Town of Moretown, VT
Local Hazard Mitigation Plan Update
Prepared by the Town of Moretown &
Central Vermont Regional Planning Commission

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Date of Town Adoption:
Date of Final FEMA Approval:

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In accordance with the Stafford Act, municipalities may perform mitigation planning and be eligible to receive increased federal funding for hazard mitigation measures. (42 U.S.C. 5165).

1. Introduction

The impact of expected, but unpredictable natural and human-caused events can be reduced through community planning. The goal of this updated plan is to provide an all-hazards local mitigation strategy that makes the communities of Central Vermont more disaster resistant.

Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Based on the results of previous Project Impact efforts, FEMA and State agencies have come to recognize that it is less expensive to prevent disasters than to repeatedly repair damage after a disaster has struck. This Plan recognizes that communities have opportunities to identify mitigation strategies and measures during all of the other phases of emergency management – preparedness, response, and recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where the hazards are most severe and identify local actions that can be taken to reduce the severity of the hazard.

Hazard mitigation strategies and measures alter the hazard by eliminating or reducing the frequency of occurrence, avert the hazard by redirecting the impact by means of a structure or land treatment, adapt to the hazard by modifying structures or standards, or avoid the hazard by preventing or limiting new development in hazard areas.

2. Purpose

The 2019 Moretown Local Hazard Mitigation Plan is an update of the town's adopted 2013 Local Hazard Mitigation Plan approved by FEMA on March 4, 2013. This Local Hazard Mitigation Plan assists the Town of Moretown in cataloguing hazards facing the region and community, and identifying strategies to begin reducing risks from acknowledged hazards based on current information. The town reviewed, evaluated, and revised the 2013 plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities. New information has been incorporated in the plan making it up to date, stronger, and more useful to the Town of Moretown officials and residents who will implement the actions and measures going forward. Implementation of this plan will make Moretown more resistant to harm and damages in the future, and will help to reduce public costs.

Moretown strives to address the strategies, goals and objectives of the 2018 State Hazard Mitigation Plan, including an emphasis on proactive pre-disaster flood mitigation for public infrastructure, appropriate floodplain and river management practices, and fluvial erosion risk assessment initiatives.

The 2019 Moretown Local Hazard Mitigation Plan is an update of the 2013 adopted plan. The plan consists of the following sections which have been reorganized and nee sections added regarding:

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- Current information since the last plan update done in 2013
- The town has updated the hazards reflecting the communities' priorities.
- Plan Update Process
- Plan Maintenance
- Update of Hazards
- Updates to Local Areas of Concern Map reflects current information
- Status of 2013 mitigation strategies
- Identification of new mitigation strategies section that reflects the current priorities and intended actions of the community over the next five years

3. Community Profile

The Town of Moretown is a small, rural, and residential, community located in west-central Washington County. It is bounded to the east by Berlin, to the south by Waitsfield and Northfield, to the west by Duxbury, and to the north by Waterbury and Middlesex. According to the 2010 Census, Moretown has a total population of 1,658 people living in 696 housing units. According to the Moretown Town Plan Moretown has a relatively dispersed population and is a rural community comprised of approximately 797 homes, nearly 90% of which are occupied on a year round basis. The Town's population has increased by less than 1% from the 2000 Census. The number of housing units has increased by 9.1% since 2000.

Moretown's 40.2 square miles are situated within the Winooski River watershed and due to the defining mountains and river valleys, stream tributaries drain into both the Dog River sub basin and the Mad River sub basin. To the east of the village rises Chase Mountain to an elevation of 2,080 feet, and to the northwest Mt Cobb, elevation 1,592 feet. As stated in the Moretown Town Plan "historically, the town's settlement patterns have been influenced by natural land forms and the distribution of natural features. Moretown is bisected by Route 100B which traverses a valley formed by the Mad River, running northeast to southwest. It is within this valley, in the southwestern region of the town, the Village of Moretown was settled in the late 1700's. The town garage, the town hall, the general store, the town offices, and the local elementary school are all located within the village, amongst a cluster of historic and contemporary homes. However, today the largest numbers of private residences are widely dispersed throughout the Town's rural lands. Residential development continues to be scattered in rural areas. Commercial development is occurring along Route 2 and at the intersection of Route 2 and 100 near the Waterbury and Duxbury town lines.

In Moretown, electricity is primarily provided by Washington Electric with Green Mountain Power servicing clients along the northern, eastern and western town boundaries. The majority of Moretown is dependent upon groundwater for its domestic water supply and individual on-site septic systems for wastewater treatment.

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3.1 Public Safety

The Town's principal fire coverage is provided by the Moretown Volunteer Fire Department (MVFD), which also provides support to portions of the Town of Duxbury. Moretown has also entered into agreements with the Waterbury Fire Department to assist with emergencies that are in proximity to Waterbury. According to Moretown's 2010 Town Report the WVFD responded to 29 calls for emergency assistance. Montpelier Ambulance Service and the Mad River Valley Ambulance Service provide ambulance service to Moretown. The ambulance services responded to 49 calls for assistance within the Town of Moretown in 2010. In regards to law enforcement, the Washington County Sheriff's Department, the Vermont State Police and the Town Constable provide law enforcement for the Town of Moretown. The Town of Moretown has an approved Rapid Response Plan that was adopted in 2011 plus the Moretown Elementary School has an emergency evacuation plan which is in the process of being updated.

The Town of Moretown has an approved Local Emergency Management Plan (LEMP) that is updated and adopted annually, after Town Meeting Day and before May 1st. The current LEMP was adopted on March 19, 2018 and is due for renewal by May 1, 2019. The town coordinates with the Central Vermont Regional Planning Commission who provides technical support and guidance with the LEOP plan update. The town requires the certifying officer to be trained in ICS 402 or ICS 100 at a minimum. All Selectboard members as of 2016 were trained in ICS 100. In conjunction with the LEOP, on April 10, 2012, the town adopted the use of the National Incident Management System (NIMS) as the standard for management and systematic approach involving all threats and hazards, regardless of cause, size, location, or complexity, in order to reduce loss of life, property, and harm to the environment.

3.2 Municipal Plan

The Town Plan includes descriptions, goals, policies, tasks and strategies in regards to flooding, groundwater protection, steep slope development, and transportation and emergency services. Moretown Zoning Regulations, last amended in March 2011, include a Flood Hazard Area Overlay District (last amended in March 2008), the purpose of which is to promote public health, safety and welfare by preventing or minimizing hazards to life or property due to flooding and provisions for stream, stream bank and wetland protection.

3.3 Emergency Relief & Assistance Funds (ERAF)

Moretown is eligible under the Vermont Emergency Relief and Assistance Fund (ERAF) to receive state funding to match Federal Public Assistance funds after a federally declared disaster. Communities that take specific steps to reduce flood damage can increase the percentage of state funding they receive from 7.5% up to a maximum of 17.5%. At the time of this Plan development, Moretown has an ERAF rating of 7.5%. Moretown has taken the specific steps to reduce flood damage by 1) participating in the National Flood Insurance Program, 2) adopting standards that meet or exceed the

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current Vermont Roads and Bridge Standards 2016, 3) adopting a Local Emergency Operations Plan which is renewed and adopted annually, 4) adopting a Local Hazard Mitigation Plan approved by FEMA. The town has not adopted Interim River Corridor protection standards (River Corridor Plan criteria) which, if it did, would bring the rate to 17.5%.

Moretown can qualify for the maximum 17.5% rate if it adopts river corridor standards that meet the Agency of Natural Resources (ANR) criteria within two years of ANR publishing a statewide river corridor map updated to include existing Phase 2 Stream Geomorphic Assessment (SGA) data. The data release, expected to occur at the end of 2016, has been delayed and the agency has not announced a new release date. The other option to qualify for the maximum ERAF rate is for Moretown to enroll in the NFIP Community Rating System (CRS) and adopt a bylaw that prohibits new structures in the Flood Hazard Area. The CVRPC is posed to assist the community in drafting a river corridor plan with the release of the Phase II data.

3.4 National Flood Insurance Program (NFIP)

Since 1982, Moretown has participated in the National Flood Insurance Program. In 2013, official Digital Flood Insurance Rate Maps became available. The Moretown FIRMS were last updated effective 3/19/2013, Community panel #50023C0209E, and can be found online at tinyurl.com/floodreadyatlas and www.msc.fema.gov. Many of the panels are not printed due to large areas being in Zone X, areas of minimal flood hazard. Using 2017 data, there are 18 structures in the 100 year flood plain; 15 residential, 1 commercial, and two public gathering places. There are 85 parcels that touch the flood plain. There are no repetitive loss properties in Moretown. There are 3 policies. Lacking a history of no repetitive loss properties in the community, it is likely that Moretown cannot meet the eligibility criteria to enroll in the NFIP Community Rating System (CRS). The administrative resources necessary for enrollment and ongoing program maintenance are likely to be a significant challenge for Moretown and a deterrent for participation.

4. Planning Process and Maintenance

4.1 Planning Process

Moretown Planning Commission in conjunction with Central Vermont Regional Planning Commission (CVRPC) coordinated the Local Hazard Mitigation Plan process. CVRPC and Planning Commission members updated the 2013 LHMP beginning in February 2019. during regularly scheduled monthly warned meetings and through email correspondence. The LHMP was also on the agenda at multiple Selectboard meetings. A draft of the LHMP was reviewed at the December 2017 Selectboard meetings. The December review identified future hazard mitigation programs, projects and activities based off of an assessment of past projects and a predictive analysis of future weather events. Town residents were present at the Selectboard meetings but made no comment on the LHP.

