Town of Barre, Vermont
2017 Local Hazard Mitigation Plan

Prepared by the Town of Barre and CVRPC

Date of Adoption: April 24, 2018

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Town of Barre
Local Hazard Mitigation Plan Update
2017
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During the course of this Plan update, the Vermont Division of Emergency Management and Homeland Security (DEMHS) changed their name to Vermont Emergency Management (VEM) effective July 1, 2017. Both names are interchangeable in this Plan.

1. Introduction

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).

The impact of expected, but unpredictable natural events can be reduced through planning and action. The goal of this Local Hazard Mitigation Plan (hereafter referred to simply as the Plan) is to update the local mitigation strategy that makes Barre Town more disaster resistant and reduces its risk from natural hazards.

Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from hazards and their effects. FEMA defines a natural hazard as a source of harm or difficulty created by a meteorological, environmental, or geological event. Based on the results of previous Project Impact efforts, FEMA and State agencies have come to recognize that it is less expensive to anticipate 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. These actions and measures, also known as "hazard mitigation strategies," can 1) alter the hazard by eliminating or reducing the frequency of occurrence, 2) avert the hazard by redirecting the impact by means of a structure or land treatment, 3) adapt to the hazard by modifying structures or standards, or 4) avoid the hazard by preventing, limiting, or relocating development, improving public education, or ensuring development is disaster resistant.

2. Purpose

The 2017 Barre Town Local Hazard Mitigation Plan is an update of the town's 2012 plan. The purpose of this Plan is to assist Barre Town in recognizing hazards facing the community, ranking them according to local vulnerabilities, and identify strategies to reduce risks from acknowledged hazards of highest concern based on current information. The town reviewed, evaluated, and revised the 2012 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 Barre officials and residents who will implement the actions and measures going forward. Implementation of this plan will make Barre Town more resistant to harm and damages in the future, and will reduce public costs.

Barre Town strives to be in accordance with the strategies, goals and objectives of the State Hazard Mitigation Plan, including an emphasis on proactive pre-disaster flood mitigation for public infrastructure, good floodplain and river management practices, and fluvial erosion risk assessment initiatives.

The 2017 Barre Town Local Hazard Mitigation Plan includes the following:

- Current information since the last plan update done in 2012.
- The 2012 mitigation strategies/actions chart is updated to reflect the current status of these strategies/actions.
- The addition of a new mitigation strategies/action section that reflects the current priorities and intended actions of the community over the next five years.

- The Hazard Ranking Methodology (see attachment) used in this 2017 Plan is updated and more robust than the hazard ranking methodology used in the 2012 plan. The 2017 methodology adds an additional level of probability under the Frequency of Occurrence criteria, looks at Warning Time, and Potential Impact.
- The updated Hazard Analysis Map reflects current information.
- A new Transportation Vulnerability Analysis Map (Vulnerability Assessment) is added to this plan.
- The hazards are updated to reflect changes in the communities' priorities.
- Minor changes have been made to the plan update and plan maintenance process to reflect scheduling changes of the Selectboard and to encourage and incorporate greater public participation.
- In addition, a glossary of terms has been added to this plan (see attachment).

3. Community Profile

Geography

Barre Town is the second largest town in Central Vermont. It is located within the southeastern corner of Washington County and borders seven neighboring communities; Plainfield and East Montpelier to the north, Berlin to the west, Williamstown and Washington to the south and Orange to the east. Barre Town almost entirely surrounds the 4.2 square miles of Barre City. According to the 2014 Municipal Plan, "Barre Town is comprised of hilly areas that are like the rim of a bowl, the center of which is Barre City." Barre Town's land mass of 31.8 square miles consists of 19,328 acres which is mostly hilly terrain covered by forest or open land. The urban areas with more intense development occur in the historic villages of East Barre, South Barre, Websterville (Upper and Lower) and Graniteville (Upper and Lower) along with communities on Trow Hill and the Richardson Road area. In 2012, Barre Town expanded the municipal forest with the assistance of The Trust for Public Lands and acquired 355 acres in Websterville and Graniteville. This acquired land is in a conservation easement with the Vermont Land Trust and Vermont Housing and Conservation Board. The town manages the Town Forest, along with the 25.7 acres previously owned by the town, for wildlife habitat, recreation, timber harvesting and management, education, and water quality protection.

Barre Town is entirely within the Winooski River Watershed. Two main rivers flow through Barre Town, the Stevens Branch and the Jail Branch. The Stevens Branch is listed by Agency of Natural Resources (ANR), Department of Environmental Conservations (DEC), as one of the seven important tributaries of the Winooski River and flows through Barre Town along VT Route 14 from the Williamstown line north to the Barre City line for approximately 2.6 miles. The Jail Branch, which is a tributary of the Stevens Branch, flows north through Barre Town along VT Route 302 from the Orange town line to the Barre City line for approximately 4 miles. The tributaries of Gunner Brook and Honey Brook have been problematic over the years causing damages from flooding and fluvial erosion. As noted in the 2014 Municipal Plan,

"The greatest impact to Barre Town with regard to flooding typically comes from flash flooding. Barre Town's hills and valleys allow for water to be collected at higher elevations in numerous tributaries, brooks, and streams, to both the Jail Branch and the Stevens Branch Rivers. Elevation change between the heads of these brooks or streams and the rivers can create tremendous fluvial erosion. Fluvial erosion is the removal of soil and rock from the bank of a water channel and is a concern throughout Vermont including Barre Town."

The Municipal Plan recommends controlling run off as a manageable way to slow erosion particularly since repairing the ravines where fluvial erosion is most significant in East Barre may be difficult and expensive. Maintaining a stormwater management system and consideration of a fluvial erosion plan are also recommended.

Population

The 2010 Census states that Barre Town has a total population of 7,924. This number represents an increase of 4.2 percent from the 2000 Census. The American Community Survey (ACS) 5-Year Estimates shows no significant change in total population for the 2014 ACS 5-Year Population Estimate measured at 7,908. According to the 2014 Municipal Plan, "Barre Town is predicted by the Regional Planning Commission to become the most populated town in Central Vermont by 2020."

Housing within the Town is widely dispersed both within rural locations and the four major villages listed above. As noted in the Barre Town Annual Report for fiscal year July 1, 2015 to June 30, 2016, the majority of lots proposed for development are from housing development projects consisting of small subdivisions (one or two lot developments). Other developments involve the continuation of filling out previously approved lots. Overall the trend for development over the past five years has been on a decline with the exception of "a bit of an upward trend" in fiscal year 14-'15. Barre Town foresees development to continue as scattered site residential development throughout the town. The main source of new residential dwellings comes from two pre-approved residential developments. These developments will likely continue to do so. Overall, new development in Barre Town since the 2012 plan has caused no change in the communities' vulnerabilities.

Barre Town has a diverse economic base with employment in the areas of granite quarrying, insurance, manufacturing, recreation, banking, food processing, government related jobs, and trade and service sector jobs. As noted in the 2014 Town Plan, one mission of the Barre Town Economic Development Plan is "to add to the Town's grand list and to reduce the Town's reliance on residential property owners to fund the operations and enterprise of Town government." The Wilson Industrial Park, with substantial investments in land and infrastructure made in 1997 and 2008, is a 160-acre industrial park located in Websterville and provides important jobs that serve the region. In 2016, the existing H.P. Hood/booth Bros. plant on Allen Street received approval to build two large additions to the plant, adding over $500,000 to the grand list. Barre Town is known for its large granite quarries and is an integral part of the Barre-Montpelier urban area. Rock of Ages, a loyal and steadfast company in Barre Town, is a large and important employer to the town and region. The majority of the quarries are located in Websterville and Graniteville. Approximately 20 percent of Barre Town's workforce is employed within the Town, while the remaining 80 percent work outside of the Town's borders.

Transportation

Barre Town is served by local, state, and US highways. The main arterial highways include Vermont Route 14 and US Route 302, which parallel prominent local waterways. In addition, Vermont Route 63 connects Vermont Route 14 to Interstate 89 in Berlin and Vermont Route 110 provides access to the town of Washington from East Barre. Barre Town has 22 major town culverts and two town bridges. In 2013, the State of Vermont, with Barre Town contributing 5% of the total cost, replaced the Bridge Street Bridge. On November 15, 2016, Barre Town Selectboard approved the Town of Barre 5-year Gravel Road Plan, FY 2018-2022 and on January 10, 2017 approved the 5-year Paved Road Plan, FY 2018-2022. Both plans guide the

management system for the town's roadways and prioritize projects over a five-year period with details on the type of work and estimated cost. The Town of Barre follows the Vermont Agency of Transportation minimum road standards, A-76 for roads and B-71 for drives.

The town is the recipient of several transportation grants for road improvement projects, including the recent 2017 AOT Bridge and Structures grant. This $175,000 grant allows the Town of Barre to implement recommendations from a 2007 Hydraulics study for the upgrade and improvement of the road culvert on the Peloquin Road. Identified as a 2012 mitigation action, this project is now moving forward with the installation of a sleeved culvert with headwalls. For a summary of transportation projects over the last five years see attachment. Many of the projects were identified as transportation highway deficiencies in the 2014 Town Plan and mitigation strategies under the 2012 Barre Town Hazard Mitigation Plan.

Utilities, Water, and Sewer

Green Mountain Power provides electricity to the majority of businesses and residents in Barre Town. The northeast corner and the southwest region of Barre Town is served by Washington Electric Cooperative. According to the 2014 Municipal Plan: The water supply for Barre Town consists of numerous sources and the systems are maintained by a variety of entities. There are two different fire districts, Graniteville FD #4 and Websterville FD #3, which provide full service with varied sources of water to residences within their districts. Barre Town also provides water to the areas of Quarry Hill, Sterling Hill, Lower Websterville and East Barre utilizing a town well and Barre City water. There are two residential developments served by private wells, the Mountain View Acres Water System at Meadow Wood Drive and the Birchwood Park System at Birchwood Park. The remaining households receive water directly from Barre City or maintain private wells. Barre City is the largest single water supply source for Barre Town and it gets its water from the Thurman W. Dix reservoir located in the Town of Orange. Disposal of wastewater is treated by individual sub-surface sewage disposal systems or connection to the municipal wastewater treatment system. Barre Town has an allotment for use of the Barre City municipal wastewater treatment system. Barre Town relies on the State of Vermont Regional Office to issue water/waste water permits for soil based wastewater systems with flows less than 6500 gallons per day, for potable water supplies (water supplies that are not public), and for municipal water and sewer connections.

Emergency Services

Barre Town is covered by multiple emergency service providers. The Lamoille County Sherriff's Department provides 24/7 dispatch call center service for all Barre Town emergency services.

In the Town, fire protection is provided by the Barre Town Fire Department from stations in South Barre and East Barre. This paid on-call Department participates in the Capital Fire Mutual Aid System. According to the Fire Chief, Chris Violette, the Fire Department responds to an average of 200 calls a year. The majority of the calls are for vehicular accidents. There are approximately 30 members on the fire department. The nearest HazMat response truck is located approximately 47 miles away at the IBM Facility in Essex Junction. The nearest HazMat decontamination, rescue and mass care trailer is located at Barre City and Berlin Fire Departments. Christopher Day serves as the Barre Town Fire Warden. He regulates open burning in the town by issuing burning permits ("Permits to Kindle Fire"), educating town residents about safe open burning practices, and maintains relationships with the local fire departments and the Vermont Department of Forest Parks, and Recreation. As the Fire

Warden, Christopher is responsible for wildland fire suppression in the town and may ask the state for technical assistance and specialized equipment.

Barre Town EMS is a regional ambulance serving the six towns of Barre Town, Berlin, Brookfield, (joining in 2008), Washington, Orange, and Topsham. The Department operates two 24-hour stations, and it responded to 3,563 calls for assistance during the fiscal year 2014-2015; a steady rise that represents a trend over the past 5 years. An increase in calls was seen again in FY15-16. According to the Barre Town fiscal year 15-16' annual report, "The number of calls for both paramedic intercepts and emergency mutual aid increased significantly when compared to past years. Looking at both these data and early numbers from FY16-17, we are beginning to see an overall increase in call volume beyond recent trends" (Christopher LaMonda, EMS Director). The department has trained critical care Paramedics, Paramedics, and advanced EMT's. In addition to the five ambulances, the department has a 12-foot Mass Casualty Incident Trailer that is capable of resupplying the ambulances in the field if the need arises and can treat up to 75 adults and 50 children. The EMS Department provides Paramedic Intercept service under agreements with the fifteen towns of Cabot, Calais, East Montpelier, Fayston, Hardwick, Marshfield, Moretown, Northfield, Plainfield, Roxbury, Waitsfield, Walden, Warren, Williamstown, and Woodbury.

The Barre Town Police Department provides law enforcement within the Town's borders, and it participates in an inter-municipal mutual aid system. The Barre Town Police Department is approved for 8 full time officers including the Chief, and 1 full time administrative assistant. Five to seven part time officers supplement services. In fiscal year 2016-2017 the Barre Town Police Department responded to 5,790 calls. Additional support is afforded by other law enforcement agencies. In June 2017, the longstanding Police Chief, Michael Stevens retired. William Dodge is the new Police Chief.

In accordance with 20 V.S.A. section 6, Local Organization for Emergency Management, the Barre Town Selectboard appoint an Emergency Management Director who "shall have direct responsibility for the organization, administration, and coordination of the local organization for emergency management, subject to the direction and control of the executive officer or legislative branch." The Town Manager, Carl Rogers, is the Emergency Manager Director (EMD) and Jack Mitchell is the Emergency Management Coordinator (EMC). Barre Town Emergency Management Office is responsible for maintaining the government functions related to providing public peace, health and safety during an attack or disaster and has an equipped Emergency Operation Center in the Municipal Office Building.

Municipal Governance- Local Ordinances, Plans and Regulations

Barre Town's current town plan was adopted in May of 2014 and regionally approved in July of 2014 therefore the existing plan is still current and active. In 2016, the Barre Town Selectboard approved amendments to several sections of their plan including Transportation, Preservation, and Energy. In general, the amendments to the Barre Town Plan are minor in nature and do not impact the overall intent of the specific plan sections that have been amended. These amendments do not extend the lifecycle of the Town Plan therefore the plan will need to be updated and completely readopted before it expires in May of 2019. As such, the Town will begin the process to update their plan in late 2017 or early 2018 in order to complete the updates before the plan expires.

The Town Plan includes a description, discussion, goals, policies and recommendations in regards to groundwater protection, water runoff and storm water drainage, surface waters, stream bank preservation and buffer zones, development on steep slopes, site design, flood hazard areas and floodways, emergency services, and public infrastructure. The Town Plan addresses Climate, Topography, Soil, and Earth Resources (section 5.11). Barre Town does not experience extreme climate events on a regular basis, and hurricanes and tornadoes are rare, however, recent severe and prolonged rainstorms have caused localized serious erosion and road washouts. The Town Plan notes, "It is important to consider best mitigation measures when repairing and planning Town infrastructure." The Vermont Economic Resiliency Initiative (VERI) report, Barre, VT, July 2015 recognizes that flooding due to severe storms will happen again and emphasizes watershed-wide stormwater planning to reduce flooding impacts as a recommendation for policy and program development. It states, "As the Barre area and neighboring communities experience growth, collaborative regulation and enhanced storm water control measures can reduce the flooding experienced in Barre Town and City. All communities in the watershed should develop dialog and collaborate on ways to limit storm water run-off from development." Under the Flood Hazard Areas and Floodways sections of the 2014 Town Plan, policies call for the development of lands to be in conformance with local, state, and federal flood hazard regulations in order to protect life, property, and the environment. When the Town of Barre updates their 2014 Town Plan, the goals and objectives of this local hazard mitigation plan will be incorporated into the updated municipal plan and vis versa when this Plan is again updated.

Land use regulations in Barre Town include Zoning By-Laws and a Subdivision Ordinance. Chris Violette, Zoning Administrator administers these regulations.

In 2009, the town adopted a 50-foot stream buffer in the zoning bylaws. On 3/9/2010, the town adopted a Flood Hazard Bylaw, incorporating it into the zoning regulations (section 5.8 Flood Hazard Area Development). The Flood Hazard Bylaw meets and exceeds the requirements of the National Flood Insurance Program. Barre Town enrolled in the National Flood Insurance Program on 6/15/1978. The NFIP is described in more detail further in this Plan.

Annually, Barre Town updates and adopts a Local Emergency Operations Plan (LEOP) between March and May 1. The LEOP is then submitted to Vermont Emergency Management (VEM) for acceptance. The Selectboard adopted the current LEOP on April 18, 2017 and received a notice of acceptance by VEM on April 21, 2017. The current LEOP is due for renewal by May 1, 2018. The town coordinates with the Central Vermont Regional Planning Commission who provides technical support and guidance with the LEOP plan update. In compliance with the LEOP, the town maintains a trained certifying official in the Incident Command System (ICS), with training specific to ICS 402 and or ICS 100 at a minimum. Barre Town ensures its Selectboard members and the Town Manager are properly trained and certified. In conjunction with the LEOP, on 4/29/2014, 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.

