, or other means of growth is a lower cost means of containment. Complete eradication is a multi-year, resource intensive process that, like preventing spread, can employ both manual and chemical tactics.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Invasive Species/ Infestation	Town-wide, although dependent on host plant for insect pests, or soils/available sunlight	The entire Town is susceptible to invasive species proliferation, depending on the species and place-dependent characteristics that allow for growth and spread of	At present, none of the species identified in the Town have had more than a negligible impact on health of residents or property. If left unchecked, invasives may crowd out native plant and wildlife species dramatically and, in some	Insect pests can ravage local silvicultural operations, value-added market product production (e.g., maple syrup industry), and tourism (seasonal leaf peepers). Invasive plants and insects may destroy/ crowd out key native	Highly Likely

	for plant infestation.	problem species.	case, can pose physical harm to residents.	species and habitat, and some cause physical harm.	
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C. Vulnerability Summary

As a result of the above profiled hazards, the Town believes the following vulnerabilities to be of highest concern due to their potentially severe consequences and likelihood of occurrence:

- Flash Flood/Flood/Fluvial Erosion:** One of the worst threats, flooding impacts roads and the village center, especially facilities for children, elders, and community emergency shelters. Under-sized bridges and culverts factor into the threat, with Strafford being home to many known, problematic choke points (as identified by the LHMP Committee). Out-dated flood hazard mapping for Orange County also compounds existing threats. 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, numerous homes and public facilities are located in the 500-year floodplain and could be impaired by a major flood event. Vulnerable commercial and public structures to severe weather and flooding include Coburn’s General Store, the South Strafford Post Office, The Our Lady of Light Church, The Strafford and South Strafford Volunteer Fire Departments, which are within the mapped Vermont River Corridor.
- Severe Summer Weather & Hurricanes/Tropical Storms:** Damage to public and private property and municipal infrastructure can be extensive during severe weather events. Prolonged power outages and downed cellular communications can greatly hamper public and business services for indeterminate periods of time. Vulnerable commercial and public structures to severe weather and flooding include Coburn’s General Store, the South Strafford Post Office, The Our Lady of Light Church, The Strafford and South Strafford Volunteer Fire Departments, which are within the mapped Vermont River Corridor.
- Extreme Cold/Snow/Ice Storms:** Lack of access to power and telecommunication services throughout the Town could severely impede response efforts, and could be especially harmful to vulnerable populations (e.g., the elderly and disabled).
- Invasive Species/Infestation:** Native biota and habitats could be severely damaged, if not destroyed. Invasive species pose a rise to the many agricultural and silvicultural businesses that currently thrive in the Town.

VI. Mitigation

A. Mitigation Goals

1. To reduce injury and losses from the natural hazard of flash flooding/flooding/fluvial erosion.
2. To reduce injury and losses from the natural hazard of severe summer weather.
3. To reduce injury and losses from the natural hazard of hurricanes/tropical storms.
4. To reduce injury and losses from the natural hazard of extreme cold/snow/ice storms.
5. To reduce injury and losses from the natural hazard of invasive species/infestation.

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

- To provide community facilities and services that meet the needs of the residents of Strafford. (p. 25)
- Strafford's policy is to support and continuously update the Rapid Response Plan and Emergency Operations Plan. (p. 29)
- 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. (p. 36)
- It is the policy of the town to consider the relationship of a road to surrounding features of the landscape when planning improvements needed to safely accommodate increasing traffic. (p. 37)
- It is the policy of the Town to require development on private roads to adhere to town access standards and to provide safe year-round access for town services, particularly fire and rescue. (p. 37)
- To maintain or enhance the quality and quantity of drinking-quality resources. (p. 39)
- To consider surface water and groundwater impacts and effects related to proposed or existing uses of land. (p. 39)
- Developments adjacent to wetlands should be planned so as not to result in undue disturbance to wetland areas or their function. Mitigating measures to protect the function of a wetland are an acceptable measure. These measures are avoidance, minimization and compensation. (p. 43)
- To enhance and maintain use of flood hazard areas as open space, greenways, non-commercial recreation and/or agricultural land. (p. 45)
- To ensure no net loss of flood storage capacity in an effort to minimize potential negative impacts. These impacts include the loss of life and property, disruption of commerce, and demand for extraordinary public services and expenditures that result from flood damage. (p. 45)