The following town residents participated in the planning process:

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Moretown Planning Commission Members

Jonathan Siegel, Chair | jsiegel@gmavt.net
Karen Horn, Vice-Chair | khorn@vlct.org
John Schmeltzer | metsch@comcast.net
Deborah Carroll |

The Town remains most vulnerable to flash flood/flood/fluvial erosion, hurricanes/severe storms/tropical storms, and wildfire/forest fire. The methodology used to perform the assessment and prioritization is described further on in this Plan. The Town will focus on flooding hazards as these events are the most common and severe. Continued investments by GMP and Washington Electric Coop, Inc. (WEC) for ongoing line clearing maintenance, upgrades to the grid, and a varied mix of power sources reduce the impact from power outages. The town is still predominantly rural and heavily forested and the potential for forest fires remain a significant threat hazard.

Additional opportunities for the public to weigh in on the planning process have been made available at Emergency Management meetings, Selectboard meetings and via opportunities through the zone reporting system. The planning meetings focused on 1) assessing past mitigation projects and compiling information on its current and future hazard mitigation programs, projects and activities, 2) identifying and ranking the hazards significant to Moretown, 3) discussion of vulnerabilities, 4) plan maintenance, and 5) public engagement. All meetings were open to the public. No public attended the working meetings between the Emergency Management Team and the Planning Commission and no public comments were received at any of these meetings. After public comments were considered, the draft plan was updated and made available during Town Meeting Day, March 6, 2018. It will also be made available during local meetings with State and local officials to allow for more public comment and review.

On 28 February 2018, the draft Plan and a completed Plan Review Tool was sent to Stephanie Smith, Hazard Mitigation Planner at Vermont Emergency Management (VEM) for review and comment. This started the review and approval process with VEM and FEMA.

Based on comments received on March 8, 2018 from S. Smith, minor revisions were made to the draft Plan prior to submittal to FEMA and outreach to adjoining towns was broadened. On March 14, 2018 the revised draft Plan was sent electronically to the additional towns of Fayston, Bolton, Huntington, and Waitsfield for review and comment with instructions to send comments to Erik Zetterstrom by email at zettx3@gmail.com. Comments were asked to be received by March 21, 2018. Any public comments received were considered by the Planning Team. The following persons were sent the revised draft Plan:

The revised Plan was sent to S. Smith for further review. After VEM review, the final plan will be submitted to FEMA for review and approval. Once FEMA approves the plan they will notify VEM of "Approval Pending Adoption" status. After Approval Pending Adoption, the plan will go before the Selectboard for adoption. The Selectboard will hold a warned public hearing and after the hearing and at a regular Selectboard meeting will approve and adopt the Moretown 2019 Local Hazard

Mitigation Plan and execute the Certificate of Adoption. A copy of the executed Certificate of Adoption will be attached to this Plan. The adopted Plan and signed certification was sent to VEM for submittal to FEMA on August 15, 2018. The Plan will expire 5 years from the FEMA approval effective date. During the review and adoption process CVRPC provided support and technical assistance.

Public comments submitted in the future will be reviewed by the Selectboard (and CVRPC Staff dependent on funding) and attached as an appendix.

Also during the Town Meeting a LHMP Committee will be identified and a Chairperson appointed. The LHMP Committee will update the plan annually and provide updates at all future Town Meetings.

During, and after, the update process, the town used the town website to post notices and informational pieces about the updated local hazard mitigation plan. The Waterbury Record was also utilized to provide public participation.

4.2 Plan Update Process

The 2019 LHMP update will be submitted as a single jurisdiction local mitigation plan. This Plan will guide the town into the next five years and maintain the town's eligibility as an applicant for mitigation grants.

The current plan is not a significant departure from the 2012 plan; however, new analysis was done to best determine where the Town should put resources in the future. Town planners updated the significant weather events history, considered changes to risk based off of past events and the likelihood of future events and their impact to infrastructure and lives, and reviewed the historical and expected locations of future events to make determinations on how best to apply resources.

Analysis showed that the worst threats and areas of concern remain the same from the 2012 plan and that continued effort needs to be applied to these threats and areas to mitigate risk. Priorities have not changed from the 2012 plan. Available resources will be applied to mitigate top priority threats. The implementation of several mitigation actions over the past five years, some not listed because the town considers them to be regular maintenance and program implementation measures, have reduced the town's vulnerability to specific hazards. Despite the fact that solid strides have reduced the risk of identified worst threats and areas, additional work needs to be done. Moretown has benefitted from the collaborative approach to achieving mitigation on the local level, by partnering with Agency of Natural Resources (ANR), Vermont Agency of Transportation VTrans, Agency of Commerce and Community Development (ACCD), Vermont Emergency Management, Central Vermont Regional Planning Commission (CVRPC), Federal Emergency Management Administration (FEMA) Region 1 and other agencies, all working together to provide assistance and resources to pursuing mitigation projects and planning initiatives in Moretown.

General Updates

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- Update of all data and statistics using available information (Section 3 and Section 5)
- Revaluation, identification and analysis of all significant hazards (Section 5)
- Acknowledgment of implemented mitigation strategies since 2011 – see matrix below (Section 4.2)
- Identification of on-going mitigation projects and strategies – see Existing Mitigation Programs, Projects and Activities section (Section 4.2)
- Identification of new mitigation strategies (Section 6)
- Hazards referred to as "non-worst threat" are now referred to as "moderate hazards"

Hazard Analysis Updates (Sections 5 and 6)

- Added location/vulnerability/extent/impact/likelihood table for each hazard to summarize hazard description (Section 5.1-5.3 – after each hazard)
- Review of Vermont Hazard Mitigation Plan, November 2018
- Review of Federally declared disasters, weather data, ANR resources, VT Flood Ready site, and NOAA/NCDC site.
- Flood/Flash Flood/Fluvial Erosion, Hurricane/Tropical storms/Severe Storms, Extreme Cold/Winter Storms/Ice Storm remain the most significant hazards. Although the town cannot predict with certainty that these events will be the norm in the future, the town continues to keep these in their analysis of hazards that they may be vulnerable to in the next five years.
- Extreme Cold/Winter Storms/Ice Storm/Power Failure remains as a moderate threat hazard. Dam Failure also remains as a moderate threat hazard.

Maps

Updates to the 2019 LHMP included a review of all of Moretown's planning documents:
The following chart provides an overview of Moretown's proposed 2013 local hazard mitigation actions along with their current status.

2013 Mitigation Action	2019 Status
Upgrade and expansion of two box culverts on Ward Brook Road	
Widening of bridge south of village on S-curves	
Blasting of lower part of gorge to open bottleneck north of village	
Phase IV of River/Jacobs Road project – raise additional section	

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Upgrade and expansion of box culvert on backside of Common Road at Foster turn	
Upgrade and expansion of box culvert at Canoe Access	
Work with ANR and CVRPC to develop Lower Mad River Corridor Plan	
Reinforce and stabilize low side of Common Road with rip rap	
Install generator at Moretown Elementary School	
Generator education and training for residents	
Upgrade electrical systems in municipal buildings and shelters	
Work with elected officials, the state, and FEMA to correct existing NFIP compliance	

Town Capabilities for Implementing Mitigation Strategy

Services provided by the Moretown municipality are overseen by a five member volunteer Selectboard.

The Town employs a handful of staff members to carry out services to its residents on a daily basis. The following are the paid positions which are involved in hazard mitigation:

Volunteer municipal officials also play a crucial role in carrying out hazard mitigation.

The municipal budgeting process occurs on an annual basis, planning for a fiscal year from July to June. The budget is usually developed between early November and early January, and put to voter approval on the first Tuesday in March at Annual Town Meeting Day. The Selectboard is charged with developing and proposing the budget to the voters, including the budget for Highway Equipment. After the budget has been adopted by vote of town residents, the Selectboard has the authority to modify it in cases of extraordinary circumstances; i.e. natural disaster, unexpected equipment/infrastructure failure (i.e., water well, power failure, major bridge/culvert failure). The budget is monitored several times a month by the Selectboard and Town Treasurer.

Municipal revenues are generated primarily through levy of taxes on property value. Other major sources are federal & state payments to support the town school, aid (including grants) from the Vermont Agency of Transportation for highways, and payments in lieu of taxes for land owned by the State of Vermont. The municipality also has the authority to incur debt through bonding.

Existing Mitigation, Maintenance, and Preparedness Programs, Projects & Activities

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The ongoing or recently completed programs, projects and activities are listed by strategy and have occurred since the development of the previous plan and were reviewed by the planning team. They share and incorporate the overall goals of the local hazard mitigation plan. Moretown has the capacity to maintain these programs and initiatives using town staff and community volunteers described in the Community Capacities above. Unless otherwise noted, there is no need to expand or improve on these programs, projects and activities.

It is important to note, the job of the Moretown Highway Foreman continues to evolve. There is an increasing need to spend more time with administrative duties of the job over the equipment operator/supervisor responsibilities. This is in part due to new requirements and regulations the town is subject to from Act 64 (the Clean Water Act) and the need of the Town to secure funding from both non–emergency and emergency grants which help to increase their capacity for implementation of mitigation strategies and actions. The Town Road Foreman, Adam Magee, has the experience and ability to perform all roles however, the time spent away from performing the duties as equipment operator is a challenge the town recognizes going forward. (Annual Town Report year ending 2016). Some of the projects completed or awarded to protect roads and increase flood resiliency during the past year are listed below:

- 1800 feet of River Road was rebuilt as part of a multi-year project that will see nearly 1,800 to 2,500 feet of this road rebuilt each year for the next few years
- Ditching, graveling and/or culvert replacements were completed on Crossett Hill Road, Pleasant Street, Morse Road, Wilder Road, Ryan Road and Turner Hill Road
- Grants were awarded to ditch and stone line the big hill of Marshall Road and replace an 18" culvert crossing
- Grants were awarded to replace culverts at the beginning of Turner Hill and remove trees that will improve stream stabilization and protect the road and the new box culvert improving flood resiliency
- Grants were awarded to replace a 4' structure on Dowsville Road which will provide better flood resiliency
- Repair of sections on Marshall Road, Turner Hill Road and Crossett Hill Road to better improve resiliency.