Barre Town 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, Barre Town has an ERAF rating of 12.5%. Barre Town 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 current Vermont Roads and Bridge Standards 2013, 3) adopting a Local Emergency Operations Plan which is renewed and adopted annually, and 4) adopting a Local Hazard Mitigation Plan approved by FEMA. The town has not met the 5th requirement of adopting Interim River Corridor protection standards (River Corridor Plan criteria) but if they did, their rating would increase to 17.5%. Maintaining these measures ensures towns the maximum state contribution rating. In 2015, the State published River Corridor data as part of a two phase project to identify river corridors throughout Vermont. By identifying the river corridors towns can implement protections to help reduce flood damage and protect residents and road networks from erosive damage. The State of Vermont is currently completing their phase 2 river corridor data and is in the process of drafting a model ordinance for Vermont municipalities to use when adopting river corridor regulations. Vermont recommends a 50' river corridor setback for smaller streams, which is consistent with Barre Town zoning regulations. At this time, Barre Town is not considering a river corridor ordinance and is waiting for the release of the phase 2 river corridor data and model ordinance by the Agency of Natural Resources (ANR) before taking any action.

National Flood Insurance Program

Since 1978, Barre Town has participated in the National Flood Insurance Program and is currently in compliance. The first Town of Barre FIRM (Flood Insurance Rate Map) was published 6/15/1978, community panel #500273. The current effective maps are dated 3/19/2013, panel number 50023C0461E and can be found online at tinyurl.com/floodreadyatlas and www.msc.fema.gov.

As noted in the Town Plan, the most significant floodplains occur along portions of the Jail Branch and Stevens Branch. As noted earlier, the greatest flood threat to Barre Town is from flash flooding when the tributaries, brooks and streams, located in the hills and valleys collect water. On March 9, 2010 the Selectboard adopted the Town Flood Hazard Area Regulations. These bylaws regulate new encroachments in the Special Flood Hazard Areas and the Floodway. Development standards are established which include a minimum 50' setback, regulated uses, minimum standards for building and floodproofing, and regulation on improvements to existing structures. The purpose of which is to, "ensure that the design and construction of development in the flood and other hazard areas are accomplished in a manner that minimizes or eliminates the potential for flood and loss or damage to life and property." Development or any encroachment in the floodway is prohibited unless certified by a qualified professional engineer, after proper analysis that the activity will not result in an increase in flood levels during the occurrence of the base flood. The bylaw requires a permit for all proposed development in areas of special flood hazard and conditional use approval is required for new buildings, substantial improvement of existing buildings and development in the floodway. The Administrative Floodplain Officer for the town is Chris Violette. There are 29 structures and 2104 acres in the floodplain of which 5 structures are located in the 100 year and 24 structures are in the 500 year boundary. There are no repetitive loss properties in Barre Town and no BCX claims. B, C, and X are zones from the older FEMA floodplain maps and are areas outside of the Special Flood Hazard zone A. Over the past five years, no new permits were issued for development in Barre Town SFHA or along its steep sloping terrain which has helped reduce the town's vulnerability to hazards. If Barre Town were able to 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

Barre Town and a deterrent for participation in the Community Rating System (CRS). Barre Town has no intention of enrolling in the CRS at this time.

Information on ERAF Eligibility Criteria – 12.5% State Share can be found at:
http://floodready.vermont.gov/sites/floodready
http://tinyurl.com/erafvt

4. Planning Process and Maintenance
4.1 Planning Process

Members of the town committee working on the local hazard mitigation plan update include:

Name	Role
Carl Rogers	Town Manager and EMD
Chris Violette	Chief, Barre Town Fire Department and Zoning Administrator, and Floodplain Administrator
Jack Mitchell	Emergency Management Coordinator
David Jennings	EMS Director (retired during review process)
Chris LaMonda	EMS Director (current)
Michael Stevens	Police Chief (retired June 2017)
Harry Hinrichsen	Town Engineer
Richard Tetreault	Public Works Director
Elaine Wang	Assistant Town Manager
William Dodge	Barre Town Police Chief (current)

Public Process:

Overview

The Central Vermont Regional Planning Commission (CVRPC) coordinated the Barre Town Local Hazard Mitigation Plan process. Laura Ranker, Planner at CVRPC assisted the town committee with the plan revisions and update. On December 10, 2015, CVRPC Executive Director Bonnie Waninger sent a letter to Town Manager Carl Rogers notifying the town of the HMGP grant awarded to CVRPC to assist nine municipalities in the update of their local hazard mitigation plan, Barre Town being one of the nine towns. On January 12, 2016 Jack Mitchell, Barre Town Emergency Management Coordinator, contacted L. Ranker to learn more about the plan update process and funding. Future contact was made between J. Mitchell and L. Ranker on January 25, 2017 at which time an initial “kick off” meeting was scheduled for March 1, 2016 at the Barre Town Offices in Websterville. L. Ranker met with the committee and then again on several other scheduled meetings thereafter to work on the revisions and plan updates. The Committee also met on a regular basis during Department Head meetings held at the Town Offices on Fridays and/or Tuesdays during the period of March 2016 to September 2017. Work on the plan was set aside during the period the town focused on their May Town Meeting Day and annual budget preparations. Additional meetings between the Town Manager and CVRPC staff took place from June 2017 to September 2017 to edit and finalize the working draft. The planning team reviewed a final draft of the Plan on 9/19/2017 with CVRPC Planning staff L. Ranker. This draft was presented to the Selectboard on 10/17/17 for their review and approval to submit to Stephanie Smith at VEM, which started the review process with VEM and FEMA.

The Barre Town Hazard Mitigation 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 Barre Town, 3) discussion of vulnerabilities, 4) plan maintenance, and 5) public engagement.

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

The following represent the avenues taken to update the Barre Town Local Hazard Mitigation Plan: All meetings were open to the public. No public attended the working meetings between the CVRPC and Town of Barre plan update committee and no public comments were received at any of these meetings.

Activities

"Kick Off" Meeting

On March 1, 2016 CVRPC staff met with the Barre Town Department Heads and the Town Manager at a regular Department Head meeting to offer assistance in updating and developing the Barre Town Local Hazard Mitigation Plan. This introductory meeting laid out the update process, identified the various stakeholders, and discussed the steps in performing the hazard risk analysis and prioritization. Copies of the 2012 plan were provided to everyone. This group became the local hazard mitigation committee charged with updating the 2012 plan. As a follow up to questions raised during this initial meeting, L. Ranker consulted with David Muse, Southern Vermont Disaster Program Manager of the American Red Cross on the status of sheltering facilities in Barre Town and the status of an application Barre Town started under the Local Sheltering Initiative Program of the American Red Cross, Vermont/New Hampshire Chapter.

Transportation Vulnerability Assessment

In June of 2016, CVRPC GIS staff Ashley Andrews and CVRPC planning staff L. Ranker worked with the town on the Transportation Vulnerability Assessment. A meeting with the Town Engineer Harry Hinrichsen took place on June 2, 2016 to review the computer generated Transportation Vulnerability Assessment Map prior to CVRPC staff field verifying the data. Critical infrastructure and hazardous sites were reviewed and priority areas identified. Data included identification of adequate and undersized culverts and bridges; road modifications for areas with low spots or high spots; identification of areas with steep slopes; and road alterations required to improve drainage such as ditches, swales, and cross bars. On 6/2, 6/7, and 6/9, CVRPC staff A. Andrews and L. Ranker drove all the roads in Barre Town to field verify the vulnerable assessment data and prioritize vulnerable sites and those at risk. Photos and notations were made. A. Andrews updated the maps generated to reflect on the ground conditions and identify priority sites which were then delivered to the Town of Barre planning team with the accompanying photos and list of priority sites. Subsequent conversations with Town Manager, Carl Rogers and the Department Heads also took place. This vulnerability assessment information was considered in updating this Plan. See attachment for this map.

Community Public Meeting

On April 24, 2016, a public meeting was warned for 6:30 p.m. at the Municipal Office Building, Selectboard meeting room. The purpose of this public meeting was to alert the community of the local hazard mitigation plan update process that was taking place and to gain input on the hazard risk analysis and prioritization. Meeting notices were posted in the five designated official local posting sites in the community (Graniteville General Store, East Barre General Store, South Barre, Websterville Municipal Office Building, and Trow Hill Grocery), the local daily Times Argus newspaper, the weekly World newspaper, and on the town website. In addition, a notice was placed in the CVRPC Newsletter alerting readers that Barre Town was engaging in hazard mitigation planning and updating the Barre Town Local Hazard Mitigation Plan. Contact information was provided in all notices to allow interested persons to receive more information about the efforts of Barre Town and where to request a copy of the plan.

CVRPC staff was present to help facilitate the meeting. The meeting had low attendance with those present being Town Manager Carl Rogers, CVRPC staff Laura Ranker, EMC and Selectboard member Jack Mitchell, Selectboard Chair Jeff Blow, and Assistant Town Manager Elaine Wang. Copies of the current 2012 plan were available. Handouts from the 2013 Vermont Hazard Mitigation Plan related to Hazard Vulnerability and methodology, a list of hazard risks, the plan update process, and maintenance were available. Those present discussed priority areas for the new plan, mitigation actions on private land versus public land, identification of some critical and vulnerable sites, and next steps. Under the next steps, it was determined that the planning team would be the Barre Town Department Heads who will meet for working sessions on Fridays during the summer months. No public comments were received.

CVRPC Commissioners Presentation

January 10, 2017 at the regular monthly meeting of the CVRPC Commissioners, staff Planner Laura Ranker gave an educational Power Point presentation on Local Hazard Mitigation Plans and hazard mitigation planning, highlighting those communities currently updating their LHMP, including Barre Town. Barre Town Commissioner, Byron Atwood was present.

Further Planning Team review

In the process of gathering information, on June 22, 2016 CVRPC staff completed the Flood Resilience Checklist with Chris Violette, Barre Town Zoning Administrator, Floodplain Administrative Officer and Fire Chief. Vermont Department of Housing and Community Development developed this checklist. In addition, CVRPC staff consulted with Town Manager C. Rogers and Fire Chief Violette on June 29 to gain information on the generator status for the school shelter site.

A working session was held on July 19, 2016 with the Barre Town Department Heads (the local hazard mitigation planning team) and CVRPC staff L. Ranker. At this meeting, the group reviewed the 2012 plan in detail, noting corrections, changes and updates to be incorporated into the plan update based on new data, changes in priorities, new developments and regulatory updates. CVRPC staff brought the Transportation Vulnerability Assessment Map for the group to review. The status of mitigation strategies and actions under the 2012 plan were reviewed and updated. Projects/actions in need of clarification were identified. Discussion on potential new mitigation projects/actions/strategies occurred and vulnerable sites in town were identified.

On January 6, 2017 CVRPC staff had a phone conversation with Jack Mitchell, EMC with regard to School Safety, outreach to the school principal, and shelter status. A working session with the Department Heads was scheduled for January 17, 2017. This meeting was later rescheduled to January 24 due to illness of CVRPC staff. On January 24, 2017, CVRPC staff met with the committee to regroup and focus on mitigation strategies; past, present, and future. Review of current regulations and plans, including the capital improvement budget, 5 year road plans (paved and gravel), and studies such as the one on Quarry Hill and the erosion control project on Nuissl Road. Discussion on strategies for public participation and engagement took place. Based on results from a town survey taken during the presidential election, the community gets information about the town by: Barre Town Newsletter (86%), access the Town website (30%), and access Front Porch forum (20%). Next steps were outlined and a tentative schedule put forth.

In March 2017, Town Manager Carl Rogers and CVRPC Planner Laura Ranker met to review the Transportation Vulnerability Assessment map and confer on the status of the edits to the draft plan update. In the following months, the town's focus shifted to the annual May Town Meeting Day and annual budgets. Work resumed with the town in August and September 2017.

In August and September of 2017, meetings between Town Manager C. Rogers and CVRPC staff L. Ranker took place to finalize the draft plan for presentation first to the full Planning Team and then to the Selectboard. On September 19, 2017 the planning team met with CVRPC staff L. Ranker to review the draft plan update. Presentation to the Selectboard followed on October 17, 2017 at which time the Selectboard approved submittal of the plan to Stephanie Smith at VEM to start the review process with VEM and FEMA. On October 19, 2017 CVRPC staff submitted the final draft with the Local Plan Review Tool Checklist to Stephanie Smith at DEMHS. On March 19, 2018 FEMA approved the Plan pending adoption by the Town of Barre Selectboard. This Plan was adopted on April 24, 2018.

Planning Team findings

The meetings indicated that the Town remains most vulnerable to flood/flash flood/fluvial erosion hazard. It remains the town's worst/top hazard. Barre Town feels flooding is still a significant hazard and continues to focus mitigation activities on flood events, as these events are the most common and severe.

Barre Town has further defined the moderate priorities of hazards and regrouped them. Severe storms has been separated out from the "Hurricane/Tropical Storm/Severe Storm" hazard category. Severe storms has been further defined to include thunderstorm winds, lightning, high winds, hail, and heavy rains. Severe storms are more frequent and intense and are more prevalent than hurricanes and tropical storms. Severe storms remain a moderate threat hazard for Barre Town and results in a majority of the flooding that occurs. Hurricanes and tropical storms are still an occurrence however not as frequent and the town continues to rank them as a moderate threat hazard.

Extreme cold, winter storms, ice storms, and heavy snows remain moderate threat hazards. Heavy snows, prevalent in Vermont and part of winter storms, was added to this category under this Plan update. Continued investments and maintenance in the town's machinery, equipment, and infrastructure and updated ordinances and regulations have positioned the town to better

address these threat hazards. Continued investments by the Green Mountain Power Company (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.

Although in the town ranking, structural fire scored high, due in part to the lack of warning, the town does not feel this is a worst/top threat hazard given the number of occurrences in town and the isolated nature of the potential impact. The town has a well-equipped, well-distributed fire department that is positioned to respond quickly to an alarm. This hazard will not be discussed in this Plan.

Public Outreach

The draft Barre Town Hazard Mitigation Plan was distributed electronically to the neighboring municipalities and provided contact information for receiving comments via email on October 20, 2017. These towns included:

Barre City Town Clerk, Carol Dawes, cdawes@barrecity.org
Barre City (Steve McKenzie, City Manager), manager@barrecity.org
Berlin Town Clerk, Rosemary Morse, townclerk@berlinvt.org
Orange Town Clerk, Kathy Felch, kfelch@orangevt.org
Plainfield Town Clerk, Linda Wells, plainfieldtc@gmail.com
Plainfield EMD Michael Cerulli Billingsley, michaelbix@gmail.com
Williamstown Town Clerk, Barbara Graham, clerk@williamstownvt.org
Washington Town Clerk, Carol Davis, washingtontownclerk@gmail.com
East Montpelier Town Clerk, Rose Laquerre (took place of Terri Conti on August 14, 201), eastmonttct@comcast.net
Montpelier Town Clerk, John Odum, jodum@montpelier-vt.org

In addition, an electronic copy was sent to Barre Town Planning Commission Chair Cedric Sandborn, Principal Barre Town Elementary and Middle School, Rob Evans, VT Floodplain Manager at DEC, Josh Cox, VEM Critical Infrastructure Planner, Eric Blatt, DEC dam safety program, Ned Swanberg, CFM Regional Floodplain Manager, and LEPC 5 Chair Katina Johnson. The draft Plan was posted on the Barre Town website and CVRPC website with hard copies made available at the Municipal Office Building. A notice was posted in Front Porch Forum, CVRPC “Friday weekly announcements”, Washington World, five official designated spots in the community, and at the Barre Town Elementary and Middle School. The public was directed to send comments to Town Manager Carl Rogers at Email: crogers@barretown.org or drop them off in the outside Drop Box located at the Town Offices. Comments were asked to be received by November 1, 2017.

The Planning Team considered all comments received and incorporated them as deemed appropriate and in keeping with the purpose and goals of the LHMP. This included meetings and phone conversations between the Town Manager, Planning Team, and L. Ranker CVRPC staff held in early November to discuss and incorporate comments received into the final Plan. Concurrently, a draft plan was submitted to Stephanie Smith at VEM on October 20, 2017 which started the review process with VEM and FEMA. Throughout the draft plan process, the Planning Team considered any and all comments and notified VEM of any plan changes resulting from incorporation of public participation.

On November 3, 2017 Stephanie Smith of VEM completed her initial review and had one comment which required adjusting the language in the resolution to more clearly address the town intention to implement the mitigation strategies identified in the plan. The resolution was revised using the recommended language provided by VEM. Katina Johnson, LEPC5 Chair, also provided comment, noting a change in Town Clerks in East Montpelier. The final Plan reflects the updated information. In an email dated 10/31/2017. Ned Swanberg, Vermont Regional Floodplain Manager provided recommendations concerning the floodplain and river corridor. The Section 3. Community Profile, sub sections on *Municipal Governance- Local Ordinances, Plans and Regulations* and the *National Flood Insurance Program* were adjusted to add clarity. Revisions to the hazard analysis map were made to remove the "busy nature" of the map. The Plan was re-submitted to Stephanie Smith on 11/13/2017 to continue the Plan review process.