- To maintain maps that reflect as accurately as possible the flood hazard areas to assist in appropriate land use decisions. (p. 45)
- 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 are relatively protected from flooding damage. (p. 46)
- Strafford should continue to maintain its membership in the National Flood Insurance Program. (p. 46)
- To recognize that upland areas adjacent to unstable rivers and to steep streams may be at risk of erosion during floods. (p. 46)
- Inform citizens to identify and practice the safe elimination of invasive plants. (p. 49)

The Strafford Town Plan was updated and adopted on 08/11/2011, and has a 5 year lifespan.

B. 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, Strafford’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 the potential funding is not readily available, and has a timeframe for implementation of more than two years but less than four. A “Low” prioritization indicates that 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 Strafford 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 Strafford’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/river corridor bylaws. Specifically, the Strafford Planning Commission will incorporate mitigation strategies included in this Plan into the Strafford Town Plan’s goals, policies, and recommendations. 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.

Hazard(s) Mitigated	Hazard Mitigation Actions	Local Leadership	Prioritization (Mitigation Project Status)	Possible Resources*	Time Frame
All Hazards	<i>Install dry hydrants on Mine Road and Turnpike Road to protect town infrastructure from structural fires and to protect the health of residents. (Mitigation)</i>	Fire Department	Low	Local resources. VT Dry Hydrant Grant Program	Fall 2021- Fall 2022
Flash Flood/ Flood/Fluvial Erosion// Severe Summer Weather// Hurricanes/ Tropical Storms	<i>Develop a schedule and program to replace undersized culverts. Appropriately sized culverts effectively handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding damage. (Mitigation)</i>	Road Foreman	High (1 st in priority of 4 natural hazard mitigation actions in 2009 plan**)	Local resources, TRORC.	Summer 2018-Fall 2019
	<i>Inventory bridges to document future damage from flooding. A constantly updated inventory will allow Strafford to keep track of frequently damaged infrastructure and will guide planning to avoid future infrastructure damage. (Mitigation)</i>	Road Foreman	Medium (New)	Local resources.	Summer 2019- Fall 2020

	<p><i>Identify streambanks that have high risk of fluvial erosion that could benefit from riparian plantings or Better Roads grant. Riparian buffers prevent erosion, restore river floodplain, and help reduce the intensity of flood events; therefore protecting town infrastructure and human health. (Mitigation)</i></p>	Road Foreman	Medium (New)	Local resources, TRORC, State resources.	Summer 2020-Fall 2021
	<p><i>Upgrade two culverts, #3 and #6, in critical condition on Sawnee Bean Road. These 12 inch culverts should be upgraded to at least 18 inches in conformance with Town Road and Bridge standards. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation)</i></p>	Road Foreman.	High (new)	Local resources, TRORC, state resources.	Summer 2018-Fall 2019

	<p><i>Upgrade culvert #22 in critical condition on Old City Falls Road to effectively handle current level of water that it experiences. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation).</i></p>	<p>Road Foreman.</p>	<p>Medium (new)</p>	<p>Local resources, TRORC, state resources.</p>	<p>Summer 2019-Fall 2020</p>
	<p><i>Upgrade two culverts on Wetmore Road, culverts #5 and #8 in critical condition. These culverts should be upgraded to at least 18 inches in conformance with Town Road and Bridge standards. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation).</i></p>	<p>Road Foreman.</p>	<p>Medium (new)</p>	<p>Local resources, TRORC, state resources.</p>	<p>Fall 2019-Fall 2020</p>
	<p><i>Upgrade culvert #6 on Turnpike Road in critical condition. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation)</i></p>	<p>Road Foreman.</p>	<p>High (new)</p>	<p>Local resources, TRORC, state resources.</p>	<p>Fall 2018-Summer 2019</p>