Community Preparedness Activities

- VTAlert was adopted by the Town in 2016 as the official Emergency Management notification system. The town will continue to conduct trainings and testing under this system as part of its ongoing use and expansion of services that are or may become available using VTAlert system.
- Capital Equipment Plan
- Water Supply Contamination Plan
- Homebound Persons Phone Tree/E911 CARE form
- The list of equipment that residents have to assist in emergency management systems

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was updated.

- Development of a Red Cross Shelter in Moretown is being explored.
- Local Emergency Operations Plan 2017 and renewed annually
- Trained and certified Selectboard members in ICS 100
- Communal awareness training with Moretown, Waterbury and Moretown and the VT State Police on emergency operations plans. Expanded tabletop exercises are planned.
- Participation at LEPC 5 meetings -EMD participates at regular meetings of the Local Emergency Planning Commission #5. Volunteer time. Funding from VT DPS, VEM. No need to expand or improve on attendance.
- Appointment of a Town Fire Warden to serve a five year term. Kyle Guyette currently serves as Fire Warden, no further action needed.

Hazard Control & Protective Works

- Maintenance Programs (Culvert Survey & Replacement (290 culverts); Highway Survey (35 miles of Town Highway)) – CVRPC Survey 2016.
- Stone line ditch initiative to meet changes in the VT Codes and Standards for all ditches with slopes >5%
- Adoption of the 2016 VTrans bridge and culvert standards.
- Purchase of Culvert Thawing machine - allows for safe opening of frozen culverts meeting current standards replacing old method of using chainsaws and propane torches.
- Purchase of a Road Roller to compact freshly graded roadways. This keeps gravel on the roadway and reduces sediment going into streams.
- Mutual Aid, Mutual Aid response agreement with surrounding communities
- Town Road and Bridge Standards. Moretown adopted the VT 2016 Road and Bridge Standards.
- Local Hazard Mitigation Plan 2012 and subsequent updates every 5 years. Plan is reviewed annually and after every disaster event with a full review and update by the Town at least every five years. Current 2012 Plan expires 3/11/2018. Plan Update is in process. Town will need to receive VEM and FEMA approval prior to adoption of this Plan.
- Primary Shelter and warming shelter have backup generators.

Insurance Programs

- Participation in NFIP –Town is currently updating zoning regulations and Flood District Overlay map. Regulations need to be adopted by the Selectboard.

Land use Planning/Management

- Ecological Reserve Lands District
    - Section 1 – Above 2,500 feet, all structures prohibited except Conditional

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Uses for structures associated with low intensity non-commercial recreation. Development in this area must make special consideration for impact on wildlife habitat and natural vegetative cover, along with erosion control

- Timber Management & Wildlife District
  - Section 2 – Between 1,500 feet and 2,500 feet only low impact, nonstructural development is a Permitted Use and minimum lot sizes are 25 acres. Low impact structures are a Conditional Use.
- Flood Hazard Overlay District
  - Section 7 – Limits construction of structures in floodplain areas designated within the Flood Insurance Rate Map for Moretown.
- Zoning Ordinances are being updated (Land Use Development Regulations). Action to adopt proposed ordinance needs to take place.
- Work to close the depleted Town Gravel Pit remains unfinished. Town continues to work with the State of Vermont to resolve the matter to officially close the pit.
- Transfer of 169 acres of State land at end of Hart Road to Town for use as a Town Forest subject to conservation easement held by the Moretown Land Trust and establish a Town Forest Committee to address issues related to management of the property. Time is needed to complete the transaction. Work of the Town Forest Committee will be ongoing and expand as needed.

Protection/Retrofit of Infrastructure and Critical Facilities

- Dry hydrants – 2
- Spare batteries for the repeaters were purchased so that repeater coverage will be available during power outages.
- Radio equipment was purchased so that each zone captain has a portable radio with an automobile antenna. In addition, reflective vests and highway cones were purchased for each zone.
- Capital Reserve Fund maintained to fund projects
- Public Awareness, Training & Education
- VTAlert exercise messages have been sent to Town Residents and all Residents are encouraged to sign up to receive alerts.
- Semi Annual radio checks and an annual table top exercise are being scheduled.
- A mailing will be sent to residents to reinforce the town zone system.
- Participation in 5-town Ridge to River task force
- Participation in Friend of the Mad River and Friends of the Winooski River nonprofit community organizations
- Use of town website for educational outreach and information dissemination

4.3 Plan Maintenance Process

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The Moretown Local Hazard Mitigation Plan will be updated and evaluated annually by a LHMP Committee to be created at the 2018 Town Meeting. At Future February Selectboard meetings the LHMP Committee will present recommend updates to the board. A review of the Local Emergency Operations Plan will also occur at this meeting. Updates and evaluation by the Selectboard will also occur within three months after every federal disaster declaration and as updates to town plan/zoning and river corridor plans come into effect. The plan will be reviewed by the Selectboard, Planning Commission and public at the abovementioned February Selectboard meeting. CVRPC will help with updates or if no funding is available, the Selectboard Chair will update the plan with the support of the LHMP Committee.

The process of evaluating and updating the plan will include continued public participation through public notices posted on the municipal website, notice in the municipal building, Valley Reporter, Front Porch Forum, Moretown Store, Crossett School, bottom of Camel's Hump Rd., and CVRPC newsletter inviting the public to the scheduled Selectboard (or specially scheduled) meeting. These efforts will be coordinated by the Selectboard.

Monitoring of plan progress, implementation, and the 5 year update process will be undertaken by the Selectboard Chair and the LHMP Committee. Monitoring updates may include changes in community mitigation strategies; new town bylaws, zoning and planning strategies; progress of implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities. If new actions are identified in the five year interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings. After a five year period, the plan will be submitted for re-adoption following the process outlined in the schematic found in the Attachments section.
Moretown shall also consider incorporation of mitigation planning into their long term land use and development planning documents. It is recommended the Town review and incorporate elements of the Local Hazard Mitigation Plan when updating the municipal plan, zoning regulations, and flood hazard/FEH bylaws. The incorporation of 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 current and future Winooski River and Mad River planning documents and studies for ideas on future mitigation projects and hazard areas.

In 2013, the Vermont Legislature passed a law requiring all towns to incorporate a flood resiliency element into their Town Plan as of July 2014. As part of meeting this requirement, Moretown will identify flood hazard and fluvial erosion hazards, strategies, and recommendations to mitigate risks to public safety, critical infrastructure, historic structures, and public investments. This Plan will help Moretown comply with the new community flood resilience requirements for Municipal Plans adopted after July 2014 and will assist the Planning Commission in their work as they update the existing and due to expire Moretown Town Plan.

5. Risk Assessment

5.1 Hazard Identification and Analysis

The following natural disasters were discussed and the worst threat hazards were identified based upon the likelihood of the event and the community's vulnerability to the event. Hazards not identified as a "worst threat" may still occur. Refer to section 4.2 for a description of the hazard mitigation rubric. Greater explanations and mitigation strategies of moderate hazards can be found in the State of Vermont's Hazard Mitigation Plan.

Flood/Flash Flood/Fluvial Erosion, based on history, has a High Likelihood of happening. At least one flood event each year over the past five years has occurred in Moretown. Therefore the likelihood of Flood/Flash Flood/Fluvial Erosion has been changed from Med to High in the above chart.

Those hazards not found to pose the greatest threat to Moretown such as avalanches, drought, earthquakes, tornadoes, dam failures (man-made), water supply contamination, extreme heat, landslides/mudslide/rockslides, invasive species, hazard material spills, structure fire, ice jams and nuclear power plant failure are not addressed in this Plan and were not included in the risk and vulnerability assessment due to the low occurrence, low probability of impact or negligible potential impact and scarce community resources (time and money). A review of the Vermont State Hazard Mitigation Plan of November 2013 provides a greater explanation of these hazards and possible mitigation strategies to address them. Like the State of Vermont Hazard Mitigation Plan, Moretown did not include the following hazards in the risk and vulnerability assessment due to the low occurrence, low vulnerability, and or geographic proximity: civil disturbance, coastal erosion, expansive soils, karst topography, sinkholes, tsunami, and volcano.

The following hazards were found to be most significant in the Town of Moretown:

- Flash Flood/Flood/Fluvial Erosion
- Hurricane/Severe Storms/Tropical Storms
- Wildfire/Forest Fire

Due to the frequent and severe nature of flooding events, Moretown feels flooding is the worst natural hazard within the Town and will focus on mitigation efforts to reduce the impacts from flooding events.