On November 14, 2017 VEM submitted the Plan to FEMA for review and approval. The Plan was returned by FEMA on 12/28/17 with a few required revisions requested in order to meet all of the plan requirements. The town reviewed the FEMA Review Tool and addressed the required revisions along with the recommended corrections before re-submitting the Plan to VEM on 1/31/2018. FEMA Approved the Plan pending adoption on 3/19/2018.

Ongoing public participation in the plan maintenance process will continue by providing opportunities for feedback at Selectboard meetings, Department Head meetings, and informational meetings particularly directed after hazard events.

Governmental participation and involvement

The Planning Team worked closely with Stephanie Smith, VT Hazard Mitigation Planner with VEM and FEMA Planners during the Plan update review process prior to final adoption by the Barre Town Selectboard.

The Barre Town Department Heads, Selectboard members, Planning Commission members, and other local officials were given the opportunity to review, provide feedback, and approve the changes that were made through the Plan revision and FEMA review process. Public comments were considered for incorporation into the final Plan prior to formal adoption by the Selectboard.

The Barre Town Selectboard stayed informed and participated in the Plan update process by receiving reports through the Town Manager at regular Selectboard meetings. The draft Plan was sent to each Selectboard member on October 13, 2017 (Rolland Tessier, Tom White, Paul White, Jack Mitchell, and Bob Nelson) for consideration at their October 17, 2017 meeting of the Selectboard. The Selectboard accepted the recommendation of the Planning Team to forward the draft plan to VEM for review and submittal to FEMA. In addition, the Selectboard was in favor of incorporating the list of storm water project activities, prepared by Harry Hinrichsen, Town Engineer, into the Plan.

Prior to formal adoption, a Public Meeting was warned by the Barre Town Selectboard on April 24, 2018, to get public comment on the final plan. Upon FEMA written notice of FEMA "Approval Pending Adoption," the Barre Town Selectboard approved and adopted the 2017 Town of Barre Hazard Mitigation Plan by resolution at a regular warned meeting of the Barre Town Selectboard. A copy of the resolution is in this Plan as an attachment.

During the update and adoption process of the 2014 Town Plan that expires in 2019, the Planning Commission will incorporate and address the hazard mitigation goals and objectives of this Plan into the updated Town Plan. Vermont statute enables this incorporation to satisfy state municipal planning requirements for towns to develop a flood resilience element in municipal plans.

4.2 Plan Update Process

Background

In December 2005, Barre Town adopted the Barre Town Local Hazard Mitigation Plan as an Annex to the Central Vermont Regional Pre Disaster Mitigation Plan, which received FEMA final approval in 2007. In 2012, the Town updated the plan creating a single jurisdiction local mitigation plan, which received FEMA approval on October 26, 2012. This Plan is an update of the 2012 Town of Barre Local Hazard Mitigation Plan Update and will guide the town into the next five years and maintain the town's eligibility as an applicant for mitigation grants.
The 2012 Barre Town Hazard Mitigation Plan was revised to reflect changes in priorities. The 2017 Barre Town Local Hazard Mitigation Plan reflects changes from the 2012 plan related to the town's vulnerabilities to hazards and how Barre Town addresses them based on changes in priorities and the effects of the implementation of past mitigation actions and strategies. 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. Barre Town 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), Division of Emergency Management and Homeland Security (DEMHS) to be renamed Vermont Emergency Management (VEM) effective July 1, 2017, Central Vermont Regional Planning Commission (CVRPC), Federal Emergency Management Agency (FEMA) Region 1 and other agencies, all working together to provide assistance and resources to pursuing mitigation projects and planning initiatives in Barre Town.

Review of Existing Plans, Studies, reports and technical information

Preparation for the planning meetings included a review of the following documents and resources as noted below as well as conversations with CVRPC GIS Planner, CVRPC Transportation Planner, Town Manager Carl Rogers, and VEM Hazard Mitigation Staff.

- Town of Barre Vermont, 2014 Town Plan, adopted May 27, 2014– the Town Plan provides town officials and CVRPC staff with updated information on the community and the goals, objectives, and recommendations for the municipality. In particular, the sections on Land Use Plan (2), Preservation (5), Transportation (3), Facilities, Utilities, and Public Safety (4) are most relevant.
- State of Vermont Hazard Mitigation Plan, November 2013 – this plan provides Barre Town and CVRPC staff with updated data on hazard occurrences, hazard risk, the state's hazard mitigation planning process, and a description of the top hazards facing Vermont over the next five years.
- 2009/2010 Barre Town Zoning Regulations including section 5.8 Flood Hazard Regulations.
- Barre Town Local Emergency Operations Plan adopted April 18, 2017.
- Stevens Branch Watershed River Corridor Management Plan, Stevens and Jail Branches of the Winooski River, Washington and Orange Counties, VT. Friends of the Winooski River,

Winooski Natural Resources Conservation District, Central Vermont Regional Planning Commission, 2009.

- Town of Barre 5 year Gravel Road Plan, FY 2018-2022, adopted 11/15/16.
- Town of Barre 5 year Paved Road Plan, FY 2018-2022, adopted 1/10/17.
- Town of Barre Local Hazard Mitigation Plan Update January 2012 – referenced extensively during this Plan update process especially with regard to hazard risk analysis and priorities, mitigation actions, and plan maintenance.
- Town of Barre 2012 Plan Review Tool FEMA approved - reference to Section 2 recommendations for next plan update and plan strengths.
- 2016 Transportation Vulnerability Assessment and map performed by CVRPC.
- Town of Barre 2017 Hazard Analysis Map.
- Barre Town Culvert Inventory.
- FEMA Local Mitigation Planning Handbook March 2013 and Local Planning Review Tool Guide- provided valuable guidance and templates for updating this Plan.
- Capital Improvement Budget.
- Vermont Economic Resiliency Initiative (VERI) Community Report July 2015, Barre, VT – a report by the Vermont Agency of Commerce and Community Development in response to Tropical Storm Irene.
- New FEMA Floodplain Maps effective 3/19/2013
- Barre Town Annual Reports 2014/2015; 2015/2016.
- EPA Flood Resilience checklist 2014 Barre Town.
- Flood Ready Vermont website (anrweb.vt.gov/DEC) Expanded Community Report for Barre Town, 3/3/17.
- Federal Emergency Management Agency, Repetitive Losses/BCX Claims, Vermont; and Non-mitigated repetitive loss properties data.
- FEMA Disaster Declarations in Vermont.
- National Weather Service.
- National Oceanic and Atmospheric Administration (NOAA), National Centers For Environmental Information and historical weather data.
- USACE CRREL website.
- American Community Survey Demographic and Housing Estimates, 2011-2015 American Community Survey 5-Year Estimates.

In the process of updating the local hazard mitigation plan, the following is a list of revisions to the 2012 Plan. There is no identification of new hazards but changes were made to the categorizing of the hazard. Hazards are clarified and prioritized based on current town conditions and vulnerability using the hazard ranking methodology as a basis.

General Updates:

- Update to the Community Profile
- Reevaluation, identification and analysis of all significant hazards
- Update to Planning Process and Maintenance.
- 2012 Mitigation Strategies Status Update Chart – acknowledgement of implemented mitigation strategies and actions since 2012 and update status of 2012 proposed actions/strategies.
- Added 2017 Mitigation Strategies/Actions Chart based on current reevaluation and prioritization. Identification of on-going, current, and proposed mitigation projects and strategies for the next 5 years.
- New Hazard Risk Assessment that expands on the community's vulnerability ranking and is similar to what is used by the Vermont Division of Emergency Management and Homeland Security. See attachment for methodology.
- Hazards referred to as "worst threat" are now referred to as "top hazards."
- Incorporation of new data and information throughout the Plan since last update in 2011/2012 including town regulations, ordinances, and hazard data (events, declarations, non-declared disasters)
- Update Existing Hazard Programs, Projects, and Activities.
- Use of a mitigation action evaluation table. See Plan attachments for table template.
- Recommended use of Mitigation Tracking Tool. See Plan attachment for tracking template.
- Glossary of Terms is added.

Hazard Analysis

- Flood/Flash Flood/Fluvial Erosion remain on the list of "top hazards" (f/k/a worst hazards), reflecting the communities belief that these hazards are the most significant and the town is still vulnerable to these hazards.
- Severe storms (Weather) has been expanded and defined to include lightning, thunderstorm winds, high wind, hail, and heavy rain. Severe storms is no longer grouped with hurricanes and tropical storms. The town's recent severe and prolonged rainstorms as noted in the 2014 Town Plan and the 2015 VERI report resulted in adding heavy rain to the severe storms category definition. Although the town cannot predict with certainty that these events will be the norm in the future, the town expands their analysis of hazards that they may be vulnerable to in the next five years.
- Extreme Cold/Winter Storm/Ice Storm/Heavy Snow; Ice Jams; Hurricane/Tropical Storms; Severe storms (lightning, thunder winds, high winds, hail, heavy rain,) remain as a moderate threat hazard.
- For each hazard, a hazard matrix is used to summarize the hazard description in a table with a location/vulnerability/extent/impact/likelihood given.

- Review of Federally declared disasters, weather data, ANR resources, VT Flood Ready site, and NOAA site.
- Review of Vermont November 2013 State Hazard Mitigation Plan.

Maps

- Updated Hazard Analysis map is added; flood plain and surface waters added, tier II sites (critical facilities), structures in Special Flood Hazard Areas, river corridors.
- Transportation Vulnerability Assessment Map is added (new map)

Status Update on Mitigation Actions Identified in 2012

The following chart provides an overview of Barre Town's proposed 2012 local hazard mitigation actions along with their current status (in order of 2012 priority from high to medium). The Planning Team reviewed these actions and reported on the status of each.

Hazard	2012 Mitigation Action	Local Leadership	Possible Resources	Time Frame	2017 Status of Mitigation Action
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/ Severe Storm	Upgrade and expand Sterling Hill Road culvert to 8' x 5' box culvert per 2007 Hydraulics Study	Selectboard, Town Manager, Town Engineer	HMGP	1-2 years	Completed
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/ Severe Storm	Develop water retention area on upstream side of McLeod Hill Road culvert	Selectboard, Town Manager, Town Engineer	HMGP	2 years	Pending funding necessary for engineering study to develop recommendations and solutions to the problem. Action carried over to 2017 Plan
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/ Severe Storm	Replace and upgrade culvert on Peloquin Road per 2007 Hydraulics Study	Selectboard, Town Manager, Town Engineer	HMGP	9/5/2017 - 10/31/2017	VTrans Structures (bridges and culverts) grant agreement approved on 11/24/2015 ($175,000 grant). Project in progress - Under Contract; Sleeved culvert with headwalls. Action carried over to 2017 Plan
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/ Severe Storm	Develop water retention area at intersection of Sterling Hill Road and Graniteville Road	Selectboard, Town Manager, Town Engineer	HMGP	2-3 years	Pending recommendation of study being performed by Friends of the Winooski River; action implementation based on recommendations of study, as appropriate. Action carried over to 2017 Plan.
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/ Severe Storm	Develop water retention area behind Barre Town School	Selectboard, Town Manager, Town Engineer	HMGP	2-3 years	Pending results of study by Friends of the Winooski River of the Sterling Hill Drainage area. This action has been carried over into the 2017 Plan.
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/ Severe Storm, Ice Jams	Project # 1, 2, 3, 5, 6, and 9 from the Stevens Branch Corridor Plan	Selectboard, Town Manager, Town Engineer , ANR	Town funds, USDA, EPA	4 years	Not done. Long term action; removed from 5 year plan due to time commitment, coordination efforts, and minimal impact and benefit to the town. This action is not carried over in 2017 Plan.

Hazard	2012 Mitigation Action	Local Leadership	Possible Resources	Time Frame	2017 Status of Mitigation Action
Winter Storms/ Severe Cold/ Ice Storms	Provide training to residents and sensitive populations on how to insulate homes (pipes, attics) for extreme cold spells	Selectboard, Planning Commission, Fire Dept.	EMPG	2 years	Completed. Now a preparedness action. Information provided in Town Newsletters.
Winter Storms/ Extreme Cold/ Ice Storms, Hurricane/ Tropical Storm/ Severe Storms, High Winds	Provide looped distribution service or other redundancies in the electrical service to critical facilities	Fire Dept., Selectboard	General Funds, EMPG, DPIG	3-4 years	Completed. Generators installed, Auto transfer switch installed at Town Offices. This action is not carried over in 2017 Plan.
NFIP Compliance	Work with elected officials, the State and FEMA to correct existing NFIP compliance issues and prevent future issues through continuous communications, training and education	Town Planner, ANR, CVRPC Certified Floodplain Manager	HMGP	2 years	Town updated Flood Hazard Regulations in 2010 that meet and exceed NFIP requirements. Town implements regulations in accordance with the 2010 Flood Hazard Regulations.
Emergency Prepared-Ness	Install generators at both Town Garages	Selectboard, Fire Dept., Town Manager	EMPG	3-4 years	One generator has been installed at the Public Works Garage for back up. It also powers the fuel pumps that are used by all Town Departments including Police, Fire and EMS. Generator for the maintenance shop is no longer a priority and the shop will use the garage as a backup if needed. Second generator will not be an action carried over into the 2017 Plan.

Town Capabilities for Implementing Mitigation Strategy

A five member volunteer Selectboard and the full time Town Manager oversee services provided by the Barre Town municipality. The seven member volunteer Planning Commission (PC) is charged with "three main jobs, beginning with the process of making amendments to the Town Plan, Zoning Bylaw, and the Subdivision Ordinance. The PC also hears requests for allowed use determinations and multiple driveway requests." (Report of the Town Officers for Fiscal Year July 1, 2015 to June 30, 2016). The quasi-judicial seven-member citizen Design Review Board with two alternates hears subdivision requests, site plan reviews, conditional uses, variances, and appeals of the Zoning Administrator. Barre Town also has a Housing Rehabilitation Program with a four member Citizen Housing Advisory Committee and makes loans available to income eligible Town residents needing home repairs related to safety and weatherization. Downstreet Housing and Community Development, formerly known as Central Vermont Community Land Trust (CVCLT), administer the Barre Town Housing Rehabilitation Loan Fund. The Selectboard appoints a member of the Citizen Housing Advisory Committee to sit on the Downstreet Loan Committee. As noted in the 2014 Town Plan, the agreement with Downstreet (formerly CVCLT), allows the Town to "distribute the money without the extra strain on staff to manage it."

The Town employs several 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:

- Town Manager (Full time) - Carl Rogers
- Town Clerk/Treasurer (Full Time) – Donna Kelty
- Floodplain Administrator (Full time)– Christopher Violette
- Zoning Administrator (Full time) – Christopher Violette
- Superintendent Public Works (Full time) - Richard Tetreault
- Fire Chief (stipend)– Christopher Violette
- Police Chief (Full time) – William Dodge
- Emergency Management Coordinator (Full time w/stipend) – Jack Mitchell
- Emergency Management Director (Full time) – Carl Rogers
- Emergency Medical Services Director (Full time) – Chris LaMonda
- Town Engineer (Full Time) – Harry Hinrichsen
- Assistant Town Manager (Full time) – Elaine Wang

Volunteer municipal officials also play a crucial role in carrying out hazard mitigation. Christopher Day is the local Fire Warden. The Selectboard oversees all municipal & mitigation activities, including hazard planning with the support of the Town Manager and Department Heads, and the Planning Commission ensures long-term community planning.

The municipal budgeting process occurs on an annual basis, planning for a fiscal year from July 1 to June 30. The following budget information and process is taken directly from the Barre Town website http://www.barretown.org/government_information/budget_infomation.
"Barre Town utilizes fund accounting, as many municipalities do. Eight fund budgets are included in the Town budget. Each budget has a specific purpose except for the General Fund, which is used for general expenses. At Barre Town's annual Town Meeting Day on the second Tuesday of May, voters elect to approve or disapprove the Budget Committee's proposed General and Highway Fund budgets. Approval of these two budgets are decided by voters because their primary source of revenue (83% for the General Fund and 92% for the Highway

Fund) is property taxes." The eight fund budgets are Ambulance, Building, Cemetery, Equipment, General, Highway, Sewer and Water.

The Barre Town Charter requires the annual appointment of a committee of five Town voters who are equal partners with the Selectboard when studying and analyzing the Town Manager's proposed budgets for eight different funds. Together the five Budget Committee members and five Selectboard members approve the General Fund and Highway Fund budgets presented to the voters for approval. The committee also approves the other six budgets. Budget Committee recruitment begins in December. In early January, the Selectboard appoints two of the five committee members. The Town Clerk-Treasurer appoints one member. These three appointees select two more members before the first meeting (last Tuesday in January). Budget Committee terms expire when the General Fund and Highway Fund budgets receive voter approval in May.

The committee meets with the Selectboard on Tuesday nights February through March (or early April depending on need). Extra meetings may be scheduled if more question-answer time with the Town Manager and department heads is needed. Committee members may, if they chose, participate in the Selectboard's budget presentations to the public."

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 Town Manager, Selectboard, and Town Clerk.

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.

Other Existing Hazard Mitigation Programs, Projects & Activities:
Barre Town is currently engaged in the following hazard mitigation programs, projects, and activities. These are listed by strategy and were reviewed for the development of this Plan. They share and incorporate the overall goals of the local hazard mitigation plan. Barre Town has the capacity to maintain these programs and initiatives using the staff and volunteers described in the Community Capacities.