	<i>Replace bridge on Cook Road with an upsized structure that will be more durable to extreme weather events and will protect other Strafford roads from damage. (Mitigation)</i>	Road Foreman.	Low (new)	Local resources, TRORC, state resources.	Fall 2023-Fall 2024
	<i>Revise Flood Hazard Area Zoning Ordinance to prevent the construction of infrastructure in areas that are vulnerable to flooding and severe weather. (Mitigation)</i>	Planning Commission	High (3 rd in priority of 4 natural hazard mitigation actions in 2009 plan**)	Local resources, TRORC.	Fall 2016 during Town Plan update-Fall 2017.
	<i>Anchor fuel tank behind Coburn's General Store on Route 132 in order to secure it in the event of flooding. (Mitigation)</i>	Fire Chief	High (New)	Local Resources	Spring 2017-Fall 2017
	<i>Consider adopting River Corridor regulations, which will incorporate VT ANR's River Corridor Map. These regulations will help residents and planners know what land is necessary for riparian functions and to will prevent the threat to current and future infrastructure. (Mitigation)</i>	Planning Commission	Low (4 th in priority of 4 natural hazard mitigation actions in 2009 plan**)	Local Resources	Fall 2021-Fall 2022

	<i>Adopt Flood Resiliency Element to Town Plan, which will identify flood hazards to Strafford and will identify goals, policies, and recommendations to mitigate risks to public health and infrastructure. (Mitigation)</i>	Planning Commission	High	Local Resources	Fall 2016 during Town Plan update-Fall 2017.
Invasive Species/ Infestation	<i>Formalize road crew best practices for seasonal mowing. Mechanical control methods will reduce the spread of invasive species. (Mitigation)</i>	Road Foreman, Conservation Commission	Medium (new)	Local Resources.	Summer 2019-Summer 2020
	<i>Road crew and volunteer efforts will coordinate to schedule mechanical control events to eradicate invasive species. (Mitigation)</i>	Road Foreman, Conservation Commission	Medium	Local Resources	Summer 2019-2020.

Hazard(s) Mitigated	Ongoing Actions to Support Mitigation and Preparedness Actions	Local Leadership	Prioritization (Mitigation Project Status)	Possible Resources*	Time frame
All Hazards	<i>Ensure that Strafford's Local Emergency Operations Plan (LEOP) is kept up-to-date, identifies vulnerable areas, and references this plan. (Preparedness)</i>	Emergency Management Director.	High	Local resources; TRORC.	Yearly
	<i>Keep gasoline powered generator located at town garage operational to be used in an emergency, as needed, at the United Church. (Preparedness)</i>	Road Foreman	Medium (New).	Local Resources	Check generator every six months
	<i>Keep four Red Cross shelters, Newton School, Barrett Hall, Tyson Gym, and United Church, stocked with cots, blankets, and MRE (Meals Ready to Eat). (Preparedness).</i>	Emergency Management Director.	Medium (New).	Local resources.	Ongoing
Flash Flood/ Flood/Fluvial Erosion// Severe Summer Weather// Hurricanes/ Tropical Storms	<i>Continue to use existing methodology for documenting infrastructure damage from hazards. This process began after Tropical Storm Irene and is ongoing. Ongoing knowledge and record of infrastructure damage helps Strafford to determine vulnerable structures, and will guide planning to prevent future infrastructure damage.</i>	Road Foreman	Medium	Local Resources.	Ongoing