Moderate threat hazards include

- Dam Failures (Bolton Falls No. 1, Moretown Mill, Ice Pond, beaver dams)
    - Moretown is in the flood inundation zone for both Waterbury and Wrightsville Dams
- Extreme Cold/Winter Storm/Ice Storm/Power Failure

A discussion of each significant hazard is included in the proceeding subsections and a map identifying the location of each hazard is attached (See map titled *Areas of Local Concern.*) Each subsection includes a list of past occurrences based upon County-wide FEMA Disaster Declarations (DR-#) plus information from local records and the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center, a

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narrative description of the hazard and a hazard matrix containing the following overview information:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Type of hazard	General areas within municipality which are vulnerable to the Identified hazard.	Types of structures impacted	Magnitude of hazard: Scale dependent on hazard	Dollar value or percentage of damages	Likelihood of hazard occurring based upon past events: HIGH = Near 100% probability in the next year. MEDIUM = 10% to 100% probability within the next year or at least once in the next 10 years. LOW = 1% to 10% probability in the next year or at least once in the next 100 years

Flash Flood/Flood/Fluvial Erosion

History of Occurrences: (Mad River Valley encompasses the towns of Waitsfield, Warren, Moretown and Fayston. The Mad River flood gauge is located in Moretown. Information from NCDC website)

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Date	Event	Location	Extent
7/17/2017	Flash Flood	Washington County	Scattered thunderstorms developed with a few containing large hail (> .75 inch in diameter) and some winds. Heavy rain additionally produced some isolated Flash Flooding.
6/30/2017	Flood	Washington County	Rainfall amounts of 2-3" in just a few hours on saturated soils from previous June rainfall caused flash flooding.
8/17/2016	Flash Flood	Moretown, Washington County	Rainfall totals of 3-5" in a few hours caused flash flooding in central Washington County.
2/25/2016	Flood	Washington County	Warm temperatures and rain melted 1-3" of water out of the snowpack, which produced ice jams and open water flooding.
7/19/2015	Flash Flood	Washington County	Thunderstorms with heavy rainfall moved over northeast Washington County Vermont repeatedly for several hours.
4/15/2014	Flood	Washington County	Snowmelt from a late season snowpack combined with heavy rain produced widespread flooding across northern and central Vermont.
7/3/2013	Flash Flood	Washington County	Record rainfall in May and June saturated the ground and elevated water levels in rivers and streams, making the region vulnerable to flooding.
8/28/2011	Flash Flood (TS Irene)	Moretown, Washington County	Mad River flood gauge at 19.07 feet; 10.07 feet above flood stage (flood stage is 9 feet) DR 4022
5/20/2011	Flash Flood	Washington County, Moretown	4" of rain, not a historical crest - DR 1995
3/6/2011	Flood; ice jams	Moretown; Washington County	1-2" of rain followed by ~15" of snow
10/1/2010	Flood	Moretown, Washington County	4-5" of rain, Mad river gauge at 10.39 ft
8/2/2008	Flash Flood	Washington County (Mad River Valley)	Mad River gauge at 7.89 feet – DR 1790
3/15/2007	Flood; ice jams	Mad River Valley	Mad River Gauge at 13.5 ft
12/24/2003	Flood	Mad River Valley	Mad River flood gauge at 14.17 feet DR 1448
12/17/2000	Flood	Mad River Valley	3" of rain; no data for Mad River

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6/27/1998	Flash Flood	Mad River Valley	3-6" of rain over 2 day period – Mad River flood gauge at 14.13 feet, 2-3 ft of water on Rte 100b through Moretown Village - DR1228
8/6/1995	Flood	Mad River Valley	Mad River flood gauge at 8.12 feet DR 1063
3/31/1987	Flood	Mad River Valley	Mad River flood gauge at 11.97 feet
3/13/1977	Flood; ice jams	Mad River Valley	Mad River flood gauge at 13.72 feet
8/5/1976	Flood	County Wide	Mad River flood gauge at 13.47 feet DR 518
9/22/1938	Flood	County Wide	Mad River flood gauge at 16.34 feet
9/22/1938	Flood	County Wide	Mad River flood gauge at 16.34 feet
11/03/1927	Flood	County Wide	Mad River flood gauge at 19.40 feet

Flooding/flash flooding/fluvial erosion is Moretown's most commonly recurring hazard. Flooding is the overflowing of rivers, streams, drains and lakes due to excessive rain, rapid snow melt or ice. Flash flooding is a rapidly occurring flood event usually from excessive rain. Fluvial erosion is the process of natural stream channel adjustments. Fluvial erosion causes erosion of sediment in some areas, while causing aggradation of sediment in other. Fluvial erosion processes occur more quickly and severely during flood events. Fluvial erosion extent data is not available for Moretown. The worst anticipated flooding is unknown in the low lying areas in Town of Moretown. The worst flooding event in Moretown's recorded history occurred in 1927, followed closely by T.S. Irene in 2011. The Mad River flood gauge readings during these events were 19.4 and 19.07, respectively. Detailed historical records relating to the extent of the 1927 flood in Moretown are not available, but were believed to be 2-3 feet higher than Irene; during T.S. Irene up to 7 feet of flooding occurred in Moretown Village. Lesser but more regular flooding occurs in Moretown, with generally 1 foot of flooding in low lying areas every two or three years. In the future, Moretown can better gather data for flooding extent by having individuals call in flood levels in areas around the Town. According to the Moretown River gauge, at the following water levels, the impact to the surrounding areas will be:

Water level (feet)	Impact
13.5	ABOUT 4 FEET OF WATER WILL COVER ROUTE 100 SOUTH OF MORETOWN...NEARLY REACHING A TRAILER PARK.
12	AT 12 FEET...ROUTE 100 WILL BE COVERED WITH WATER IN MORETOWN...ROUTE 100B WILL BE PARTIALLY COVERED. WATER WILL INUNDATE TELEPHONE FLATS NEAR WAITSFIELD.

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9	AT 9 FEET...THE MAD RIVER BEGINS TO LEAVE ITS BANKS. FIELD FLOODING OCCURS BETWEEN WAITSFIELD AND MORETOWN...AND SOME LOCAL ROADS WILL FLOOD.

With approximately 7.5 miles of the main stem flowing through the Moretown, the Mad River is the most prominent body of water within the town boundaries. The Mad River originates in Granville Gulf and flows in a northerly direction through Moretown Village and along Vermont Route 100B. The town's northern boundary is formed by over 7 miles of frontage on the Winooski River. Several streams originating in Moretown's upland areas converge with the Mad and Winooski River.

The majority of Moretown's development is located in the Mad River valley. Based on the results of overlaying the FIRM flood maps with the location of E911 points, there are 430 properties that are located within the National Flood Insurance Program's designated 100- year floodplain. The estimated loss for a severe flooding event for all properties located within the town's 100-year floodplain is approximately $64,779,500. There are no repetitive loss properties in Moretown. Moretown's FIRM was effective starting 3/1/1984. The Hazard Analysis Map (attached) identifies the Moretown Town Offices, the Catholic Church, and Moretown Fire Department, all within the designated flood plain. (See area of local concern.) The Town participates in the NFIP program and has a total of 28 active policies with a total coverage amount of $6,813,800. The Zoning Administrator is responsible for enforcing the flood hazard regulations.

As previous events have made clear, however, even areas beyond the NFIP designated 100-year floodplain may be vulnerable to flood related hazards. The Town has 25 properties in the fluvial erosion hazard zone, totaling $3,766,250. Information gathered from the Moretown Planning Commission indicated the following stretches of road have experienced flood-induced washouts. They are:

1) A small stretch of road on River Road by (phase IV of River Road project);
2) Low lying area of Lovers Lane;
3) Section of Route 100B north of Murphy Road; and
4) Section of Route 100b south of Moretown Bridge B2

During the spring thaw Moretown roads are also susceptible to flooding due to ice jams. Natural geological features and flood-plain encroachments restrict ice to move freely downstream and cause water to back up on to the following stretches of road:

1) Section of Route 100B south of the Ward swimming hole;
2) Section of Route 100B at the northern intersection of Old Route 100B Road;
3) Section of Route 100 B between Bridge Road and Stevens Brook Road.

Natural geologic features, flood-plain encroachments, seasonal flash flooding and undersized culverts flooding in Moretown undermines the stability of low lying roads and isolates rural residents from emergency services. (See Areas of Local Concern Map)

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Moretown experienced heavy flooding in August 2008 event (DR 1790). During that event several roads and associated culverts were severely damaged due to flash flooding of smaller brooks. These areas include:

- Moretown Mountain Road (20 foot gorges along length of road, box culvert damaged and replaced)
- Dickerson Road – impassable for about a month
- Ward Brook Rd

The records for all events were lost in TS Irene. It is believed the Town incurred over $200,000 of damages during the August 2008 event. During the May 2011 event, Moretown experienced minimal damages on Herring Brook Road. The road was undermined and several culverts were washed out. The damages cost $35,000. During Tropical Storm Irene, Moretown experienced flooding of up to 8 feet within the Village from the Mad River. Route 2 along the Winooski River was also severely flooded with floodwaters up to 20 feet in some areas. Flood waters were above normal predicated levels due to debris blocking bridges and culverts[LJ1].