<u>COMMUNITY PREPAREDNESS ACTIVITIES</u>

1. Local Emergency Operations Plan – 2017.

Annual Update of Barre Town's Local Emergency Operations Plan (LEOP). Last updated and adopted on 4/18/17. Volunteer time from Town Manager/EMD, Department Heads, and Selectboard with assistance from CVRPC Emergency Management Planner. This document is reviewed annually and updated with current and correct contact information for three Points of Contact and other pertinent information for emergency preparedness, response and recovery. Town maintains training of certifying officer in ICS 402 and ICS 100. The LEOP is sent to the VT Department of Public Safety, Vermont Emergency Management for

acceptance and for their records. Funding from VT VEM. There is no need to expand or improve on this program at this time. Next update is due by May 1, 2018.

2. School Safety Evacuation Plan.

The Barre Town Middle and Elementary School participates in the Vermont School Crisis Planning program and follows the VT recommended school guidelines. The School Safety Evacuation Plan is practiced with regular drills and coordinated with the local fire and police departments. All school personnel are involved in implementation of the evacuation plan. Current School personnel has access to the VT school safety website and state resources for support and training. Funding from School Budget and VT Dept. of Education. There is no need to expand or improve on this program at this time

3. Capital Equipment Plan (CEP).

Annually updated as part of the Town Budget and planning process. Voter participation at Town Meeting and by vote at Town Meeting. Town Manager with support of Department Heads as appropriate, and Selectboard put forth the CEP. This requires annual review and approval. Funding from Town budget. Process is satisfactory and there is no need to expand or improve program/policy.

4. 5 year Gravel Road Plan, FY 2018 – 2022, adopted 11/15/2016.

Annual review by Town Manager and Selectboard with consultation with Public Works Superintendent and Town Engineer. Support and assistance from CVRPC and AOT as applicable. Funding from Town Budget and Better Roads Program. Will be integrated with Water Quality standards and regulations pertaining to the Lake Champlain Basin and watershed as applicable. Process and Plan are satisfactory, no need to currently expand or improve program.

5. 5 year Paved Road Plan, FY 2018 – 2022, adopted 1/10/2017.

Annual review by Town Manager and Selectboard with consultation with Public Works Superintendent and Town Engineer. Support and assistance from CVRPC and AOT as applicable. Funding from Town Budget and Better Roads Program. Will be integrated with Water Quality standards and regulations pertaining to the Lake Champlain Basin and watershed as applicable. Process and Plan are satisfactory, no need to currently expand or improve program.

6. Participation at SERC and LEPC 5 meetings.

Program. Town Manager/EMD and EMC participate at regular meetings of the State Emergency Response Commission and the Local Emergency Planning Commission #5. Volunteer time. Funding from VT DPS, VEM. No need to expand or improve on attendance.

7. Red Cross Shelter Agreement.

Town shelters are designated at Barre Town Middle and Elementary School (BTMES) and East Barre Fire Station. Facilitated by Shelter Managers and community volunteers. Coordination with Town Manager/EMD, Selectboard, School Principal. Action to complete: designation of BTMES as a Red Cross Shelter and install a generator at BTMES shelter site. Volunteer effort. Funding ARC VT/NH District and Town Budget. There is a need to expand and improve the designation and capacity of the BTMES site. There is no need to expand or improve the East Barre Fire Station shelter.

8. LEPC5 representation.

The Barre Town Emergency Management Director is a voting representative on the Local Emergency Planning Committee #5 which meets bi monthly. The EMD has access to trainings promoted by the CVRPC and VEM to assist and support him in his position as EMD.

9. Fire Warden.

Appointment of a Town Fire Warden to serve a five year term. The Town Fire Warden is Christopher Day. No need to expand program.

HAZARD CONTROL AND PROTECTION OF CRITICAL INFRASTRUCTURE AND FACILITIES

1. Culvert Survey – 2013, spot update in 2016.

Completed culvert inventory survey in 2013 with CVRPC GIS Planner, intern staff and Transportation Planner using georeferenced culvert locations. A spot update was performed in 2016. Inventory is scheduled every 3 years with CVRPC. Town Highway Forman, Public Works Superintendent and Town Engineer provide staff time with assistance from CVRPC staff. Funded by VTrans TPI funding. Completed, No need to improve or expand on.

2. Mutual Aid response agreement with surrounding communities.

Barre Town participates in Capital Fire Mutual Aid and EMS District 6. Police, Fire, EMS and Public Works. Provides regional support and coordination. Funded by Town Budget. No need to expand or improve service.

3. Town Road and Bridge Standards.

Authority– Barre Town adopted the VT 2013 Road and Bridge Standards on 4/9/2013. A Certificate of Compliance with Road and Bridge Standards was issued 2/24/2015. Adopted by the Selectboard and implemented by the Town Engineer, Public Works Superintendent, Road Forman and road crew. Assistance from CVRPC. Funded by VTrans and Town budget to implement. Standards are minimum for construction of roadways, ditches, culverts, bridges, and guardrails. No need to expand or improve on.

Barre Town has approved 5 year Road Plans for both paved (approved 1/10/17) and gravel (approved 11/15/16) roads which are reviewed annually by the Selectboard. These plans prioritize the road projects for the community over the next five years and provide project cost estimates.

4. Barre Town Zoning Regulations with section on Flood Hazard Area Development (section 5.8).

Authority - Barre Town updated the zoning regulations in 2009 and Flood Hazard regulations in 2010. Email of 5/3/2010 from Ned Swanberg, Regional Floodplain Manager, confirmed FEMA review and approval of the amended Town of Barre Flood Hazard Regulations finding they meet or exceed the requirements of NFIP. Town Zoning Administrator implements the regulations with assistance from Planning Commission and DRB as applicable. Assistance from ANR CFM and CVRPC. Funded by VCDP Municipal Planning Grants. No need for expansion or improvement at this time. Will be reviewed as part of the update process for the Municipal Plan.

5. Barre Town Local Hazard Mitigation Plan 2012 and subsequent updates every 5 years

Policy/Program – Barre Town Local Hazard Mitigation Plan is developed by staff time and adopted by the Selectboard with assistance from CVRPC staff, DEMHS staff, and FEMA. Funding provided by Town budget, VT VEM, FEMA, and CVRPC. The local hazard mitigation 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 10/26/2017. 2017 Plan Update is in process. Town will need to receive VEM and FEMA approval prior to adoption of this Plan.

6. Dry Hydrants.

Program – Over the years, Barre Town has installed various dry hydrants to expand the Fire Suppression system and water access to the Fire Departments. Funding sources are VACD, FPR, and Town Budgets. Town Manager, Fire Department Chief, Board of Selectmen assist and support program. No action to expand or improve program at this time.

7. Shelters wired for backup generators – (see above Community Preparedness Activities #7).

Program, ongoing review. St. Sylvester's Church is not a shelter site and there is no need to expand or improve it. Wiring of the Barre Town Middle Elementary School is in place for a generator. Purchase and installation of a generator is necessary to improve and expand the capacity of the school as a shelter. There is no need to expand or review wiring of the East Barre Fire Station.

INSURANCE PROGRAMS

1. Participation in NFIP.

Authority/Program – Barre Town participates in the NFIP since 6/15/1978. It has adopted Flood Hazard regulations (lasted updated in 2010) and enforces the regulations. It uses the most recent FEMA FIRMs for Barre Town in Washington County, VT. Chris Violette, Town Zoning Administrator serves as the NFIP administrator. Assistance is provided from ANR and CVRPC as requested. Funding from Town Budget. The Towns current Flood Insurance Rate Map was updated effective 3/19/2013. Community Panel #500273. No need for expansion or improvement.

LAND USE PLANNING/MANAGEMENT

1. Town of Barre Vermont, 2014 Town Plan.

Policy/Program. The 2014 Town Plan was adopted on May 27, 2014. The Barre Town volunteer Planning Commission members with assistance from Town staff develop the plan for adoption by the Selectboard. CVRPC and VCDP and other state agencies provide support and assistance on specific elements and draft language. Funding is provided by VCDP Municipal Planning Grants. The Town Plan is update as required by state statute and during the update process consideration is given to the incorporation of other town policies and plans, such as the local hazard mitigation plan and flood resiliency. The Town Plan was recently updated. During the next Town Plan update in 2019 action will be taken to improve and expand on it as necessary by incorporating information from this Local Hazard Mitigation Plan.

2. Zoning Regulations, 2009 and Flood Hazard Development Regulations, 2010.

Authority – see above Insurance Programs, Participation in NFIP, #1.

3. Subdivision Regulations, 2008.

Authority - The Barre Town volunteer Planning Commission members with assistance from Town staff develop the Subdivision regulations for adoption by the Selectboard. CVRPC and VCDP and other state agencies provide support and assistance on specific sections and draft language. Funding is provided by town budgets. The Subdivision regulations are update as required by state statute and during the update process consideration is given to the incorporation of the goals of the Town Plan and other town policies and regulations pertaining to development. No action to improve or expand on these regulations at this time.

4. Stevens Branch Corridor Plan 2009.

Completed Action – Study presented a series of recommendations. Town is not in the position to implement the recommendations due to a lack of funding, coordination and cooperation among parties, and lack of staff capacity and time. Funded by Friends of the Winooski River, Winooski Natural Resources Conservation District, and Central Vermont Regional Planning Commission. This is a one-time action, so there is not a need to expand or improve on it. When the town has the financial and personnel capacity and cooperation of other parties, it may look to implement some of the recommendations of the study/plan.

5. Adoption of Vermont AOT "Codes & Standards for Roads", 2013 - see above Hazard Control and Protection of Critical Infrastructure and Facilities, Town Road and Bridge Standards, #3.

6. Barre Town Hazard Mitigation Plan.

Update and adopt Barre Town Local Hazard Mitigation Plan in 2017 prior to the expiration of the 2012 Plan. This action is in process. Town Manager, Department Heads and Selectboard are key responsible parties.

PUBLIC AWARENESS, TRAINING & EDUCATION

1. Fire safety educational programs for students.

Program – Ongoing Action. Education and communication to students (and families) regarding fire safety, fire prevention, and important information. Volunteers from the Town Fire Departments and funded from fire department budget and school safety budget. This is an ongoing action and there is no need to expand on or improve this action.

2. Town Website/Newsletter articles/Front Porch Forum.

Ongoing Action – The Town of Barre has a website and posts information on a regular basis as well as distributing an electronic newsletters. Front Porch Forum is another tool Barre Town uses to disseminate information out into the community. Town staff perform the tasks and their time is funded from the town budget. A survey conducted in 2016 to determine how residents get community information showed 86% read the Barre Town Newsletter, 30% access the Town website, and 20 % access Front Porch forum. There is no need to expand or improve on this action.

4.3 Plan Maintenance Process

The Town, over the next five years, will continue to review and evaluate this Plan's assessment of vulnerability, adhere to its maintenance schedule, as best as it can, and begin implementing, when possible, the mitigation actions proposed in this Plan. Monitoring of plan progress and implementation will be undertaken by the Town Manager. 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 of this Plan. The town may use the mitigation action tracking sheet (see template in attachment section of Plan) or similar method to assist with progress reporting on the mitigation actions and strategies taken over the next five years.

The Barre Town Local Hazard Mitigation Plan will be reviewed annually. The first step will be the review by the Department Heads at a regular staff meeting prior to a June Selectboard meeting. Town staff will summarize comments for presentation to the Selectboard. The Selectboard will review the Plan annually at a June Selectboard meeting of their choice to discuss and evaluate its effectiveness. A review of the mitigation actions/strategies and the status of each will occur at this meeting, noting those that have been completed and identifying next steps for those pending implementation, as applicable. Input from the Department Heads and the public will be incorporated into the Plan when relevant. Any revisions or updates to be incorporated into the Plan as a result of the review will be noted. This June meeting of the Barre Town Selectboard will provide the opportunity for public participation and for local officials and the public to learn about the town's progress in implementing hazard mitigation measures and provide input on future activities and Plan revisions. Review of the time table for mitigation actions against actual activity will provide a basis for evaluating the effectiveness of the Plan and if the goals of the Plan are being met. Further, the Town will review the status of the hazard risks identified in the Plan to determine if the risks and priority assigned are still relevant. The Barre Town Manager/Emergency Management Director will be the primary point of contact and will initiate the monitoring, evaluation, and review of the plan maintenance process. The Town Manager will take the Plan maintenance activities to the Selectboard per agenda and discussion.

Review and evaluation by the Selectboard will also occur within three months after every federal disaster declaration directly impacting Barre Town. In 2013, the Vermont Legislature passed legislation requiring all towns to incorporate flood resiliency elements into their Municipal Plans as of July 2014. Future updates to the Barre Town Town Plan adopted May 27, 2014 must meet this requirement and this local hazard mitigation plan will help the town comply. Barre Town will consider incorporation of the mitigation actions outlined in this Plan into the Town Plan during the municipal plan update process in 2019 (five years from the Town Plan adoption date). The Town Plan update will be led by the Barre Town Planning Commission, who will review this Plan and determine those mitigation actions/strategies/goals that should be included in the updated Town Plan. Further, the Town will reference the Barre Town Local Hazard Mitigation Plan in revisions, amendments, and updates to other applicable municipal bylaws and ordinances such as zoning regulations, flood hazard/FEH bylaws, capital improvement plans, and the 5 year road plans in much the same way as the Planning Commission will do for the Town Plan. It is recommended the Town consider recommendations in the 2015 VERI report, the 2009 Stevens Branch River Corridor planning documents, and any future studies and planning documents performed by CVRPC or others on behalf of the Town of Barre for ideas on future mitigation projects and hazard areas.

The process of evaluating and updating the plan will include public participation through means such as notices posted on the municipal website and in the municipal building, Washington World, Times Argus, and the town newsletter, inviting the public to the scheduled Selectboard (or specially scheduled) meeting. Additional stakeholders should be invited to the meeting, including, Barre Town Middle Elementary School, local businesses and civic/non-profit organizations, emergency responders, CVRPC Planning staff, and the Vermont Central Region, Regional Floodplain Manager whose expertise on NFIP, flood hazard/fluvial erosion/river corridor regulations and other applicable initiatives may benefit the communities planning process. These efforts to engage public participation will be coordinated by the Town Manager or Assistant Town Manager.

In order to maintain a current up to date unexpired Plan, within one year of this Plan expiration date, the plan update process with FEMA should begin. For the next Plan update, CVRPC will assist and support the Town of Barre at their request provided there is funding and staffing available for CVRPC to do so. If CVRPC is unable to assist the Town of Barre, then the Town will update the plan using the Town Department Heads, Assistant Town Manager, and Town Manager or the Selectboard will update the plan or the Selectboard may appoint a committee of interested citizens with the Emergency Management Director serving on this committee to draft changes. The Town of Barre is responsible for the update and maintenance of this Plan.

Barre Town will incorporate the goals and objectives of the hazard mitigation plan into their long term land use and development planning documents and the Municipal Plan. It is recommended the Town review and incorporate elements of the Local Hazard Mitigation Plan when updating the municipal plan, road plan, and inundation hazard and river corridor regulations. The Town may consider reviewing any future CVRPC 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 municipal plan as of July 2014. As part of meeting this requirement, Barre Town 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 Barre Town comply with the new community flood resilience requirements for Municipal Plans adopted after July 2014 and will assist the Planning Commission in their work when they update the existing Barre Town 2014 Town Plan.

5. Risk Assessment

5.1 Hazard Identification and Analysis

The Planning Team performed an evaluation of the known hazards to the area and the risks the hazards pose looking at three main questions, 1) what damage can happen given the Town's vulnerabilities, 2) how likely are they to occur, and 3) how damaging can they be. Using a table to show this process, the town was able to then prioritize actions designed to mitigate the effects of each of the disaster types. The Town looked at past occurrences at the town, county and state level for guidance. Although the Town cannot predict the future, recent changes in the climate have made old weather patterns less predictable and Vermont has seen an increase in the number and severity of storms, especially high intensity rainfall events. In response to the changes in the weather patterns, Barre Town has separated severe storms from hurricanes and tropical storms and further defined severe storms as high winds, thunderstorm winds, hail, heavy rains, and lightning keeping it as a moderate threat hazard.

The methodology used to rank the hazards and score them is found as an attachment of this Plan. In this 2017 Plan, the Town expanded on the risk analysis by considering factors such as frequency of occurrence, warning time, and potential community impact modeling the methodology used in the 2013 Vermont Statewide Hazard Mitigation Plan. Unlike the state process, the geographic extent focused on Barre Town, a mostly rural community and not the entire State of Vermont and therefore did not use the statewide or region wide extent. The potential impact defined as the severity and extent of damage and disruption is categorized as negligible, minor, moderate, or major. A negligible potential impact is isolated occurrences of minor property damage, minor disruption of critical facilities and infrastructure, and potential for minor injuries. A minor potential impact is isolated occurrences of moderate to severe property damage, brief disruption of critical facilities and infrastructure, and potential for injuries. A moderate potential impact is severe property damage on a neighborhood scale, temporary shutdown of critical facilities, and or injury or fatality. A major potential impact is severe property damage on a metropolitan or regional scale, shutdown of critical facilities, and or multiple injuries or fatalities.