Extreme Cold/Snow/Ice Storms// Severe Summer Weather (high wind)	<i>Once specific at-risk residents are identified, develop a plan to reach out to those (and all) residents to educate them about accessible heating centers and Red Cross facilities in Strafford. Knowledge and ability to access these areas by residents will reduce the risk to human health in the event of a hazard.</i>	Emergency Management Director	Medium	Local Resources	Yearly.
	<i>Identify power critical customers that are vulnerable to power outages. (Preparedness).</i>	Emergency Management Director	High	Local Resources	Every four months.
	<i>Budget to ensure the Town has sufficient funds to provide safe winter travel conditions, which will reduce the threat to the health of residents.</i>	Selectboard	High	Local Resources	Yearly
	<i>Encourage Green Mountain Power to continue regular tree trimming along power lines through their Phase 3 power project to ensure clear and maintained utility corridors and to protect utility and town infrastructure.</i>	Emergency Management Director	Low	Local Resources	Yearly
Invasive Species/ Infestation	<i>Road crew and volunteer efforts will coordinate to schedule mechanical control events to eradicate invasive species.</i>	Road Foreman, Conservation Commission	Medium	Local Resources	Every summer.

	<i>Create a community education program for municipal staff and residents. (Preparedness)</i>	Conservation Commission	Medium (new)	Local Resources.	Summer 2018
	<i>Develop a Forest Preparedness Plan (Preparedness)</i>	Conservation Commission	Medium (new)	Local Resources.	Summer 2018

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

** The second priority action identified in the 2009 Strafford Pre-Disaster Mitigation Plan has been completed.

Appendices

Appendix A: Hazard Ranking Methodology

<u>Frequency of Occurrence</u> Probability	<u>Warning Time</u> Amount of time generally given to alert people to hazard	<u>Potential Impact</u> Severity and extent of damage and disruption *Note: Severity of damage and disruption generally correlates with magnitude (extent) of an event
<p>1 = <i>Unlikely</i> <1% probability of occurrence in the next 100 years</p> <p>2 = <i>Occasionally</i> 1–10% probability of occurrence per year, or at least one chance in next 100 years</p> <p>3 = <i>Likely</i> >10% but <100% probability per year, at least 1 chance in next 10 years</p> <p>4 = <i>Highly Likely</i> 100% probable in a year</p>	<p>1 = More than 12 hours</p> <p>2 = 6–12 hours</p> <p>3 = 3–6 hours</p> <p>4 = None–Minimal</p>	<p>1 = <i>Negligible</i> Isolated occurrences of minor property damage, minor disruption of critical facilities and infrastructure, and potential for minor injuries</p> <p>2 = <i>Minor</i> Isolated occurrences of moderate to severe property damage, brief disruption of critical facilities and infrastructure, and potential for injuries</p> <p>3 = <i>Moderate</i> Severe property damage on a neighborhood scale, temporary shutdown of critical facilities, and/or injuries or fatalities</p> <p>4 = <i>Major</i> Severe property damage on a metropolitan or regional scale, shutdown of critical facilities, and/or multiple injuries or fatalities</p>

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.

Label	Material	Height	Width	Length	Comments	Road Name
338	1	72	72	30	eroding beneath footers. Waterfall in the middle	VAN DYKE RD
133	10	72	72	72		BROOK RD
200	1	18	8	24		JUSTIN MORRILL MEM HWY
043	10	72	72	24		WETMORE RD
042	1	26	10	12		BROOK RD
337	10	72	72	72	concrete headers - deep pool below	VAN DYKE RD
204	1	18	5	22		JUSTIN MORRILL MEM HWY
113	1	72	72	12		TOGNACCI RD
069	10	96	96	72	multiplate	MILLER POND RD
039	1	72	72	13		BROOK RD
213	10	72	72	60	multiplate	JUSTIN MORRILL MEM HWY
187	1	15	10	24	1919, rotting concrete	JUSTIN MORRILL MEM HWY
278	10	72	72	120	brook runs thru it	ROUTE 132
131	10	64	64	36	good concrete buttress	ALGER BROOK RD
076	1	84	84	34		MILLER POND RD
068	10	48	48	36		BROOK RD
010	10	36	36	48	concrete header is paved over - a little short	JUSTIN MORRILL MEM HWY
136	11	5	5	24		ROBINSON RD
250	10	18	18	24		ROUTE 132
018	10	72	72	48	multiplate	JUSTIN MORRILL MEM HWY
270	1	72	72	96	huge. Brook runs thru it	ROUTE 132
025	1	24	12	60	brand new	JUSTIN MORRILL MEM HWY
320	1	144	144	24	7 feet high. 1926. footers are failing	OLD CITY FALLS RD
061	10	108	108	72	multiplate culvert, at the junk yard	MILLER POND RD
295	10	36	36	48		OLD CITY FALLS RD
340	10	72	72	24	deep pool downstream	VAN DYKE RD
081	10	60	60	29		MAPLE HILL RD
247	1	108	108	24	crosses stream by school	ROUTE 132
012	13	36	36	48		COBURN RD
135	10	60	60	48		ALGER BROOK RD