The following roads and buildings were damaged during TS Irene:

- Moretown Fire Station (8 ft of water)
- Moretown Town Hall (5 ft of water on ground level)
- Ward Brook Rd
- Route 2
- Bridge Rd – lost entire bridge – est. $1 million to replace
- Moretown Mountain Rd
- Moretown Common Rd
- Route 100b (3 bridges)
- Williams Rd
- Tarts Rd
- Lovers Lane
- Butternut Hill Rd
- Dickerson Rd
- Gove Rd
- Jones Brook Rd
- Doctor's Brook Rd
- Herring Brook Rd
- Howes Rd
- McGibbons Rd
- Hathaway Rd
- Salaki Rd

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It is estimated that Moretown incurred $1.8 million in public infrastructure damage. Private property damages have yet to be calculated; however, 52 homes were flooded.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Flooding	Floodplain and see above road locations	Culverts, bridges, road infrastructure, private property	TS Irene - ~6" of rain, Mad River flood gauge at 19.07 feet; 9 ft is flood stage	Over $1.8 million from TS Irene; ~$65 million in floodplain properties	High

Vermont's Act 64 is our legislature's response to the effects of flooding and runoff from roads connected to its major streams, rivers, ponds and lakes. Full implementation begins in 2018. It provides guidelines and goals to communities throughout Vermont for improving the resilience of roads during severe weather thereby enabling them to be more effective in diverting pollutants and sediment from entering these water resources. It provides grant opportunities to aid municipalities in funding the remediation of erosion or flood-prone areas. Many towns are already engaged in implementing the Act's directives. 2038 is the target year for the successful completion of road improvements required for all municipalities via an incremental yearly approach. Moretown is actively working with the Agency of Transportation, Agency of Natural Resources and the Central Vermont Regional Planning Commission to meet the new regulations and requirements, including the Municipal General Roads Permit. Moretown participates in the region's Transportation Advisory Committee (TAC) as well.

Damage to roads and the cost of their rehabilitation is a continuing challenge for communities around the state. Although no storms approaching Tropical Storm Irene's magnitude have occurred since 2011, heavy rainfall at rapid rates of accumulation continues to effect road infrastructure. Events are often localized but cumulatively have sometimes triggered federal and state disaster status allowing grant money to be accessed by affected communities. Over the last five years, since Tropical Storm Irene, Moretown has experienced at least one flood event a year. The following table shows the cost of some major events that have occurred in Moretown since 2017.

Moretown has lessened the impacts and the town's vulnerability to the hazard of flooding/flash flooding/fluvial erosion with mitigation activities and repairs done to its infrastructure over the past five years (and as previously noted in the 2012 Plan). The Town Capital Reserve Fund, Town Highway Fund budget, AOT grants, Federal and State assistance fund, and the recent completed Culvert Inventory and Highway Survey are tools and resources that help the town prioritize and implement their strategies. With the Culvert Inventory and Highway Survey

completed, the Town is, “well positioned to apply for grants for assistance in fixing some of our bigger infrastructure challenges.” (year ending 2016 Annual Town Report, Selectboard Report).

As noted in the Moretown Town Plan, and further emphasized by work of the Ridge to River task force, storm water management is a priority for the community and over the past five years emphasis had been placed on various storm water mitigation projects, studies and activities.

It is important to note that Vermont has experienced a majority of their flooding in areas along upland streams and in road drainage systems that do not adequately convey the amount of water they are receiving. Flooding in these areas should be expected and planned for. The National Weather Service has seen a trend in recent years of more intense, locally severe storms with high intensity rain and flooding associated with them.

The topography and extent of several streams and tributaries make Moretown susceptible to the danger of flash flooding. As noted in the Vermont State Hazard Mitigation Plan, these areas are not shown on the FEMA FIRMs. The Vermont Department of Environmental Conservation River Program is working to provide statewide coverage of fluvial erosion hazard (FEH) areas along the streams and river corridors. The river corridor is in the process of being delineated for the larger streams and rivers and setbacks have been established for the smaller upland streams. This data is due to be released within the next year and will be a valuable tool for Moretown in their efforts to help mitigate the risk of flash flooding. Once the statewide river corridor digital map layer is finalized it will facilitate mitigation and river corridor protection planning and prioritization. If funding is available and the political will exists, CVRPC can assist Moretown in the development of river corridor regulations that incorporate the Vermont mapped Fluvial Erosion Areas once these maps are released.

Hurricanes/Tropical Storms/Severe Storms

History of Occurrence (from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center (NCDC) website and FEMA DR List). Mad River Valley encompasses the towns of Waitsfield, Warren and Fayston)

Date	Event	Location	Extent
7/23/2016	Thunderstorm	Moretown, Washington County	Significant and widespread damage occurred with more than 20,000 utility outages.

9/8/2012	Thunderstorm	Moretown, Washington County	A tight pressure gradient created strong surface southerly winds of 20 to 30 mph with frequent gusts in excess of 40 mph across the region.
8/28/2011	Tropical Storm, Flash Flood (TS Irene)	Moretown; Washington County	Mad River flood gauge at 19.07 feet; 10.07 feet above flood stage (flood stage is 9 feet) – DR 4022
7/06/2011	Thunderstorm	Washington County	50 knot winds; 15,000 people in VT lost power
5/26/2011	Hail/Thunderstorms/Flash Flooding	Moretown; Washington County	1" hail, 25,000 customers lost power in VT, 3-5" of rain, not a historical Mad river crest DR 4001
8/9/2010	Thunderstorm/Wind/Hail	Moretown	50 knot winds
7/21/2010	Hail	Washington County (Mad River Valley)	1" Hail
7/18/2008	Hail	Mad River Valley	1" Hail, 30 knot winds
7/9/2007	Hail, thunderstorms	Mad River Valley	Baseball sized hail DR 1715
7/1/2006	Hail, thunderstorms	Mad River Valley	1" Hail, severe t-storms
9/29/2005	Severe thunderstorms	Mad River Valley	Downed trees and power lines, 35 knot winds
9/16/1999	Tropical Storm Floyd	Statewide	Tropical storm winds and flooding
7/22/1999	Hail, Thunderstorms	Mad River Valley	1.5" hail, severe t-storms
6/27/1998	Severe Storms	County Wide	Mad River gauge 14.13 ft DR 1228
7/15/1997	Severe Storms	County Wide	3-5" of rain, Not a historical crest
5/19/1982	Thunderstorm winds	County Wide	56 knot winds
7/3/1964	Hail	County Wide	1.5" hail
9/22/1938	Hurricane	Statewide	Category 1 force winds

Hurricanes and tropical storms are violent rain storms with strong winds that have large amounts of rainfall and can reach speeds up to 200 mph. Hurricane season is between the months of June and November. A severe thunderstorm is a thunderstorm that contains any one or more of the following three weather conditions: hail that is 3/4 of an inch or greater in diameter, winds 58 miles per hour or greater (equivalent of 50 knots or greater), and/or

tornadoes. Severe storm events can occur in late spring and early summer as temperatures increase in the summer season. The frequency and intensity of hurricanes, tropical storms, and severe storms is expected to increase with climate change.

On Aug 28, 2011, Tropical Storm Irene hit Vermont and proceeded to deposit 4-5" of rain over Moretown. See the flooding section for damage from Irene and other flooding and severe storm events. The Town adopted new road and culvert standards and is now focusing on upsizing all culverts and having hydraulic studies performed on culverts that are repeatedly flooded. Wind during Irene was not a problem; however, high winds can knock down trees and power lines causing power loss.

The impacts associated with hurricanes and severe storms are mainly associated with flooding impacts. The past five years of severe storm data associated with flooding and the damage locations from April, TS Irene, and the May 28, 2011 storm events are outlined in the Flood/Flash Flood/Fluvial Erosion hazard section of this Plan. There were no high wind impacts associated with these events. Over the past five years, Thunderstorm winds associated with severe storms have become more prevalent. The statewide storm in July left 51,300 customers without power for an extended period of time (days). Specific data for Moretown is not available but during these storms local knowledge showed the town experienced downed trees and limbs, debris, scattered power outages, and temporary travel delays while roads were cleared of trees and limbs.

Similar to flooding, the extent of severe storms is not well documented in the Town of Moretown. The impact of storms is usually flood related. See flood extent description in flood section above. Wind and hail extent data from storms is not well documented as there is no monitoring station in Moretown. Estimates for wind and hail are gathered from Washington county wide data off the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the NCDC website. To date, the worst wind extent in Moretown was hurricane force winds from Hurricane Belle. In the future, Moretown could consider installing a monitoring station on major brooks and training staff as spotters to better gather data for wind and flood events. The scales used by spotters to measure the extent of the severe storm events are:

Saffir-Simpson Scale for Hurricane Classification				
Strength	**Wind Speed (Kts)**	**Wind Speed (MPH)**	**Pressure (Millibars)**	**Pressure**
Category 1	64- 82 kts	74- 95 mph	>980 mb	28.94 "Hg
Category 2	83- 95 kts	96-110 mph	965-979 mb	28.50-28.91 "Hg
Category 3	96-113 kts	111-130 mph	945-964 mb	27.91-28.47 "Hg
Category 4	114-135 kts	131-155 mph	920-944 mb	27.17-27.88 "Hg
Category 5	>135 kts	>155 mph	919 mb	27.16 "Hg
Tropical Cyclone Classification				
Tropical Depression	20-34kts			
Tropical Storm	35-63kts			
Hurricane	64+kts or 74+mph			

Beaufort Wind Chart – Estimating Winds Speeds

Beaufort Number	MPH Range	MPH Average	Terminology	Description
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

Combined NOAA/TORRO Hailstorm Intensity Scales

Size Code	Intensity Category	Typical Hail Diameter (inches)	Approximate Size	Typical Damage Impacts
H0	Hard Hail	up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33-0.60	Marble or Mothball	Slight damage to plants, crops
H2	Potentially Damaging	0.60-0.80	Dime or grape	Significant damage to fruit, crops, vegetation
H3	Severe	0.80-1.20	Nickel to Quarter	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.2-1.6	Half Dollar to Ping Pong Ball	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.6-2.0	Silver dollar to Golf Ball	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	2.0-2.4	Lime or Egg	Aircraft bodywork dented, brick walls pitted
H7	Very destructive	2.4-3.0	Tennis ball	Severe roof damage, risk of serious injuries
H8	Very destructive	3.0-3.5	Baseball to Orange	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5-4.0	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	4+	Softball and up	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Hazard	Location	Vulnerability	Extent	Impact	Probability
Hurricane/ Tropical/ Severe Storms	Town Wide for Wind impacts, see flooding above for locations	Large trees, power lines, culverts/ bridges	~6” rain – TS Irene ; Mad River flood gauge at 19.07 feet; 9 ft is flood stage	Data gap – depends on severity	Medium