The hazards were ranked based on these factors to determine which hazards posed the greatest risk to Barre Town and found to be the most significant. The higher the score the more likely to pose a risk. However, the town further looked at the risk when considering the total score and in some cases determined the higher score was for example due to a lack of warning and not significant because the potential impact was negligible or the probability of occurrence was unlikely. An earthquake is an example of this; while an earthquake may occur occasionally with little or no warning, it was removed from further analysis as a hazard due to the very low magnitude of those earthquakes that have occurred in Barre Town. Another example is structural fire. Structural fire scored the highest but given the negligible impact of isolated occurrences with minor damage and the town fully equipped with two fire stations strategically positioned in town and a fully trained and qualified firefighter unit, the Planning Team removed this hazard as a significant threat or risk to the community. Further discussion, associated mitigation actions and follow-up is provided in this Plan.

Those hazards not found to pose the greatest threat to Barre Town such as avalanches drought, earthquakes, tornadoes, wildfires, dam failures, water supply contamination, extreme heat, landslides/mudslide/rockslides, invasive species, hazard material spills, structure fire, and nuclear power plant failure are not addressed in this Plan due to 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, Barre Town 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 natural disasters were discussed and the top priority hazards were identified based upon the likelihood of the event and the community's vulnerability to the event. The Hazard Assessment Table reflects the hazards Barre Town feels can be expected, or at least are possible, to occur in Town.

Hazard Assessment

HAZARD	FREQUENCY OF OCCURRENCE	WARNING TIME	POTENTIAL IMPACT	HAZARD SCORE
Avalanche (avalanches are not likely to form in Town due to the topography in Barre Town)	Unlikely (1)	None –(4)	Negligible –(1)	6
Landslide/Mudslide/Rockslide	Unlikely (1)	None –(4)	Negligible –(1)	6
Dam Failure	Unlikely (1)	6-12 hrs (2)	Major – (4)	7
Drought	Occasionally (2)	12+ hours – (1)	Minor – (2)	5
Earthquake	Occasionally (2)	None –(4)	Minor – (2)	8
Extreme Cold/Winter Storm/Ice Storm/ Heavy Snow	Likely (3)	12+ hrs (1)	Minor – (2)	6
Flash Flood/ Flood/ Fluvial Erosion	Likely (3)	6-12 hrs (2)	Moderate – (3)	8
Ice Jam	Occasionally - Likely (2.5)	6-12 hrs (2)	Minor – (2)	6.5
Hurricanes/Tropical Storms	Occasionally (2)	12+ hrs (1)	Moderate – (3)	6
Tornado (Due to the topography of Barre Town, tornados are not likely to form in Town)	Unlikely (1)	3-6 hrs – (3)	Moderate – (3)	7
Severe Storms (Lightning, Thunderstorm Winds, High Winds, Hail, Heavy Rain)	Likely – Highly Likely (3.5)	12+ hrs (1)	Minor – Moderate (2.5)	7
Heavy Rain	Likely – Highly Likely (3.5)	6-12 hrs (2)	Minor – Moderate (2.5)	8
High Wind	Likely (3)	3-6 hrs – (3)	Minor – (2)	8
Thunderstorm Winds	Likely (3)	6-12 hrs (2)	Minor – Moderate (2.5)	7.5
Hail Storms	Occasionally (2)	6-12 hrs (2)	Minor – (2)	6
Lightning	Likely (3)	6-12 hrs (2)	Minor – (2)	7
Structure Fire	Highly Likely (4)	None –(4)	Negligible –(1)	9
Water Supply Contamination	Unlikely (1)	None –(4)	Minor – Moderate (2.5)	7.5
Wildfire/Forest Fire	Unlikely – Occasionally (1.5)	None –(4)	Negligible – Minor (1.5)	7
Hazardous Material Spill	Occasionally - Likely (2.5)	None –(4)	Negligible – Minor (1.5)	7
Invasive Species / Infestation	Occasionally (2)	12+ hrs (1)	Negligible – Minor (1.5)	4.5
Extreme Heat	Unlikely (1)	12+hrs (1)	Negligible –(1)	3
Tsunami (VT is landlocked)	N/A	N/A	N/A	N/A
Volcano (VT has no active volcanoes)	N/A	N/A	N/A	N/A
Nuclear Power Plant Failure (Vermont Yankee Nuclear Power Plant was permanently shut down in 12/29/2014 and the fuel was removed from the reactor on 1/12/2015. Current negotiations on the decommissioning are taking place with a possible date of 2018; earlier than the previous 2020 date set.)	N/A	N/A	N/A	N/A

Just because the town has not identified a hazard as a top priority or significant threat, does not mean the hazard will not occur in the future, they are just not the focus of this Plan.

Barre Town has identified the following hazards to be the most significant in the Town.
Top threat hazards include:

- Flood/ Flash Flood/ Fluvial Erosion

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

Moderate threat hazards include:

- Extreme Cold/Winter Storm/Ice Storm/Heavy Snow
- Severe Storms (lightning, thunderstorm winds, high winds, hail, heavy rain)
- Ice Jams
- Hurricane/Tropical Storms

A discussion of each significant hazard is included in the proceeding subsections. An updated Hazard Analysis Map is included in the attachments to this Plan. Each subsection includes a list of past occurrences based upon County-wide and State-wide FEMA Disaster Declarations (DR-#), where applicable. Information was also gathered from local records, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (formally known as the National Climate Data Center, NCDC), reports from the National Weather Service in Burlington, Vermont, the Vermont Forest, Park and Recreation Department, and VT State Hazard Mitigation Plan. This section includes a narrative description of the hazard and a hazard matrix containing the following overview information as shown in the chart below. The information identified in the "Extent" and "Likelihood/Probability" columns are based on the hazard ranking methodology as discussed in section 5.1 of this Plan and further defined in the attachment.

Overview Information in 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 event	Strength or magnitude and general details of the most notable event(s): Minimal, Moderate; or Severe*	Dollar value or percentage of damages	Likelihood of hazard occurring based on past events: Unlikely: <1% probabiity of occurrence in the next 100 years. Occasionally: 1-10% probability of occurrence per year, or at least one chance in next 100 years. Likely: >10% but <100% probability per year, at least 1 chance in next 10 years. Highly Likely: 100% probable in a year.

5.2 Top Threat Hazards
Flood/Flash Flood/Fluvial Erosion
History of Occurrences:
Flood/flashflood/fluvial erosion is Barre Town'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 others. Fluvial erosion processes occur more quickly and severely during flood events.

Flooding of land adjoining the normal course of a stream or river has been a natural occurrence since the beginning of time. If these floodplain areas were left in their natural state, floods would not cause significant damage. Development has increased the potential for flooding because rainfall that used to soak into the ground or take several days to reach a body of water now quickly runs off streets, parking lots and rooftops and through human-made channels and pipes.

Past instances of flooding in Barre Town have included rain and or snow melt events that cause flooding of the major floodplains along the main rivers in town and localized flash flooding from intense rainstorms and severe storms. Debris and ice build-up can contribute to the failure of infrastructure (culverts and bridges) during these events. The State of Vermont Hazard Mitigation plan states, "In recent years, flood intensity and severity appear to be increasing."

The most prominent bodies of water in Barre Town are the Stevens Branch River, the Jail Branch River, and the Gunner Brook. As Barre Town is a series of hilltops surrounding the valley all the major water bodies flow into Barre City and eventually feed into the Winooski River. According to the Municipal Plan "slopes (within Barre Town) in excess of 10-15% are not uncommon, and simultaneously serve to enhance the aesthetic appeal of Barre Town while posing environmental planning challenges for development. The challenges run to erosion control, sewage management, site design, road or driveway integrity, surface water run-off and seasonal access." Spring thaws and intense rainfalls impact soil composition, slope and contours. Sections of Lower Graniteville, Websterville Road, East Barre, and Quarry Hill are vulnerable to spot flooding, basement impact, storm sewer over-capacity and road erosion created by the impact of spring thaws and intense rainfall.

The majority of Barre Town's development is located outside of the floodplain. There are 29 structures and 2104 acres in the floodplain with 5 structures in the 100 year boundary and 24 in the 500 year boundary. Fluvial Erosion Hazard (FEH) Zones extend beyond the NFIP floodplain and take into account the movement of a river channel. Within Barre Town, 28 properties lie within a FEH zone. The Town's flood hazard regulations were updated in 2010. The zoning administrator is responsible for enforcement of the flood hazard regulations.

Industrials retention ponds throughout Barre Town present a threat of flooding. Retention Ponds are located at a gravel pit on Quarry Hill Road, at the Rock of Ages Quarry in Graniteville and the former Pike Plant in Websterville. While a data deficit prevents analyzing the specific vulnerability, extent and impact of these industrial retention ponds, these ponds have the potential to over top their banks and cause flooding.

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. Barre Town has experienced firsthand the damage caused by these severe storms.

The topography and extent of several streams and tributaries make Barre Town 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 Barre Town 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. Barre Town does not currently have river corridor regulation or interim regulations. The town's flood hazard regulations incorporated into the local zoning regulations are avoidance–based flood hazard bylaws that regulate development and fill in the Special Flood Hazard Area. The Vermont mapped Fluvial Erosion Areas have not been released yet.

The following chart indicates the history of occurrence with regard to this hazard in Barre Town. Data is local, county-wide and state-wide. Specific data for Barre Town is limited or difficult to obtain. The closest flood gauge is located in Montpelier. Where local data is available it is provided in the History of Occurrences chart. Federal declared disaster numbers are noted where applicable. Data on the fluvial erosion damage in number of acres lost was not found for the events. Fluvial erosion extent data is unavailable. Information to complete the history of occurrences was taken from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center, the FEMA Declared Disasters in Vermont data base, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records.

Flood/Flash Flood/Fluvial Erosion
History of Occurrences:

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
6/29/2017 – 7/1/2017 DR 4330-VT	Flood/Flash Flood	County wide: Washington County; Localized: Barre Town	Heavy rains in 7 counties. 1.35 - 1.45 inches of rainfall in Barre Town with saturated soils resulted in flash flooding causing road washouts. Minor damage to Nuissl Road estimated at<$1,000.
8/16/2016 – 8/17/2016	Flash Flood	County wide: Washington County; Localized: Barre Town	Rainfall totals of 3 to 5 inches in a few hours caused flash flooding in central Washington County.
7/19/2015 7/20/2015	Flash Flood	County wide: Washington County; Localized, Barre Town, Barre City, Plainfield.	Excess of 2" torrential rainfall with training thunderstorms. Flash flooding in Barre & Plainfield. Flash flood warnings w/about an hour lead time for the flooding in Barre and Plainfield. The Gunner Brook drainage basin in Barre & Plainfield received the brunt of the storm, w/ catastrophic flash flooding resulting in road closures & road washouts. Flood waters destroyed roads, bridges & culverts. In Barre, Gunner Brook flooded homes and businesses, leaving a layer of mud, silt & other debris. Barre Town damages to Cummings Road ($35,500 low bid), Plainfield Brook Road ($49,900 low bid), portion of Mitchell Road, & Nuissl Road. Debris removal ($1,105).
4/15/2014 – 4/18/2014 DR 4178-VT	Flood Severe Storms	State-wide County-wide Washington County	Heavy rains & melting snow pack; widespread flooding & release of 4-6 inches of water from snowpack causing many waterways to reach near bankfull conditions across Central VT. Roads & bridges damaged. No specific data for Town of Barre.
6/25/2013-7/11/2013 DR 4140-VT	Flood/Flash Flood/Fluvial Erosion Severe Storms	State Wide; County wide: Washington County; Localized: Barre Town	Numerous showers & thunderstorms with torrential, flooding rains across portions of VT. Rainfall rates of 2 inches/hour. A woman was struck & injured by lightning in Barre. Impact to roads & bridges. A few GMP Customers w/out power. Federal share obligated to Town of Barre was $5,184 with 2 projects.
8/26/2011 – 9/2/2011 DR 4022-VT	Tropical Storm *causing mass, severe flooding and flash flooding, and fluvial erosion.	State-wide County-wide: Washington County Localized: Barre Town	Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet); Statewide rainfall of 3-5 inches with 5-7+ inches in Central VT. Flooding, flash flooding, fluvial erosion across Washington County VT. Winooski River primary river to flood in Washington County. WEC, Inc. & GMP customers without power for prolonged period of time (days). Federal share obligated to Town of Barre was $52,229.82 with 4 projects. Fluvial erosion extent data is unavailable.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
5/27/2011 DR 1995-VT DR 4001-VT	Flood/Flash Flood Severe Storm	County wide: Washington County; Localized: Barre Town	Montpelier flood gauge at 17.59 feet, 3-5" plus of rainfall & severe flash flooding & resultant river flooding as well. Federal share obligated to Town of Barre for severe storm was $227,485.10 with 19 projects.
10/1/2010	significant flood event	County Wide: Washington County	$156,000 property damage in Washington County (adjusted for inflation) per SHMP. No specific data for Town of Barre.
8/01/2008 - 8/2/2008 DR 1790-VT	Flash Flood/ Severe Storm	County wide: Washington County; Localized, Barre Town	3" rainfall on 8/1 with additional heavy rains on 8/2 of 4-5" inches over a 2-3 hour period. Heavy rainfall, a slow moving storm and saturated soils set up conditions for flash flooding across the county. Barre Town's northwestern roads flooded. Flooding was observed over the Jail Branch and its tributaries including Taplin Road in Barre and Route 302 in East Barre. Property damage due to flash flood in Washington County was over $551,515 (adjusted for inflation) per SHMP. Federal share obligated to Town of Barre under severe storm was $66,696.61 with 12 projects.
7/11/2007 DR 1715 VT	Flash Flood	County-wide: Washington County; Localized: Barre Town - East Barre	3"-6" of rain in 2 hours. The hardest impacted areas included Barre. Washed out roads, flooded basements and homes damaged or destroyed, vehicles washed downstream. Routes 302 and 110 in East Barre near former Dugout Restaurant flooded. The former Dugout Restaurant and several homes were flooded with significant flood & structural damage. Federal disaster for 5 counties with estimated storm damage total in excess of 3 million dollars. Property damage in Washington County was over $1,861,052.63 (adjusted for inflation) per SHMP. Federal share obligated to the Town of Barre was $420,272.16 with 9 projects.
5/18/2006 – 5/20/2006	significant flood event	County Wide: Washington County	Two day heavy rainfall event of 2"-4" of rain on very wet antecedent conditions due to previous above normal monthly rainfall. Numerous flooded roads & fields. $79,130.44 property damage in Washington County (adjusted for inflation) per SHMP. No specific data for Town of Barre.
8/12/2004	significant flood event	County Wide: Washington County	$35,862.05 in property damage in Washington County (adjusted for inflation) per SHMP. No specific data for Town of Barre.
12/17/2000	Flood	County Wide: Washington County	3" of rain, $1 M in damages. No specific data for Town of Barre.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
9/16/1999 – 9/21/1999 DR 1307 VT	Tropical Storm Floyd *causing flood/flash flood/fluvial erosion	County Wide: Washington County	Montpelier flood gauge at 9.30 feet, 5”-7” rain county wide. No specific data for Town of Barre. Fluvial extent data unavailable.
6/27/1998 DR 1228-VT	Flash Flood	County Wide: Washington County	$5M in damages, 3”-6” rain across county. Several homes and businesses without power and flooded.
1/19/1996	Flood; ice jam	County Wide: Washington County	Montpelier flood gauge at 14.64 feet. Roads washed out, power outages. No specific data for Town of Barre.
8/4/1995	Flood	County Wide: Washington County	Montpelier flood gauge at 6.94 feet; $1.5M damages county wide. No specific data for Town of Barre.
8/5/1976 DR 518-VT	Flood	County Wide: Washington County	Montpelier flood gauge at 12.31 feet. No specific data for Town of Barre.
6/28/1973 – 6/30/1973 DR 397 VT	Flooding/ Flash Flood	State wide; County Wide: Washington County	Montpelier flood gauge at 17.55 feet. As much as 6 inches of rain within 24 hours in some areas. Damage estimated at 64 million (1973 dollars). Town of Barre specific data not available.
9/22/1938	Flood, Hurricane	County Wide: Washington County	Montpelier flood gauge at 14.11 feet. No specific data for Town of Barre.
11/02/1927-11/04/1927 (Flood of 1927)	Flood	County Wide: Washington County	Montpelier flood gauge at 27.10 feet. One of VT’s worst disasters. Heavy rain, 4-9 inches statewide, fell on frozen ground. Damage and loss of live occurred with 84 deaths, over 1,000 bridges taken out, over 600 farms and businesses destroyed, and miles of roads and railways claimed. No specific data for Town of Barre.

Montpelier flood gauge provides the closet extent data for flood levels in Barre Town. During Tropical Storm Irene, the Montpelier flood gauge was 4 feet above flood stage. The worst flooding event in Barre Town's history was the 1927 event; however, exact data from that event is not available. In the 1927 event, the Montpelier flood gauge was at 27.10 feet; however, since the 1927 flood a number of flood control dams have been installed in the region to prevent the same flooding extent. Lesser but more regular flooding occurs in Barre Town, with generally 1 foot of water in areas designated on the areas of concern map. Most flooding is of the flash flooding nature caused by severe storms.