BridgeType	Inspection Notes	Location	RouteLogBr	Structure Number	Street Name	ST
ROLLED BEAM	9/15/2014 Structure is in satisfactory condition. The curbs need concrete repairs, having all loose material removed and then patched. The guardrail should be replaced to meet standards. The beams need general cleaning and painting. JWW/JDM 07/22/	0.1 MI TO JCT W CL2 TH2	00030	100910003009101	BROOK	RD
ROLLED BEAM	9/17/2014 This structure needs to have new approach and bridge guardrail installed that meets standards, as well as new posts for the approach rail. There is heavy bank erosion on the upstream end of abutment 1 that should have anti erosion protection 07/22/2014 - Bridge is in good shape. ~ MJ/JS 07/16/2012 No maintenance is needed at this time. JWW 09/02/11 Irene inspection, no major concerns at this time. MJKJM	0.1 MI TO JCT W CL3 TH23	00027	100910002709101	OLD CITY FALLS	RD
CONCRETE SLAB	9/17/2014 Structure is in good condition. JWW/JDM 07/28/2010 - MJ/DS	0.15 MI TO JCT W C3 TH22	00020	100910002009101	OLD CITY FALLS	RD
CONCRETE SLAB	9/17/2014 Structure is in good condition. JWW/JDM New structure; added in 2012.	0.x MI S TO JCT W TH2	00052	100910005209101	TAYLOR VALLEY	RD
CONCRETE T-BEAM	9/15/2014 Structure is in satisfactory condition. JWW/JDM 7/22/2014 - Bridge is in satisfactory condition. T beams could use some spot cleaning and patch repair. Approach rail system could use improvement. Rail at the southeast corner is somewhat lo	0.2 MI TO JCT W CL3 TH24	00028	100910002809101	JUSTIN MORRILL MEM	HWY
CONCRETE SLAB	9/17/2014 Structure is in good condition. JWW/JDM New structure; added in 2012.	0.7 MI TO JCT W CL3 TH7	00022	100910002209101	JUSTIN MORRILL MEM	HWY
ROLLED BEAM	9/15/2014 & 5/29/2014 New approach and bridge guardrails need to be installed. Most of the approach rail lays on the ground and the bridge rail height is 21", this does not meet the standard of 28" and needs to be replaced. The beams need general clean	0.02 MI TO JCT W CL2 TH1	00061	100910006109101	TYSON	RD
2 SP RLD BM W TIM DK	9/17/2014 Two of the pressure treated timber posts of the pier bent on the downstream end have large voids in the top of the posts due to rot. The pier bent footing is undermined through at the upstream end for the first 3'. A new pier bent should be 6/26/2014 Due to the water level, unable to see the soffit area and the beams. Soffit area should be reinspected when water level is down. ~FRE/TJB	@ JCT W CL3 TH7	00016	100910001609101	MUNDEL	RD
CONCRETE T-BEAM	7/9/2013 The deck and substructure continue to deteriorate. There is deep spalling along the base of 9/15/2014 This structure is in good to satisfactory condition. Anti scour protection should be put in place along both abutments to prevent further undermining of the footings. JWW/JDM	0.4 MI S JCT. VT.132 W	00029	200177002909102	ROUTE 132	
ROLLEDBM W TIMBER DK	07/22/2014 - Channel has chronic contraction scour issues. Bot	0.05 MI TO JCT W CL2 TH2	00072	100910007209101	EASTBURN	RD

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 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.