Winter Storm/Ice Storm/Extreme Cold/Power Outage

History of Occurrence (from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center (NCDC) website and FEMA DR List.) Due to the area-wide nature of winter storms, snowfall depths vary in and around the Town of Moretown. Snow and/or ice events occur on a regular basis during the winter months. Recent significant events have included:

Date	Event	Location	Extent
11/26/2018	Winter Storm	Washington County	In Washington county, snow accumulated 6-14”
11/15/2018	Winter Storm	Washington County	A widespread 3-8” of snow fell in Washington county
3/13/2018	Winter Storm	Washington County	Long duration snowfall event eventually delivered 12-30” across Washington county
3/7/2018	Winter Storm	Washington County	A long duration snow event deposited 7-13” across Washington county,
2/7/2018	Winter Storm	Washington County	A widespread 5-8” of snow fell across Washington county.
12/22/2017	Winter Storm	Washington County	Snowfall amounts of 6-12”were reported
12/12/2017	Winter Storm	Washington County	A widespread 6-12” of snow fell across Washington county
3/31/2017	Winter Storm	Washington County	Widespread 6-12” of a heavy, wet snow fell across the region
3/14/2017	Winter Storm	Moretown, Washington County	Snowfall totals across Washington county generally ranged from 14-24”
2/12/2017	Winter Storm	Moretown, Washington County	Widespread 8-14” of snowfall reported
12/29/2016	Winter Storm	Washington County	A widespread 5-10” of snow was observed.
11/20/2016	Winter Storm	Washington County	Snowfall of 6-12”was observed in higher elevations
2/2/2015	Winter Storm	Washington County	Snowfall across Washington county was 6-12”

1/18/2015	Winter Storm	Washington County	A heavy wet snow of 2-6" fell across Washington county, accounting for isolated to scattered power outages.
1/7/2015	Extreme Cold	Washington County	Temperatures were zero to 10 above zero with winds of 15 to 30 mph that created wind chills colder than 20 to 30 below zero
12/9/2014	Winter Storm	Moretown, Washington County	Heavy, wet snowfall totals across Washington county ranged 6-24"
11/26/2014	Winter Storm	Washington County	Snowfall totals of 8-14" were found across Washington county
3/12/2014	Winter Storm	Washington County	Snowfall totals across Washington county were generally 12-20"+
12/14/2013	Winter Storm	Washington County	8-12" of snow fell across Washington county
3/19/2013	Winter Storm	Washington County	6-14" of snow fell across Washington county
2/8/2013	Winter Storm	Washington County	6-12" of snow fell across Washington county
12/26/2012	Winter Storm	Moretown, Washington County	Snowfall totals of 9-18" were common in Washington county
2/29/2012	Winter Storm	Washington County	Storm total snowfall accumulations ranged from 9-15"
2/24/2012	Winter Storm	Washington County	Storm total snowfall accumulations ranged from 4-18"
11/23/2011	Winter Storm	Moretown, Washington County	5-12" of a heavy, wet snow mixed with rain and sleet at times fell across Washington county.
3/6/2011	Winter storm	County wide	15-25" of snow, 10,000 customers lost power statewide
2/23/2010	Winter Storm	County wide	20" of snow and 50,000 customers lost power statewide
2/22/2009	Winter Storm	County Wide	16" of snow, 30 mph wind gusts
2/1/2008	Winter storm	County wide	3-7" of snow and ice ¼-1/2"thick, 50 mph wind gusts
2/14/2007	Winter storm	County wide	22" of snow
2/14/2006	Winter storm	Moretown, County Wide	30" of snow
1/4/2003	Winter storm	County wide	19" of snow

3/5/2001	Winter storm	County wide	15-30” of snow
12/31/2000	Winter storm	County wide	10” of snow
1/15/1998	Winter storm	County wide	10-12” snow (not a DR in Washington County)
12/29/1997	Winter storm	County wide	21” of snow
12/7/1996	Winter Storm	County wide	12” of snow
3/21/1994	Winter storm	County Wide	5-11” of snow
11/1/1993	Winter storm	County wide	15” of snow
1/3/1993	Freezing Rain	Statewide	¼-1/2” of ice formed

A winter storm is defined as a storm that generates sufficient quantities of snow, ice or sleet to result in hazardous conditions and/or property damage. Ice storms are sometimes incorrectly referred to as sleet storms. Sleet is similar to hail only smaller and can be easily identified as frozen rain drops (ice pellets) that bounce when hitting the ground or other objects. Sleet does not stick to wires or trees, but in sufficient depth, can cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surfaces coating the ground, tress, buildings, overhead wires and other exposed objects with ice, sometimes causing extensive damage. Periods of extreme cold tend to occur with these events.

Although winter storms and periods of cold temperatures are a frequent occurrence, the extent of winter storms within Moretown is difficult to estimate as it is dependent on the size and path of the storm. In general, Moretown does not consider a storm of up to 12 inches of snowfall significant because they are equipped to handle it. The chart of historical occurrences in this Plan identifies some of the more significant events from 2017 - 1993. Specific data for Moretown does not exist.

For the next plan update, Moretown will more closely monitor winter storms and collect data to determine the worst extent possible on the Town. Extent data can be based on volumes of snow; winter weather alerts issued, or wind chill factor. See tables below for descriptions and scales.

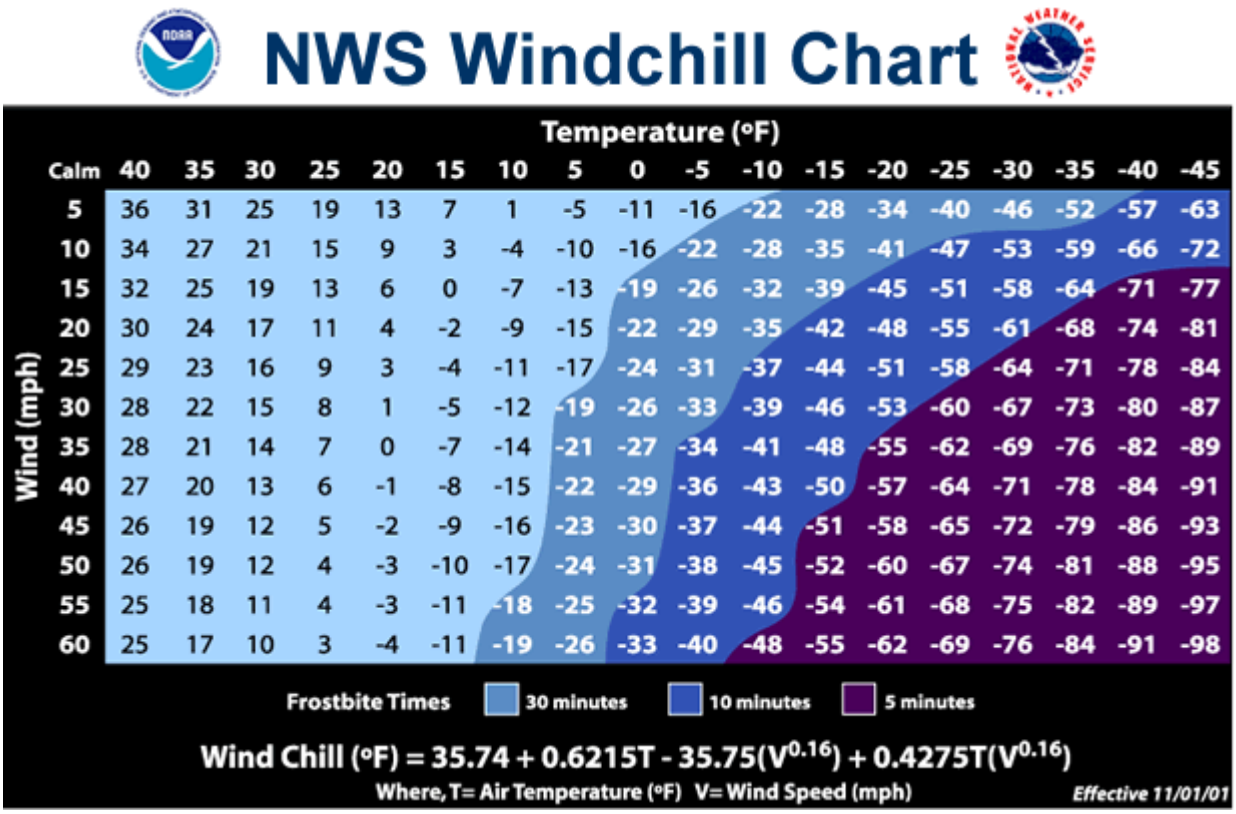
Based on past occurrences, the worst anticipated winter weather Moretown could experience would be 2-3’ of snow with more at higher elevations and several days of power outages. Past worst storms were in March 2011 and after that the Blizzard of 1888. More recently in the past five years, the worst winter storm occurred December 9 to December 13, 2014 with Vermont receiving a federal declaration (DR4207-VT) for the storm damages. Heavy wet snow with a snow to water ratio of 8:1 caused over 175,000 power outages, the second most power outages due to weather in the state of Vermont at that time. FEMAs total Public assistance grant funds obligated to the state was $3,949,028.57. An extended period of extreme cold occurred in January and February of 2015. Dangerously cold wind chills of 30 degrees below zero and colder occurred. Overall, in the past five years the extreme cold, winter storms, ice storms, and heavy snows have spared the state of Vermont compared to the historical records of the past when heavy snowstorms and winter storms were more frequent and common. Power outages caused

by broken tree limbs or downed trees from wet heavy snow loads or ice storms continue to create a challenge to the town.