Over the last five years, since Tropical Storm Irene, Barre Town has experienced at least one flood event a year. The most significant flood/flash flood/fluvial erosion event over the past five years to occur in Barre Town with substantial damages was on July 19 and 20, 2015. An excess of two inches of rain with training thunderstorms fell giving less than an hour lead time to the flash flood alerts. The Plainfield Brook Road and Cummings Road were severely damaged and washed out when water overtopped the roads washing out the downstream side of the road banks due to the culverts on each road being jammed tight with woody debris and trees gushing down from the Gunner Brook. Contracts for the work on Cummings Road totaled $35,500 (low bid) and for work on Plainfield Brook Road totaled $49,900 (low bid). The town contracted for immediate debris removal in the amount of $1,105. Portions of Mitchell Road, & Nuissl Road were also damaged. Funds to cover the damages came from the State AOT Town Highway Emergency Fund Program since the event was not a federally declared disaster. During reconstruction, the Town took measures to deter future erosion, create water storage areas, and build headwalls around the culverts to reduce the risk of future damage by flooding/flash flooding. The area was not significantly impacted by the storms in 2016 and 2017 that caused significant damages to other towns in Washington County. The History of Occurrences provides the extent and impact descriptions by event for many years.

In the past, the May 2011 Flood/Flash Flood/Severe Storm event brought 3 to 5 inches or more of rain to the area resulting in severe flash flooding and river flooding. The Barre Town received federal funds for 19 projects. The flash flood event of July 11 – 12, 2007 is one of most significant flooding events in recent history. According to the VT DEC report approximately 4-6 inches of rain fell in a 24 hour period between noon on July 11 and July 12 causing significant stream bank erosion, road embankment and shoulder wash, culverts and bridges to be overtopped and outflanked and enormous amounts of sediment and debris to be deposited along private residential property. According to the Town Engineer, Barre Town sustained damage upward of $690,000 and recalls that many of these locations sustained similar damage following a flood event in 1973. The damages from the July 2007 event are outlined in the 2012 Barre Town Local Hazard Mitigation Plan and are not repeated here.

Barre Town 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 Road Plans and Highway Fund budget are tools and resources that help the town prioritize and implement their strategies. As noted in the Town Plan, 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 and activities. A history of this activity follows as prepared by the Town Engineer, Harry Hinrichsen.

List of Barre Town Road Improvement Projects for Storm Water Mitigation
Updated 10-17-17

2012

- Sterling Hill Box Culvert – 9/2012 - replaced a 36" Diameter metal culvert with a precast 9' x 6' box culvert and stabilized embankments with riprap.
- Farwell St. Paving Grant – improved headwalls for culverts on both inlet and outlets between Nichols and Mekkelsen Rds.
- Cheney Rd. – Performed ditch and stabilization work for culvert outlets near the Apple Blossom intersection. Stone riprap was installed.
- Clark Rd. – Replaced an existing culvert and installed stone liner for the inlet, outlet and ditch near the east side of F. W. Webb.
- Camp St. - Regraded and stabilized the ditch line near #355.
- Middle Rd. – Installed various paved lead-offs and rip rap for the ditch along the northerly side between Meadow Wood Dr. and the Lazy Lions Campground.
- Beckley Hill Rd. – Reshaped ditches on the gravel portion of the road. DPW installed rip rap between the top of the hill and LePage Rd.
- Lyman Rd. – Reshaped ditches on both sides of gravel road and installed rip rap.

2013

- Bonnie & Diane Lanes – July - Repaired washed out section of stone lined ditches – replaced rip-rap with larger stone improved swales and added stone check dams.
- Richardson Rd. – July – Replaced stone lining in ditch area near Cross St. with larger rip-rap after flood damage there.
- Richardson Rd. – replaced culvert under road and stoned inlet and outlet for erosion protection north of Goldsbury Woods
- Sterling Hill Rd. – Stabilized ditch with stone riprap along southerly embankment between entrances for Silver Circle and at outlet for culvert over bank toward brook near House # 121
- Upper Usle Rd. – Stabilized culvert outlet and ditch between Upper & Lower Usle near Blondin residence
- Averill Rd. – Stabilized ditches on both sides with rip rap

2014

- Cutler Corner Rd. – Stabilized ditches on north side with rip rap from Ladd Rd. to Town Line.

2015

- Donahue Road – 2015 - Slip-lined metal culverts with Polyethylene pipe and improved with stone headers and or wingwalls.
- Littlejohn Road – 2015 - Slip-lined 48" metal culvert with Polyethylene pipe and improved embankment with stone header and stabilized erosion blanket with seed & mulch.
- Mitchell, Plainfield Brook, & Cummings Rds. – September 2015 – Repaired sections of roads damaged by flooding. The Town stabilized embankments, installed new headwalls, reinforced stream channels, installed stone-lined channels and removed storm debris from the brook area on all three roads.

- Peloquin Rd. – June - stone-lined an existing road ditch. Installed a storm water overflow for Bonnie Lane along the length of Peloquin Rd. Redirected a section of Peloquin Rd. ditch to a new outlet and stone-lined the new outlet that lead more directly to the brook near Holden Rd.
- Silver Circle – recovered drainage outlet and used riprap to stabilize outlet on southwest corner of Silver Circle near # 42.

2016

- Graniteville Rd. – July – stone lined ditch on south side of road in Lower Graniteville between Church Hill and McLeod Hill Rds. as part of a Class 2 Road Grant.
- Miller Rd. Ext. – Reestablished and stabilized drainage at several locations including Isabelle Rd., Cedar Cliff, and Sunrise Rd. Regraded and reshaped ditches at filed inlet structures between Sunrise and West Rd.
- W. Cobble Hill Rd. – Stabilized ditches and placed rip rap on culvert outlets near Philbrook and Meadowcrest Streets.
- Philbrook St. - Replaced culvert on lower end of Philbrook St. – Placed Rip rap at outlet

2017

- September 2017 – Peloquin Rd. - slip-lined an existing 84” Metal culvert with polyethylene pipe. The Structures Grant provided for cast-in-place inlet wing walls and header as well as downstream erosion protection.

Better Roads Grant Work

- Taplin Rd. – B Rds. Program grant - replaced open ditch with catch basins, culvert pipe and stone lining between Sunnyside Dr. and the cross culvert on Taplin near # 259
- Nuissl Rd. – 2017 - Installed a stone header, wingwall inlet for a 36” culvert along with stone lined ditch along much of the upper section of gravel road. DPW also stabilized a steep embankment with Type 2 stone armor.

Historical channel management activities, floodplain encroachments, adjacent land use practices and/or changes in watershed hydrology associated with conversion of land cover and drainage activities, within and beyond the NFIP floodplain, have frequently been documented to have devastating consequences. The Barre Town Local Hazard Analysis Map 2017 identifies areas that have experienced flooding in the past. The 2010 flood regulations establish development standards for the SFHA in an effort to reduce the risk of flood damage and maintain the floodplain area to receive waters.

The following matrix provides an overview of the hazard:

FLOOD/FLASH FLOOD/FLUVIAL EROSION HAZARD OVERVIEW

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 event	Strength or magnitude and general details of the most notable event(s)	Dollar value or percentage of damages	Likelihood of hazard occurring based on past events: Unlikely: <1% probability of occurrence in the next 100 years. Occasionally: 1-10% probability of occurrence pre year, or at least one chance in next 100 years. Likely: >10% but <100% probability per year, at least 1 chance in next 10 years. Highly Likely: 100% probable in a year.
Flood/Flash Flood/ Fluvial Erosion	In most areas where roads cross waterways, including bridges and culverts. Areas of steep slopes. Areas of most concern include: Sterling Hill Drainage area, McLeod Hill Road, Graniteville Road, Holden Road, Darshir Lane, Nuissl Road, Gunner Brook, Peloquin Rd., Cummings Road, Quarry Hill Rd., Industrial retention ponds including quarry holes.	Town road infrastructure: bridges, culverts and low lying roads. Existing 29 structures and 2104 acres in SFHA.	July 19-20, 2015 Flash Flood- 2" severe intense torrential rainfall w/ training thunder-storms w/in hrs. < than 1 hour flood alert warning TS Irene - 8/26/2011 - 9/2/2011; Major.3-4 inches rain, Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet); May 2011 - Flash Flood - Major. Montpelier Flood gauge at 17.59 ft., 3-5 plus inches rain. July 2007 - Flash Flood. Major. 3-6 inches of rain over a 2 hour period. Extent data for fluvial erosion is unavailable.	2007 flood-damages >$690,000 2011 flood damages = $300,000 8/26/2011-9/2/2011 damages federal share obligated 4 projects, $52,229.82 5/27/2011 damages federal share obligated >$227,485.10 w/19 projects 7/19-7/20/15 Flash flood $86,505	Likely – Highly Likely

5.3 Moderate Threat Hazards
Extreme Cold/Winter Storms/Ice Storms/Heavy Snow

Vermont is known for its cold snowy winters and Vermont towns and their residents are generally equipped to handle this weather. It is when the winter weather becomes extreme that a hazard is created. Severe winter storms bring heavy snow loads, ice, damaging winds, dangerous wind chills, below zero temperatures, power outages, downed trees and power lines, collapsed roofs and buildings, stranded motorists and vehicles, road closings, restricted transportation, and school and business closings.

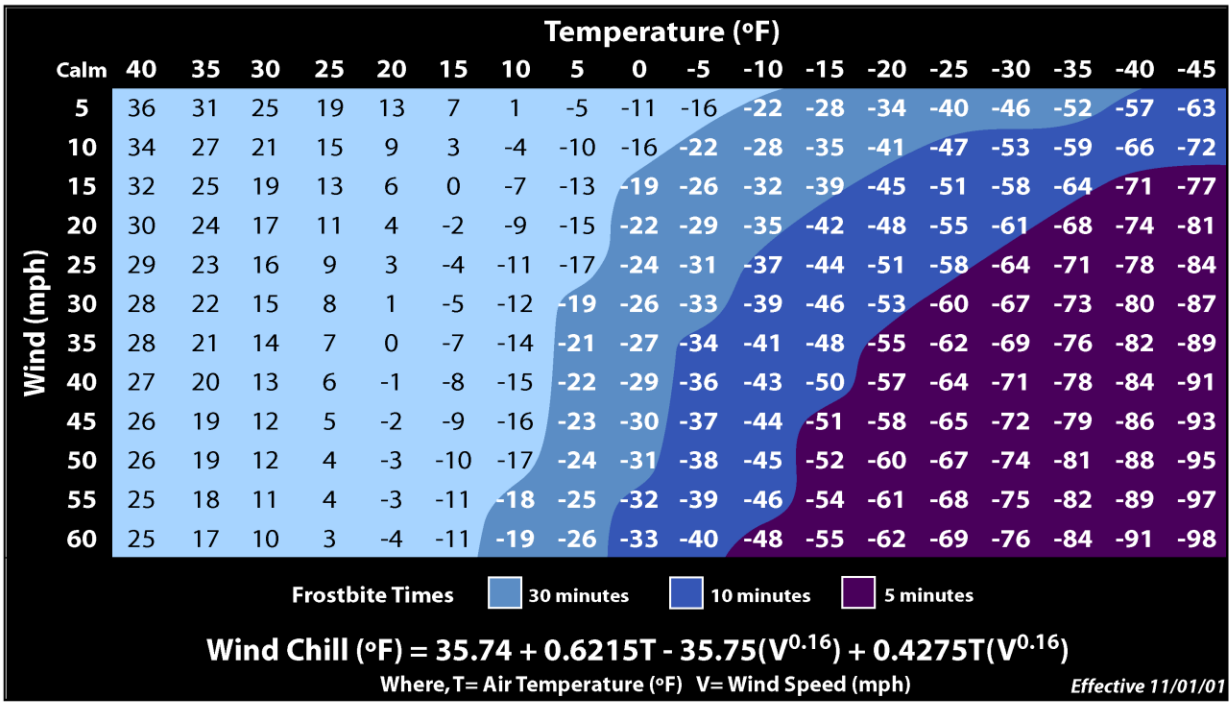
The physical impacts of winter storms are town wide due to the expansive nature of winter storms. A winter storm is defined as a storm that generates sufficient quantities of snow, ice or sleet to result in hazardous conditions and/or property damage. Ice storms are sometimes incorrectly referred to 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.

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.

NOAA defines Heavy Snow as generally snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less. In forecasts, snowfall amounts are expressed as a range of values, e.g., "8 to 12 inches." However, in heavy snow situations where there is considerable uncertainty concerning the range of values, more appropriate phrases are used, such as "...up to 12 inches..." or alternatively "...8 inches or more...” A Blizzard is defined as conditions that are expected to prevail for a period of 3 hours or longer that involve sustained wind or frequent gusts to 35 miles an hour or greater; and considerable falling and/or blowing snow (i.e., reducing visibility frequently to less than a ¼ mile).

Vermont is known for cold winter temperatures. Extreme cold is arctic air, together with brisk winds, that can lead to dangerously cold wind chill values. People exposed to extreme cold are susceptible to frostbite in a matter of minutes. Areas most prone to frostbite are uncovered skin and the extremities, such as hands and feet. Hypothermia is another threat during extreme cold. Hypothermia occurs when the body loses heat faster than it can produce. Wind chills can be life threatening. The wind chill temperature is how cold a person or animal feels when outside. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As wind increases, it draws the heat from the body through exposed skin and reduces the body’s skin temperature and eventually the body’s core temperature. Often times exposed skin can freeze within minutes of exposure.

Wind Chill Chart



The NOAA website at http://www.nws.noaa.gov/om/cold/wind_chill.shtml provides a wind chill chart (above) and states, "the National Weather Service (NWS) Wind Chill Temperature (WCT) index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. The index does the following:

- Calculates wind speed at an average height of 5 feet, the typical height of an adult human face, based on readings from the national standard height of 33 feet, typical height of an anemometer
- Is based on a human face model
- Incorporates heat transfer theory based on heat loss from the body to its surroundings, during cold and breezy/windy days
- Lowers the calm wind threshold to 3 mph
- Uses a consistent standard for skin tissue resistance
- Assumes no impact from the sun, i.e., clear night sky."

Barre Town experiences frequent occurrences of severe winter storms, extreme cold temperatures, heavy snows, and ice storms. Barre Town 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 - 1998. Information to complete the history of occurrences was taken from the NOAA NCEI, FEMA Declared Disasters in Vermont database, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records.