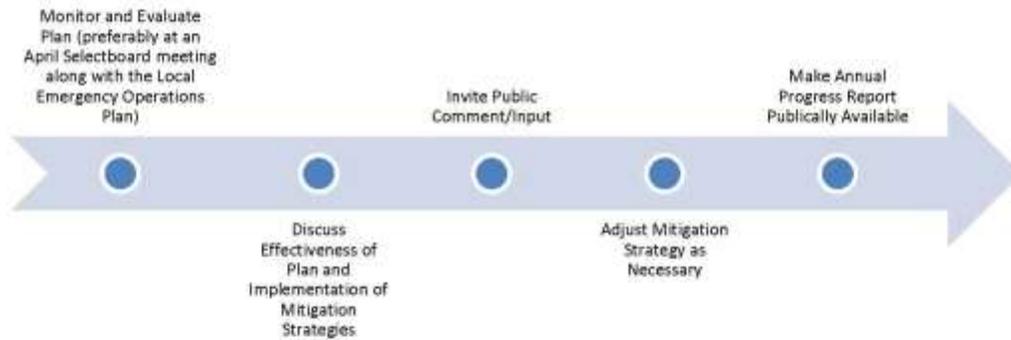
Latitude	Longitude	Road Name	ChannelWidth	StructureLength	StructureHeight	StructureWidth	StructureMaterial
43.91152	-72.39402	TAYLOR VLY RD	8	20	2	2	Steel Corrugated
43.88421	-72.36994	OLD CITY FALLS RD	6.3	36	2.4	3.2	Steel Corrugated
43.8519	-72.43591	ROBINSON RD	11.8	35	3	3	Steel Corrugated
43.8529	-72.43559	ORDWAY RD	11.8	35	3	3.5	Steel Corrugated
43.88547	-72.31336	MILLER POND RD	13.3	40	3.5	3.5	Steel Corrugated
43.87931	-72.40407	WETMORE RD	9.7	30	3.2	2.9	Plastic Corrugated
43.82954	-72.39284	ROUTE 132	12.7	96	6.2	5.6	Steel Corrugated
43.86802	-72.33008	DODGE RD	12.3	24	2.7	3.4	Steel Corrugated
43.83085	-72.37984	ROUTE 132	12.4	93.4	6	6	Concrete
43.92022	-72.36148	VAN DYKE RD	9	36	3.5	4.2	Steel Corrugated
43.90106	-72.39052	TAYLOR VLY RD	12	30	3.1	4.4	Steel Corrugated
43.8544	-72.36637	ALGER BROOK RD	18	39.5	3.7	5.3	Steel Corrugated
43.90423	-72.29952	AYERS RD	9.7	32	4.2	3.8	Steel Corrugated
43.84916	-72.43578	ROBINSON RD	11.8	32	4	4	Steel Corrugated

Appendix C: Five-Year Review and Maintenance Plan

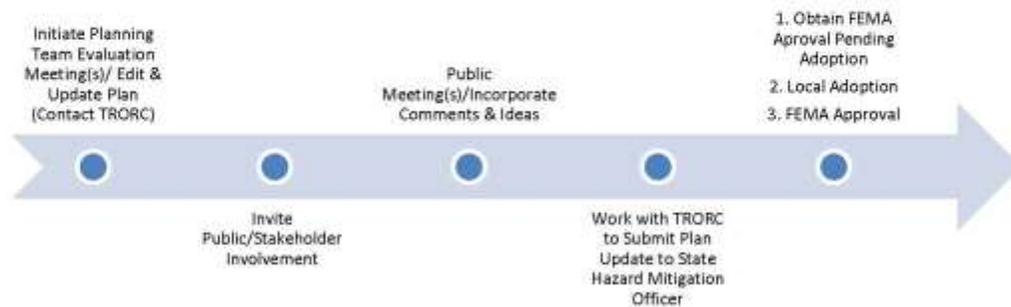
Five-Year Local Hazard Mitigation Plan Review/Maintenance



After Plan Adoption—Annually Implement & Evaluate



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



Attachments

Attachment A: Map of the Town of Strafford