Extent Scale - Winter Weather Alerts

Winter Weather advisory Winter storm watch	This alert may be issued for a variety of severe conditions. Weather advisories may be announced for snow, blowing or drifting snow, freezing drizzle, freezing rain, or a combination of weather events. Severe winter weather conditions may affect your area (freezing rain, sleet or Heavy snow may occur separately or in combination).
Winter Storm Warning	Severe winter weather conditions are imminent.
Freezing rain or freezing drizzle Sleet	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice Glaze on roads and all other exposed objects. Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.
Blizzard Warning Frost/freeze warning	Sustained wind speeds of at least 35 mph are accompanied by considerable falling or blowing snow. This alert is the most perilous winter storm with visibility dangerously restricted. Below freezing temperatures are expected and may cause significant damage to plants, crops and fruit trees.
Wind Chill	A strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50 degrees lower in a calm atmosphere. The combined cooling power of the wind and temperature on exposed flesh is called the wind-chill factor.

Wind Chill Extent Scale



One of the major problems associated with ice storms is the loss of electrical power. Major electric utility companies have active, ongoing programs to improve system reliability and protect facilities from damage by ice, severe winds and other hazards. Typically, these programs focus on trimming trees to prevent encroachment of overhead lines, strengthening vulnerable system components, protecting equipment from lightning strikes and placing new distribution lines underground.

Electric service in Moretown is provided by Green Mountain Power (GMP) and Washington Electric Cooperative Inc. (WEC) Each utility has a specific area they are allowed to serve under the State of Vermont rules governing a utilities service territory. WEC serves 395 residential homes and commercial businesses via 28.533 miles of high voltage distribution lines located in the town of Moretown. In general WEC serves those homes and businesses located in the more remote areas of Moretown served by dirt roads and located in the higher elevations of the Town. WEC serves the Moretown area from a substation several miles away located on the Moretown Common Road. Because the lines serve much of the remote and higher elevation areas in Moretown they are more prone to damage from falling trees especially during heavy wet snows, ice storms and violent electrical storms. As a result, homes located in these areas may experience a higher frequency and duration of outages than homes located in the low lying areas and valleys such as those along the Route 100 corridor. GMP serves homes and businesses located generally along the Route 100, Route 100B and Route 2 corridors along the Winooski River and Mad River. These areas are not as prone to significant weather events and therefore experience a reduced

frequency of outages. When outages do occur, access to make repairs is via a paved road and therefore can be done more quickly than in the more remote areas.

Both GMP and WEC have online real time outage tracking tools. In addition WEC and the Moretown Emergency Team have redundant means of communication in place in the event of a sever outage in WEC territory.

Vulnerable populations, such as the elderly and handicapped are of greatest risk to this hazard. If this type of multiple hazard event takes place for an extended period of time, back-up power would be necessary for critical facilities such as the Crossett Brook Middle School, Thatcher Brook Primary School building, Harwood Union High School, Town Offices, and Town Highway Garage. The Town Garage and the Thatcher Brook Primary School building both have generators giving them back up capacity and the ability to be used as shelters if needed.

Moretown is reviving a Homebound Persons Phone Tree that lists vulnerable residents. This list is disseminated to members of the community with All-Terrain Vehicles or Snowmobiles who volunteer to rescue their homebound neighbors in the case of a hazard. The E911 CARE form is also posted on the Town Web page which allows residents that have special requirements in the event of power outages or other emergencies to provide information on their needs that is made available to first responders during an emergency. The Emergency Team will maintain and keep the list up to date.

In 2017, Moretown voters approved the purchase of a professional Culvert Thawing Machine using money from the Capital Reserve Fund. The new machine increases the Town capacity to handle frozen culverts and other town infrastructure. Thawing culverts to prevent water from going over the roadways will reduce the potential for damage to the town infrastructure and also allow safe travel. The Town equipment (trucks, plows, etc.) is maintained on a regular schedule and the Selectboard with the input from the Road Foreman, budget for equipment replacement.

During the many winter storms, ice storms, and extreme cold, Moretown has experienced school closings, increased road maintenance, pressure on the town highway budget, power outages (from downed lines and extreme cold), downed trees and tree limbs, vehicular accidents, collapsed structures from heavy snow and ice loads, frozen culverts and more. In addition, the potential for increased medical needs due to over exertion with clean up and snow removal and falls, often with broken bones, due to icy surfaces exists.

By observing winter storm watches and warnings, adequate preparations can usually be made to lessen the impact of snow, ice and sleet, and below freezing temperature conditions on the Town of Moretown. Providing for the mass care and sheltering of residents left without heat or electricity for an extended time and mobilizing sufficient resources to clear broken tree limbs from roads, are the primary challenges facing community officials. Shelter locations include: Crossett Brook School, Harwood Union High School and Thatcher Brook Primary School (Waterbury). The Town encourages residents who are in remote locations to be equipped with

generators and backup fuel supplies, water, food, and medical supplies in the event of prolonged power outages and travel restrictions. In the event of an extended power outage, the Town is in the position to open its emergency shelter. Often, residents without power will seek family and friends to stay with during the duration of an outage.

Other major problems include closed roads and restricted transportation.

Many of the impacts from these hazards can be reduced by using common sense and practicing preparedness measures such as staying off the snow and ice covered roads until they are cleared, having vehicles equipped with proper winter gear and snow tires, using moderation and resting when removing snow and cleaning up from a storm, keeping heating pipes cleared and well ventilated, keeping roofs clean of heavy snow/ice loads, checking on and helping the elderly and disabled residents of the community, and listening to the local weather forecast for storm updates. Participating in the free VTAlert system is highly encouraged and an important resource in emergency preparedness.

Hazard	Location	Vulnerability	Extent	Impact	Probability

Extreme Cold/Winter or Ice Storm in conjunction with power failure	Town Wide. All roads, utility poles and lines, Town Forest, Private woodlots/ timber stands, private residences and businesses, public infrastructure	Elderly & handicapped populations, remote structures, old/under insulated structures, public infrastructure and utilities, trees, telecommuni-cations, school system	Minimal to Moderate depending on severity; 18+" snowfall in March 2011 event Jan/Feb 2015 15-20 days below zero with wind chills of negative -30 degrees below zero. 12/9/2014 – 12/13/2014 6 to 24 inches wet heavy snow in county. No specific extent data for Moretown is available.	Depends on severity – additional sheltering/ plowing/ emergency services costs for town. School closing and vehicular accidents. Downed trees and power lines. Prolonged power outages for 175,000 customers statewide. 12/2014 FEMA Total PA obligated statewide $3,949,028 A gap in the data exists for Moretown.	High

6. Mitigation

The goal of this Plan is to update the local mitigation strategy that makes Moretown more disaster resistant and reduces its risk from natural hazards. Further, it is the goal of this Plan to take actions to reduce or eliminate the long-term risk to human life and property from:

- The natural hazard of flash flood/flood/fluvial erosion.
- The natural hazard of hurricanes, severe storms, and tropical storms.
- The natural hazard of wildfire and forest fire.
- The natural hazard of extreme cold/winter storm/ice storm/power outage.
- The natural hazard of dam failure.

6.1 Town Plan Goals and Objectives that Support Local Hazard Mitigation

- The quality of the town's forest, water, air, wildlife and soil resources is protected and enhanced. (Natural Resources)
    - Make public and private new and existing infrastructure (e.g., culverts, roads, housing, etc.) more compatible with natural resources so that the impact on natural resource are minimized.
- Water resources and the built environment are not in conflict. (Flood Resiliency)
    - Avoid new development in identified flood hazard, fluvial erosion, and river corridor protection areas. If new development is to be built in such areas, it does not exacerbate flooding and fluvial erosion.
    - Encourage the protection and restoration of floodplains and upland forested areas that attenuate and moderate flooding and fluvial erosion.
    - Engage in flood emergency preparedness and response planning.
- Land development protects natural resources and maintains Moretown's rural character by concentrating smaller scale commercial use and residential development in areas near services, reducing strain on infrastructure and providing access to open space for recreation. (Land Use)
    - Regulate land development in a manner that protects important natural resources while encouraging a range of land uses in appropriate locations.
    - Maintain existing forest resources while promoting sustainable forest product enterprises.
    - Concentrate residential development in areas that does not increase strain on town infrastructure or impact natural resources.
- Facilities, services, and utilities are safe, practical, efficient, reliable, affordable and available. (Community Utilities, Facilities and Services)
    - Provide emergency services to Moretown residents at a level adequate to protect public health and safety.
    - Assure public health is protected through adequate waste disposal programs and systems.