Extreme Cold/Winter Storms/Ice Storms/Heavy Snow
History of Occurrences

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
3/14/2017-3/15/2017	Winter Storm	Statewide, County wide, Washington County	Major Nor'easter with heavy intense snowfall. Snowfall totals across Washington County generally ranged from 14 to 24 inches with isolated higher totals. Blizzard conditions during heaviest snow fall. Snow rates at times 4-5 inches/hour. Numerous schools, businesses & local government offices closed, & numerous vehicle accidents & stranded vehicles. WC property damage 25K per NOAA.
2/1/2015-2/28/2015	Extreme Cold	Statewide, County wide, Washington County; Localized: Barre Town	In February, many sites recorded 15 to 20+ days below zero & on several days, dangerously cold wind chills of 30 below zero or colder occurred. Record Cold February 2015 for much of Vermont. Many communities witnessing the coldest month since December 1989 or January 1994. The average departure was 13 to 17 degrees below normal. Damage to infrastructure, frozen water mains, etc. totaled at least $1 million. 1/15/15 - 2/28/15 $2,300 four to five main lines freeze ups Websterville Fire District #3 (VT0005247), 3/18/15 Mill Street $1,882; 4.5 hours to repair (VT0005566)
1/7/2015-1/8/2015	Extreme Cold	Statewide, County wide, Washington County; Localized: Barre Town	15 below to 25 below zero in Washington county; with winds of 15 to 30 mph that created wind chills colder than 20 to 30 below zero through the overnight into the morning hours of January 8th. School opening delays; Frozen water mains - 1/2/15 Platinum Plain $2,966 8 hours to repair (VT0005566)
12/9/2014-12/13/2014 DR-4207-VT	Winter Storm	County wide, Washington County; Localized – Barre Town	Heavy, wet snowfall totals across Washington county ranged from 6 to 24 inches. 12 inches in Barre. Snow to water ratios of 8:1 or less accounted for snow-loaded trees that resulted in more than 175,000 power outages in the region from December 9th through December 12th This was the 2nd most power outages due to weather in the state of Vermont. Many vehicle accidents as well. FEMA Total PA obligated statewide $3,949,028.57.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
11/26/2014-11/27/2014	Winter Storm	County wide, Washington County	Snowfall totals of 8 to 14 inches. No specific snowfall data for Barre Town. Numerous vehicle accidents occurring with heavy holiday commuter traffic.
3/12/2014-3/13/2014	Winter Storm	Statewide, County wide, Washington County	Snowfall totals across Washington County generally 12 to 20+ inches. No specific data for Barre Town. Strong winds drifting blowing snow; gusts up to 35-40mph. Numerous motor vehicle accidents, school & business closures. Property damage 40K per NOAA.
2/13/2014	Winter Storm Heavy Snow	Statewide, County wide, Washington County	Heavy snowfalls 10 "– 24" throughout Washington County at rates of 1-2+ inches an hour. No specific data for Barre Town.
12/26/2012-12/28/2012	Winter Storm	County wide, Washington County	Snowfall accumulations of 12" to 18". Numerous vehicle accidents. 20K property damages per NOAA. No specific data for Barre Town.
11/23/2011	Winter Storm; Ice Storm	County wide, Washington County	Five to twelve inches of a heavy, wet snow mixed with rain, freezing rain, & sleet. Numerous vehicle accidents during the morning commute as well as isolated to scattered power outages due to wet, heavy snow bending or breaking tree limbs onto power lines. No Barre Town specific data.
3/6/2011-3/7/2011	Winter storm Ice Storm	County wide, Washington County; Localized – Barre Town	Heavy rain changed to heavy sleet & then wet snow. 15" to 30" of snowfall reported in Washington County with ice accumulation up to 1/4 inch in Central Vermont. Rapid snowmelt & heavy rainfall accounted for ice-covered rivers to swell & cause ice flows. Several reports of ice jams & flooding related problems in the Winooski river valley (see Flood chart). Roads impassable, numerous accidents & stuck vehicles; portions of I89 closed multiple times. Burlington Int'l Airport closed from midday on the 6th to midday on the 7th. Nearly 10,000 customers lost electrical power; nearly all school districts were closed on the 7th along with local/state governments. Slightly more than a dozen dairy farms lost milk production due to trucks unable to reach farms and production facilities. Washington County 25K Property damage, 20k Crop damage per NOAA.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
2/5/2011-2/6/2011	Winter Storm Ice Storm	State wide; County wide, Washington County	Quick-hit storm w/snowfall rates up to 3 in./hr. heavy wet snow (8:1 snow/water ratios) along with sleet, freezing rain & 10 to 15 minutes of thundersnows; snowfall accumulations of 6 to 10 inches. Snow depths (and Snow water equivalents) after this storm were generally 18 to 30 inches (4 to 6 inches in the valleys with 36 inches or greater across the higher terrain). Heavy snow loads;~ dozen structure failures of garages, barns & carports; injured or killed livestock. No specific Barre Town data.
2/2/2011	Winter Storm	State wide; County wide, Washington County	Snowfall across Washington County 10 - 20 inches; rate in excess of 2"/ hour at times. No specific data for Barre Town
4/27/2010-4/28/2010	Winter Storm	County wide, Washington County	Accumulations of a heavy, wet snow ranged from 4 to 12 inches in the valleys, 10 to 24 inches above 800 feet elevation. Heavy wet snowfall caused numerous downed tree limbs, branches & trees causing scattered power outages affecting over 20,000 customers. Property damage in WC per SHMP was $26,000 (adjusted for inflation)
2/23/2010 – 2/25/2010	Winter Storm	County wide, Washington County; Localized – Barre Town	20 inches heavy wet snow. 50,000 customers without power. Property damage in WC $260,000 (adjusted for inflation) per SHMP.
2/22/2009 – 2/23/2009	Winter Storm	County wide, Washington County; Localized – Barre Town	16" snow BT, 10 to 18 inches across much of central & eastern VT. 10-20 mph winds w/wind gusts to 30 mph. Considerable blowing & drifting of snow impacting travel across the region.
1/14-2009-1/18/2009	Extreme Cold	State wide; County wide, Washington County	Temperatures dropped over 20 degrees within several hours. Minimum temperatures during period 10-30 degrees below zero. Isolated readings > 40 below zero. Max. temps. during period: single digits above & below zero. Numerous cold weather related problems including dead vehicle batteries & broken home/business water pipes.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
12/11/2008-12/12/2008	Winter Storm mix Ice Storm	County wide, Washington County	Snow changing to freezing rain, freezing drizzle,& sleet, then back to snow across central & northern VT. Combined snow & sleet accumulation ranged from 5 to 9 inches along with a glaze coating of ice. This storm caused hazardous driving conditions, numerous school closings, civic and government closings, and power outages. Property damage in Washington County $45,084.18 (adjusted for inflation) per SHMP. No Barre Town Specific data.
2/1/2008	Winter Storm mix; Ice Storm	County wide, Washington County; Localized – Barre Town	3-7" of snow, ¼ - ½ Inch thick ice accumulation, & wind gusts up to 50 mph. Significant wintry mix of snow, sleet & freezing rain across portions of north central & northeast VT. Power outages, hazardous road conditions, numerous vehicle accidents, & multiple school, civic and government closings on February 1st. Property damage of 15K per NOAA.
3/9/2007	Extreme Cold	State wide; County wide, Washington County	Frigid temperatures. Morning lows 10 to 34 degrees below zero
3/5/2007-3/6/2007	Extreme Cold	State wide; County wide, Washington County	Frigid temperatures & blustery winds. Temperatures 10 to 30 degrees below zero. Winds of 15 to 30 mph created dangerously cold wind chills of 20 to 40 degrees below zero
2/14/2007	Winter Storm, Heavy Snow	County wide, Washington County; Localized – Barre Town	22" of snow BT. Heavy snowfall 20-35 inches regionally. Snowfall rates of 2 to 4 inches/hour w/brisk winds of 15 to 25 mph, whiteout conditions, considerable blowing and drifting of the snow, making roads nearly impassable. Wind chill values of 10 degrees below zero or colder. The deep snowfall and deeper snow drifts (4-6+ feet) caused numerous problems, including blocked heat vents that resulted in the build-up of carbon monoxide & sent dozens of people seeking treatment at area hospitals. Indirect injuries included vehicle accidents & cardiac arrests due to overexertion during snow removal. Snow removal operations took several days. Partial or total collapse of 20 + barn roofs & the deaths of >100 cattle in VT. Property damage in Washington County (adjusted for inflation) $237,192.99 per SHMP.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
1/25/2007-1/29/2007	Extreme Cold	State wide; County wide, Washington County	0 to 25 degrees below zero; brisk NW winds 10 to 15 mph & temps. Wind chills 25 to 40 degrees below zero.
10/25/2005-10/26/2005	Winter Storm	County wide, Washington County	Rain changing to wet heavy snow, accompanied by gusty winds. 8 to 14 inches total snowfall. With foliage still on the trees, the weight of the snow easily took many trees & tree limbs down with extensive power outages. Thousands were without power. Numerous traffic accidents were reported. Property damages in Washington County $115,555.56 (adjusted for inflation) per SHMP.
2/10/2005	Winter Storm	County wide, Washington County;	Across north central & northeast VT, snowfall accumulations were generally between 10 and 20 inches. Power outages were reported. No specific Barre Town data. WC property damage $25,422.22 (adjusted for inflation) per SHMP.
1/13/2004-1/16/2004	Extreme Cold	State wide; County wide, Washington County	Wind chills 25 -45 below zero.
12/14/2003-12/16/2003	Winter Storm	Orange and Washington counties	Orange & Washington counties, snowfall accumulations 10-20 inches. Minor traffic accidents. No specific Barre Town data. Washington County Property damages of $37,142.86 (adj. for inflation) per SHMP.
12/06/2003-12/07/2003	Winter Storm	County wide, Washington County;	Snow accumulations 12 - 20 inches. Numerous, mostly minor traffic accidents. Property damage 20 k per NOAA.
1/4/2003	Winter Storm	County wide, Washington County; Localized – Barre Town	19” snow BT, (region range 12 -20 inches). Roads were treacherous. Numerous minor traffic accidents. Property damage (adjusted for inflation) per SHMP at $49,523.81
3/30-3/31/2001	Winter Storm	Washington, Orange and Windsor Counties	Wet heavy snow fall 10-20”. Some power outages & slippery roads, minor accidents. No Barre Town specific data.
3/22-3/23/2001	Winter Storm	County wide, Washington County	Heavy, wet snow generally 7 to 25 inches; > in mountains. Power outages reported & numerous accidents. Property damage 50K (NOAA)
3/5/2001-3/7/2001 DR/EM 3167-VT	Winter Storm	County wide, Washington County; Localized – Barre Town	15” - 30” of snowfall. Closed schools & vehicle accidents. In Barre a roof collapsed under likely snow load.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
3/21/1998 – 3/22/1998	Heavy Snow	County wide, Washington County	Snow accumulations generally 15 to 20 inches across northwest & north central VT; 12" elsewhere. No specific data for Barre Town.
3/14/1998-3/15/1998	Heavy Snow	County wide, Washington County	complex pattern of snow accumulations across VT, with the heaviest snowfall in & east of the Green Mountains. 14" in central region. A number of traffic accidents were reported.
1/15/1998	Winter Storm	County wide, Washington County; Localized – Barre Town	10-12" snow (not a DR in Washington County)
12/29/1997	Winter Storm	County wide, Washington County; Localized – Barre Town	21" of snow
12/7/1996	Winter Storm	County wide, Washington County; Localized – Barre Town	12" of snow
3/21/1994	Winter Storm	County wide, Washington County; Localized – Barre Town	5-11" of snow
11/1/1993	Winter Storm	County wide, Washington County; Localized – Barre Town	15" of snow
1/3/1993	Freezing Rain	County wide, Washington County; Localized – Barre Town	¼-1/2" freezing rain

During the many winter storms, ice storms, and extreme cold, Barre Town 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, increase medical needs due to over exertion with clean up and snow removal, falls often with broken bones due to icy surfaces, vehicular accidents, collapsed structures from heavy snow and ice loads, frozen culverts and more.

To lessen the impact of snow, ice and sleet, and below freezing temperatures on the Town of Barre and its residents it is important that the community observe winter storm watches and warnings and take adequate preparations. The Town and State are well equipped and experienced to deal with winter conditions and snow/ice removal. 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. The town has wired the main emergency shelter at the Barre Town Middle and Elementary School to accommodate a generator. The town and school are working together to fund the purchase and installation of a generator at the facility to upgrade and

enhance its capacity as the town's emergency shelter. The town will need to seek grant funding to support the project. The Town encourages residents who are in remote locations to be equipped with generators and backup fuel, 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.

Green Mountain Power and Washington Electric Coop, Inc. follow a regular tree-trimming schedule and line-clearing program that has reduced the number and severity of power outages in the community. The lack of power and telecommunications throughout the town is especially concerning for the most vulnerable populations; the elderly, disabled and medically dependent. Lack of access to power and telecommunication services can hinder response efforts.

Barre Town has equipment to thaw frozen culverts and other town infrastructure. 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. Over the last five years the town installed a generator at the Public Works Garage for back up to run the fuel pumps in the case of a power outage. The fuel pumps provide fuel to all the town departments for their equipment and vehicular needs. Other town critical facilities such as the Emergency Operations Center housed at the Town Offices, the Police Department and the Fire Stations are equipped with generators.

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.

It remains true now as it did in 2012, based on past occurrences, the worst anticipated winter weather Barre Town could experience would be 2 to 3 feet of snowfall in a 24 hour period with more totals at higher elevations and several days of power outages. Using the wind chill scale and historical information, the estimate for extreme cold is negative 60 degrees Fahrenheit. 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. FEMAs total Public assistance grant funds obligated to the state was $3,949,028.57. Extreme cold in 2015 caused damage to water supply mains in the Websterville Fire District #3, Mill Street, and the Platinum Plain water supply system, freezing and bursting pipes. Damages totaled over $7,000 dollars. 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. Additional labor to clear the debris from roads and open them up again could be a task of an organized citizen town volunteer group, an action/strategy to be explored in this Plan.

Extreme Cold/ Winter Storm/Ice Storm/Heavy Snow
Overview of Hazard

Hazard	Location	Vulnerability	Extent	Impact	Probability
Extreme Cold/ Winter Storm/ Ice Storm/ Heavy Snow	Town-wide, all roads, utility poles and lines, Town Forest, Private woodlots/ timber stands, private residences and businesses, Fire Districts and other water supply systems, public infrastructure	Elderly & handicapped populations, remote structures, old/under insulated structures, public infrastructure and utilities, telecommunications, trees, school system.	February 2015 – 15 – 20 days below zero with wind chill of -30 º below zero 12/9/2014 - 12/12/2014 DR 4207 VT 12 inches very wet heavy snow; 3/6-3/7/2011 event 15-30" of snow/ 4" ice accumulation Feb. 14, 2007 event 22" snow in Barre Town, wind chill 10º below zero;	February 2015 – $1M statewide property damage frozen infrastructure, frozen culverts, over $7,000 in damages to water supply systems in Barre Town 12/9/2014 -12/12/2014 DR 4207 VT: statewide Federal obligation $3,949,028.57; 175,000 power outages; roads closed, numerous accidents, schools closed, and building collapses. A data gap exists for Barre Town. 3/6-3/7/2011 event 10,000 customers without power; all schools closed, roads closed/impassable, Data gap exists for Barre Town. Feb. 14 2007 event: property damages data gap exists for Barre Town. Impacted sheltering, travel, schools, plowing, highway budget, emergency services, power, and communications.	Likely to Highly Likely

SEVERE STORMS (Lightning, Thunderstorm Winds, High Winds, Hail, Heavy Rain):

According to NOAA, severe weather is a destructive storm or weather that usually is applied to local, intense, and often damaging storms such as thunderstorms that must include winds of 58 mph (50 knots) or greater, hail storms one inch in diameter or greater, and tornadoes, but it can also describe more widespread events such as tropical systems, blizzards, nor'easters, and derechos. A thunderstorm wind equal to or greater than 40 mph (35 knots or ~64 km/h) and/or hail of at least ½" is defined as approaching severe. The Town of Barre has defined severe storm as the occurrence of lightning, thunderstorm winds, high winds, hail, and heavy rain.

Lightning produces thunder. Lightning is the electrical charges in the atmosphere between clouds, the air, or the ground. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges builds up enough, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning (as defined by NOAA). The discharge of electricity produces light (lightning) and sound (thunder). Lightning can kill, cause forest fires, and damage property. Barre Town has had persons and property structures struck by lightning.

Thunderstorms, further defined in the Vermont State Hazard Mitigation Plan as follows, "Thunderstorms range in size and type. An ordinary cell thunderstorm consists of one cell with an updraft and downdraft and produce strong winds, rain, lightning, and even hailstones. Multicell cluster thunderstorms consist of several ordinary cell thunderstorms in the vicinity of each other. Multicell cluster thunderstorms are extremely prone to causing flash flooding. Squall line thunderstorms move in a linear front that can exceed 100 miles in length, with the strongest rains and winds at the front of the storm. Supercell thunderstorms are the largest, longest lasting, and most devastating thunderstorms. Nearly all tornadoes are formed from supercell thunderstorms. Supercell thunderstorms can also form hailstones larger than golf balls. These Supercell storms have a clockwise rotating winds that exacerbate the storm. Lightning, hail, flash flooding, and tornadoes are all associated with this type of thunderstorm." Thunderstorm activity in Barre Town causes power outages, damaging winds, hail, flooding and transportation and economic disruptions, particularly from blown down trees. Thunderstorms can generate high winds and down hundreds of large trees within a few minutes. According to the Vermont State Hazard Mitigation Plan, thunderstorms are the most prevalent hazard event occurring in Vermont and "severe summer thunderstorm winds occur more frequently than any other natural hazard incident within Vermont."

High Winds are usually associated with severe thunderstorms in Vermont. When winds are sustained at 31 to 39 mph for at least an hour or any gusts at 46 to 57 mph, the National Weather Service will issue a wind advisory. If winds reach 58 mph or more, the National Weather Service will issue a High Wind Warning. The National Weather Service has classifications for hurricane and tropical storm winds, which can be found in the Saffir-Simpson Scale graphic found later on in this Plan as well as the Beaufort Wind Chart used to estimate wind speeds. High winds cause damage to property and personal safety, and are a concern for the electrical and telecommunication utilities in Washington County and throughout the state due to customer power outages and damage to infrastructure.