6.2 Proposed Hazard Mitigation Programs, Projects & Activities

Hazard mitigation programs, projects and activities that were identified for implementation at the Moretown Local Hazard Mitigation meeting:

Hazards Mitigated	Mitigation Action	Local Leadership	Prioritization	Funding Resources	Time Frame
Flooding, Severe storms	Upgrade sections of Crossett Hill Road to meet new State requirements	SB, Road Foreman	High	HMGP, AOT funds, ERP funds, town funds	1-2 years 2019 -2020
Flooding, Severe Storms	Upgrade sections of Camels Hump Road to meet new State Requirements	SB, Road Foreman	High	HMGP, AOT funds, ERP funds, town funds	1-2 years 2018 - 2019
Flooding, Severe Storms	Upgrade and expand culvert on Atwood Rd	SB, Road Foreman	High	HMGP, town funds	2022
Flooding, Severe Storms	Repair/Upgrade and improve Head Wall on Scrabble Hill Road	ANR,SB, Road Foreman	High	HMGP, ERP funds, town funds	2-3 years 2019- 2021
Flooding, Severe Storms	Upgrade and expand 6 foot culvert on Stevens Brook Rd	SB, Road Foreman	Medium	HMGP, town funds	2-3 years 2019- 2021
ALL Hazards	Preparedness action: perform a sensitive populations survey to update homebound persons phone tree	EMD, LHMP Committee Fire Chief	Medium-Low	Local funds and Volunteers	2019-2020, annually thereafter.
Flooding, Severe Storms	Upgrade bridge on Camels Hump Road	SB, Road Foreman	Medium - Low	HMGP, Town funds, AOT	2021 - 2023
Flooding, Severe Storms	Upgrade Box culvert Camels Hump Road	SB, Road Foreman	Medium - Low	HMGP, Town funds, AOT	2021 - 2023

Wildfire/ Forest Fire	Participate in the development of wildfire suppression methods for the State Forest land in Moretown.	SB, Fire Chief, Town Fire Warden	Low	ANR, FPR, Town	2021-2023
Flood/Flash Flood/ Fluvial Erosion; Hurricanes, Severe Storms, Tropical Storms	Adopt Moretown Land Use Regulations and Flood Hazard Overlay District	PC, SB, ZA, CVRPC	High	Town funds	2018
All hazards	Perform Planning Study on feasibility of a Stormwater Utility	PC,SB, CVRPC, ANR, AOT, MRVPD, Ridge to River Task force	Low	ACCD, HMGP, ERP, Local funds	2023
Severe storms, hurricanes, tropical storms	Upgrade and improve Marshall Road with ditching and stone lined section on the big hill and improve culvert crossing with installation of a 18 inch culvert	SB, Road Foreman, CVRPC, AOT	High	CVRPC grant $7,500	2018
Flood/Flash Flood/ Fluvial Erosion; Severe Storm/ hurricanes/ tropical storms,	Replace undersized culvert on Turner Hill with a larger more flood resilient box culvert	SB, Road Foreman, AOT	High	VTrans structure grant $112,320	2018
Flood/Flash Flood/ Fluvial Erosion; Severe	Remove trees around new box culvert at Turner Hill to protect culvert and improve stream stabilization	AOT, ANR, SB, Road Foreman	High	AOT Better Back Roads grant $22,072	Summer 2018

Storm/ hurricanes/ tropical storms					
Flood/Flash Flood/ Fluvial Erosion; Severe Storm/ hurricanes/ tropical storms	Replace undersized 4 foot culvert on Dowsville Road with a new super structure that will provide better flood resiliency.	AOT, ANR, SB, Road Foreman	High	VTrans structure grant $329,705	Summer 2018
Wildfire/ forest fire	Develop a Community Wildfire Protection Plan for the 169 acre Moretown Forest	PC, Town Forest Committee, SB, ANR FPR, NCCD	Low	ANR FPR, Town funds, Land Trust	2022 -2023
All Hazards	Update American Red Cross Shelter Agreements and perform facility survey	SB, EMD, School District, ARC	Med	ARC, Local funds	2019 - 2020
Dam Failure	Survey and develop a list of local trappers and follow EAPs	LHMP Committee, EMD, SB	Low	Local funds, VT fish and Game, Trappers Association	2022-2023
All hazards	Conduct exercise to test LEOP with neighboring towns	EMD, Fire Chief, SB, LHMP Committee, VT Sate Police, and towns of Moretown and Waterbury	Medium	Local funds	2019-2021
All Hazards	Conduct community forum and resilience celebration	Friends of the Mad River, Ridge to River, MRVPD,	Medium	Local funds, High Meadows, FMR	Fall 2020

		CVRPC, SB, EMD, LHMP Committee, PC, DRB, Community			
All Hazards	Develop monitor teams throughout community to gather extend data	EMD, LHMP Committees	Medium	Local funds	2019-2020
All Hazards	Update 2014 Moretown Town Plan and adopt new Plan prior to expiration in 2019	PC, SB, CVRPC	High	ACCD, local funds, CVRPC	2018 - 2019

VEM also emphasizes a collaborative approach to achieving mitigation on the local level, by partnering with ANR, VTrans, ACCD, Regional Planning Commissions, FEMA Region 1 and other agencies, all working together to provide assistance and resources to towns interested in pursuing mitigation projects and planning initiatives.

The mitigation activities are listed in regards to local leadership, possible resources, implementation tools, and prioritization. The method used for prioritization of the actions was qualitative and based upon: 1) the Community's need to address the issue, 2) the action's cost, 3) the action's benefit, and 4) the availability of potential funding. Emphasis was placed on a review of the benefits (pros) and costs (cons) when prioritizing the mitigation actions with the expectation that the benefits would outweigh the costs.

In performing the benefit cost review, the team reviewed a wide range of questions concerning the mitigation actions. How immediate and critical is the need to the community? How costly is the action? Is it a low-cost strategy? Is the action cost effective and seem reasonable for the nature of the project? Are funds already secured or readily available? Does the action use outside funding sources? Is there a time restriction on expending funds? Can the action be budgeted in the current or upcoming budget cycle or does it require long term debt? What is the level of risk to community assets (people, economy, structures, critical facilities & infrastructure, and the natural environment)? Does the action provide for the protection of life and property and reduce the risk for loss, injury, or damage? How critical are the community assets that benefit from the action? How fast will the action take to implement? How many people and or area will benefit from the action; whole community, neighborhood, individual? What benefits will the action provide? Does the action support the community goals, polices and plans?

The following categories are used to define the priority of each mitigation action/strategy.

HIGH - A High prioritization denotes that the action is either critical or potential funding is readily available or in hand, and should have a timeframe of implementation of less than two years. These projects also use grants and other outside funding sources; provide the greatest protection from loss of life and property damage; are cost effective; have a larger benefit; and provide a higher degree of risk reduction for community assets. Generally, the community assets that benefit from these actions are critical and of high priority.

MEDIUM - A Medium prioritization is warranted where the action 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. These projects are somewhat cost effective at reducing damage to property and people, have some benefit, and provide some degree of risk reduction for community assets.

LOW - 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. These actions may have limited benefit or the cost effectiveness is low. The community assets that benefit from the action are not in immediate need or are a low priority.

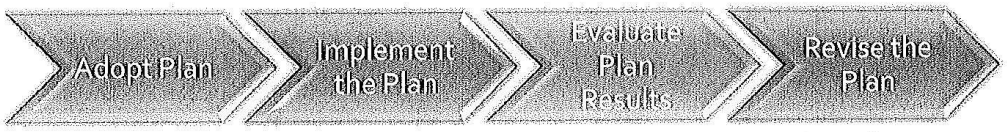
Moretown understands that in order to apply for FEMA funding for mitigation projects that a project must meet FEMA benefit cost criteria. The Town must also have a FEMA approved Hazard Mitigation Plan as well.

7. Attachments

- Areas of Local Concern Map
- 5 year plan maintenance and review process
- Certificate of Adoption

Town of Duxbury
Areas of Local Concern
Legend
Structures in the Floodplain
E911 Sites
Residential (27 in Floodplain)
Commercial (1 in Floodplain)
School (2 in Floodplain)
Government
Health Clinic
House Of Worship
Industrial
Public Gathering (2 in Floodplain)
Utility
ZONE
Floodplain
Vermont Town Forest Database
Railroad
Flood Prone Areas
Roads
Streams
Intermittent
Perennial
Conserved Land
N
Miles
0
0.5
1
2
SOURCE:
Roads:VTRANS, 2017
Surface Waters: 1:5000 CVRPC Surface Water.
Map created 3-29-2005 by CVRPC.
Map updated 7-24-2017 by CVRPC.
N:\towns\duxbury\LHMP\areas_concern
Data is only as accurate as the original source.
This map is for planning purposes only.
This map may contain errors and omissions.
CVRPC
WATERBURY
MORETOWN
WAITSFIELD
DUXBURY
BOLTON
HUNTINGTON
FAYSTON

5-Year Plan Review/Maintenance



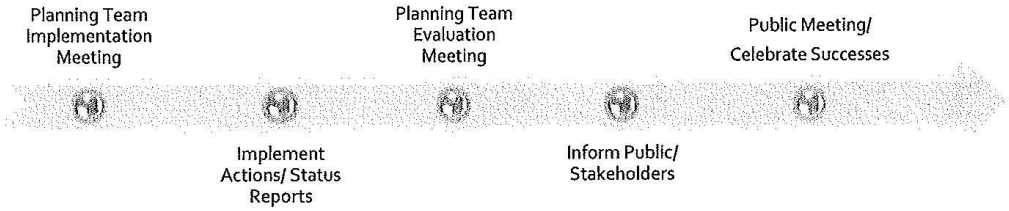
- •Brief local leadership on plan approval
- •Formally adopt plan
- •Publicize plan approval and adoption
- •Celebrate success

- •Confirm/clarify responsibilities
- •Integrate mitigaction actions
- •Monitor and document implentation of projects and actions
- •Establish indicators of effectiveness or success

- •Effectiveness of planning process
- •Effectiveness of actions
- •Document success & challenges of actions
- •Update and involve community
- •Celebrate successes

- •Review factors affecting community's context
- •Analyze findings; determine whether to revise process or strategy
- •Incorporate findings into the plan

After Plan Adoption-Annually
Implement and Evaluate



Fifth Year, and After Major Disaster
Evaluate and Revise