Beaufort Wind Chart – Estimating Winds Speeds

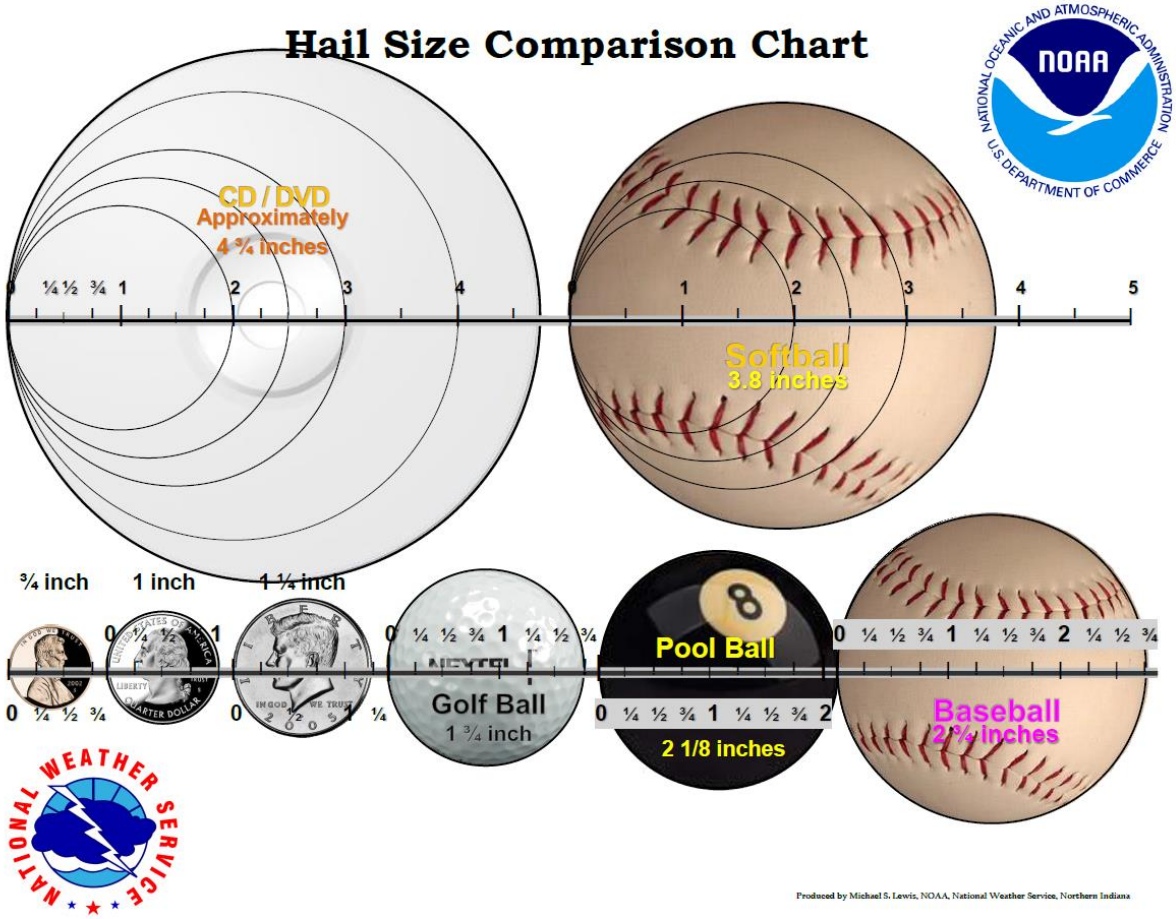
Beaufort Number	MPH Range	MPH Average	Terminology	Description
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	15	Moderate 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

Hail is defined in the Vermont State Hazard Mitigation Plan as, “a form of precipitation composed of spherical lumps of ice. Known as hailstones, these ice balls typically range from 5-50 mm in diameter on average, with much larger hailstones forming in severe thunderstorms. The size of a hailstone is a direct function of the severity and size of the thunderstorm that produces it.” Hail is known to cause devastating crop damage, property damage, and bodily injury if one is struck. NOAA has created a diagram to help visualize the size of hail in relation to common items like a softball or golf ball or coins as depicted below.

<u>Guide for determining hail sizes:</u>

less than 0.50" Pea
0.50" - Marble/Mothball
0.75" - Dime/Penny
0.88" - Nickel
1.00" - Quarter
1.25" - Half Dollar
1.50" - Walnut/Ping Pong
1.75" - Golf Ball
2.00" - Hen Egg
2.50" - Tennis Ball
2.75" - Baseball
3.00" - Tea Cup
4.00" - Grapefruit
4.50" - Softball



The high winds and hail produced by severe thunderstorms can damage crops, trees, structures, and property. High winds and hail tend to be localized but can cause significant damage and loss, especially to farmers and woodlot owners who can lose their whole crop in a single event. In Vermont, hail storms have seen hail the size of .75 inches up to 3 inches and hail the size of 1.5 inches is not uncommon. High winds during thunderstorms have been common in Washington County causing numerous downed trees and power outages. Most recently, Barre Town sustained substantial damage from thunderstorm winds during the June 2013 storm with 55 knot winds which downed numerous trees and caused widespread power outages. At the peak of the storm, 20,000 customers in Washington County were without power. The May 26- 27, 2011 severe storm with hail and thunderstorm winds was a federal declared disaster (DR 4001-VT). Barre Town reported 50-knot winds and 1-inch hail with numerous downed trees and power outages. Barre Town received $227,485.10 for 19 projects as the federal share of obligated funds. On August 25, 2007, Barre Town was one of the hardest hit communities in Washington County by the severe storm and thunderstorm winds of 70 mph (61 knots) and 1 inch hail. Earlier that same year in July, a severe storm and thunderstorm winds came through the area causing damages and was declared a federal disaster (DR 1715-VT). Barre Town received a federal share of $420,272 in obligated funds for damages.

In 1999, Tropical Storm Floyd passed through Vermont. The primary impact from Floyd was downed trees and power lines due to high winds. Approximately 3,000 people were without power in the Central Vermont Region. About 51/2 - 6 1/2 ” of rain fell over Central Vermont; however, flood impacts were offset by drought conditions from earlier in the year. There were no high wind impacts associated with the 2011 events of Tropical Storm Irene and the May 28, 2011 storm.

Barre Town has forested areas both in public and private ownership. High winds threaten the viability and productivity of this cash crop and can affect the local economy. Downed trees can make transportation corridors impassable and cut power service to town residents and neighboring communities. Lightning, with the potential for strikes to the trees within the forested area, also threatens this resource.

The impact of severe storms can be flood related. Heavy precipitation associated with thunderstorms often causes flash flooding due to the large amount of precipitation over a short period of time coupled with the mountainous and steep terrain of Vermont. Barre Town has experienced 2 – 5 inches of rain during severe storms. In Vermont, severe thunderstorms occur most often in the spring and summer. Damage from flooding is covered under the Flood/Flash Flood/Fluvial Erosion hazard threat of this Plan and can include property and structure damage, erosion, and loss of life. Flash floods cause rapid rises in water levels with little time to prepare but generally recede quickly. The worst flood event was the 1927 storm when the Winooski River in Montpelier was 12 feet above flood stage. Some extent data for Barre Town is derived from the Montpelier flood gauge. Several severe storm related disaster declarations have taken place over the past five years that include Washington County (see history of occurrences chart). Barre Town has experienced flash flooding on numerous occasions over the years and has a high likely hood of this occurrence to continue.

Information to complete the history of occurrences for severe storms was taken from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center, FEMA Declared Disasters in Vermont database, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records. The extent of severe storms is not well documented in the Town of Barre.

SEVERE STORM (Lightning, Thunderstorm Winds, High Winds, Hail, Heavy Rain)
History of Occurrences

Date and Disaster Declaration # if applicable	Event (by FEMA Classification)	Location	Extent and Impact
9/11/2016	Thunderstorm Wind	County wide, Washington County; Localized, Barre	Scattered severe thunderstorms knocked down numerous trees & utility lines; caused subsequent power outages. In addition, numerous cloud to ground lightning strikes caused power outages. Winds 50 knots.
6/2/2013	Thunderstorm Wind	County wide, Washington County; Localized, Barre	55 knot winds. Numerous trees downed by thunderstorm winds in Barre. County wide, widespread thunderstorms with pockets of damaging winds and large hail. At the peak of the event, roughly 20,000 customers had lost power.
5/29/2012	Lightning	County wide, Washington County; Localized, Barre	Numerous thunderstorms with heavy rain, damaging lightning & some isolated large hail & strong winds. Some of these thunderstorms deposited up to 2 inches of rainfall in portions of north-central and northeast Vermont. House fire caused by lightning strikes in Barre.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
7/06/2011	Thunderstorm Winds	County wide, Washington County	50 knot winds; 15,000 people in VT lost power. No specific data for Barre.
5/26/2011 – 5/27/2011 DR 4001-VT	Severe Storm, Hail, Thunderstorm Winds	County wide, Washington County; Localized, Barre/East Barre	50 knot winds & 1 inch, quarter size hail reported in Barre; damaging winds & very large hail (up to 2.5 inches in diameter) in region. Some 25,000+ customers lost power during these storms. In addition, several rounds of thunderstorms traversed the same areas in central Vermont near the Route 2 corridor between Middlesex and Lunenburg. The end result of 3 to 5+ inches of rainfall and severe flash flooding and resultant river flooding as well. (See flash flood/flood chart). Scattered severe thunderstorms and localized flash flooding and winds of 50 knots continued on 5/27. Scattered trees down reported in Barre. Federal share of obligated funds for Barre Town $227,485.10 for 19 projects.
2/26/2010	High wind	Statewide, County wide, Washington County	Winds 50 knot winds. Strong easterly winds of 80 to 100 mph with 45 to 60+ mph wind gusts. Numerous communities witnessed downed tree limbs, branches and some trees that resulted in downed power lines and power outages. Power outages in Vermont ranged from 20,000 to 40,000 customers. No Barre Town specific data
7/21/2008-8/12/2008 DR1790	Severe Storm	State wide, County wide, Washington County; Localized, Barre	Barre Town share of federal obligated funds $66,696.61 with 12 projects.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
8/25/2007	Thunderstorm Winds	County wide, Washington County; Localized, Barre	Estimated 70 mph (61 knot) wind gust. Intense severe thunderstorms with 1 inch quarter size hail. Widespread damaging winds and some large hail across central, southern and eastern Vermont. Barre was one of the hardest hit communities. Numerous trees and power lines down, as well as structural damage due to fallen trees throughout Barre and Berlin due to estimated winds around 70 mph. Some of the streets affected included Main street, Merchant street, Airport road as well as portions of Route 14 and Route 62. 100K in property damages per NOAA.
7/9/2007-7/11/2007 DR 1715-VT	Severe Storm, Hail, Thunderstorm Winds	County wide, Washington County; Localized, Barre/East Barre	Numerous areas of thunderstorms occurred across the region with a wide variety of weather conditions, which included very large hail (quarter to golf ball size hail; baseball size hail in Duxbury), damaging winds and several structures struck by lightning. Lightning struck a house in Barre. In Washington County property damage of $21,894.74 (adjusted for inflation) per SHMP. Barre Town federal share of obligated funds $420,272.16.
6/02/2007	Hail, Thunderstorm Winds	County wide, Washington County; Localized, Barre/East Barre	55 knot winds and .88 inch hail, nickel size hail reported in East Barre. 3/4" to golf ball size hail reported countywide. Thunderstorms were locally severe, producing damaging winds that knocked down numerous trees and power lines in Barre.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
9/11/2006	Thunderstorm Winds	County wide, Washington County; Localized, Barre	50 knots. Scattered severe thunderstorms knocked down numerous trees and caused subsequent power outages. In addition, numerous cloud to ground lightning strikes caused power outages. Several trees and utility lines downed by thunderstorm winds.
8/02/2006	Thunderstorm Winds	County wide, Washington County; Localized, South Barre	60 knot winds with scattered thunderstorms. Some of these thunderstorms were locally severe and produced damaging winds that knocked downed tree branches and power lines county wide. In South Barre, numerous trees were snapped, uprooted and knocked down on Wilson street.
6/19/2006	Thunderstorm Winds	County wide, Washington County	50 knot winds. Severe thunderstorms occurred in Washington County. No specific Barre Town data.
2/17/2006	High wind	County wide, Washington County	Winds 37 knots. Sustained winds of 35 to 45 mph with damaging wind gusts in excess of 60 mph. Widespread reports of trees and power lines down, blocking roads and causing structural damage. Barre reported damage. Power outages were widespread across the area, with an estimated 50,000 customers statewide in Vermont without power

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
10/16/2005	High wind	County wide, Washington County	40 knots strong winds. Countywide tree damage was reported. Power outages were reported across the area. No Barre Town specific data
10/15/2005-10/17/2005	Heavy Rain	County wide	2 1/2 to 5 inches rainfall, heavy at times. Pockets of localized minor low land flooding occurred. No Barre Town specific data
10/7/2005-10/9/2005	Heavy Rain	County wide	3 and 4 inches of rain fell enhanced by moisture from the remnants of Tropical Storm Tammy. No Barre Town specific data
9/29/2005	High wind	Washington, Lamoille, Orleans counties; Localized Barre	35 knots, large scale damaging winds estimated at a sustained 35 to 45 mph with higher gusts. Trees and power lines were blown down countywide across the counties of Lamoille, Orleans and Washington, with thousands experiencing power outages at times. In Washington County, trees and power lines were down in the towns of Warren, Barre, Berlin (with a road blocked) and Marshfield.
8/30/2005-8/31/2005	Heavy Rain	County wide	2 and 3 inches rainfall from the remnants of Katrina.
7/8/2005-7/9/2005	Heavy Rain	County wide	1 and 3 inches of rain fell as remnants of Tropical Storm Cindy. 2.15 inches at the Montpelier Knapp State Airport (MPV) set a new daily record for July 9th.
6/9/2005	Thunderstorm Winds	County wide, Washington County	60 knot winds. Power outages and tree damage reported. Very heavy rain also accompanied this storm. No Barre Town specific data.
8/03/2004	Thunderstorm Winds	County wide, Washington County; Localized, South Barre	52 knot winds Thunderstorms in Washington county were severe. In and around the town of South Barre, trees were blown down, and a roof was torn off a duplex by thunderstorm winds. Lawn furniture was also blown around.
11/13/2003	High wind	Washington, Lamoille, Orange counties; Localized Barre	35 knots strong winds. Numerous trees and power lines were blown down.
10/26/2003-10/27/2003	Heavy Rain	County wide	Rainfall ranged from 1 1/2 to 2 1/2 inches with the greatest amounts in and east of the Green Mountains.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
10/15/2003	High wind	Washington, Addison, Rutland counties	50 knots strong winds. Power outages and uprooted trees. No specific data for Barre Town.
7/21/2003	Thunderstorm Winds	County wide, Washington County; Localized, Barre	60 knot winds. Rapidly moving thunderstorms associated with this system resulted in a transport down to the surface of strong upper level winds. In Barre, numerous trees were uprooted. Some structural damage was reported. Power lines were blown down with a number of residents without power.
9/27/2002-9/28/2002	Heavy Rain	County wide	1 1/2 and 2 1/2 inches of rainfall reported as remnants of Tropical Storm Isidore; locally higher in the mountains. Earlier in the month, September 14-15, the remnants of Tropical Storm Hannah resulted in rainfall of around an inch across the same area. No flooding was reported with either event.
6/23/2002	Thunderstorm Winds	County wide, Washington County; Localized, Barre	No specific magnitude data available. A few storms reached severe criteria. Thunderstorms blew down trees in Barre.
2/10/2001	High wind	Washington County; Localized Barre	No wind speed data available. Very windy conditions caused blown down trees and power lines with power outages in the towns of Marshfield, Plainfield, Worcester, Barre and Montpelier.
11/23/1998	High wind	Washington County; Localized Barre	No wind speed data available. Strong southwest winds resulted in downed trees and power lines. Most of the wind damage was reported in the western half of the county, specifically in the localities of Montpelier, Barre, Berlin, Warren and Middlesex where up to 1000 power outages were reported.
6/17/1998 DR1228-VT	Severe Storm	County wide, Washington County;	3-6” of rain, not a historical crest in Montpelier. See flood/flash flood/fluvial erosion chart for further details.
7/15/1997	Severe Storm	County Wide	3-5” of rain
5/19/1982	Thunderstorm winds	Barre Town, County Wide	56 knot winds
7/3/1964	Hail	County Wide	1.5” hail

Overall, as one of Vermont's more prevalent hazards, Barre Town will continue to be vulnerable to severe storms. Barre Town has sustained localized storms with winds up to 50 knots or more, 1 inch or greater hail, and dangerous lightning strikes with many of the storms bringing heavy precipitation of 2 - 5 inches. The severe storms often result in power outages, downed trees, and flooding which will continue to create a challenge for the community. Barre Town has lessened the impacts and the town's vulnerability to the hazard of severe storms with regular roadside tree trimming, mitigation actions and improvements done to its infrastructure to address flooding, and implementation of storm water management projects. Additional labor to clear the debris from roads and open them up again could be a task of an organized citizen town volunteer group, an action/strategy to be explored in this Plan.

Similar to other hazard situations, to lessen the impact of severe storms on the Town of Barre and its residents it is important that the community observe severe storms watches and warnings and high wind advisories and warnings and take adequate preparations. In cases of high winds and thunderstorm winds, providing for the mass care and sheltering of residents left without power for extended periods of time and mobilizing sufficient resources to clear broken tree limbs from roads, are the primary challenges facing community officials. The town has wired the main emergency shelter at the Barre Town Middle and Elementary School to accommodate a generator. The town and school are working together to fund the purchase and installation of a generator at the facility to upgrade and enhance its capacity as the town's emergency shelter. The town will need to seek grant funding to support the project. The Town encourages residents who are in remote locations to be equipped with generators and backup fuel, 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.

The Town equipment is maintained on a regular schedule and the Selectboard with the input from the Road Foreman, budget for equipment replacement. Over the last five years the town installed a generator at the Public Works Garage for back up to run the fuel pumps in the case of a power outage. The fuel pumps provide fuel to all the town departments for their equipment and vehicular needs. Other town critical facilities such as the Emergency Operations Center housed at the Town Offices, the Police Department and the Fire Stations are equipped with generators

Green Mountain Power and Washington Electric Coop, Inc. follow a regular tree-trimming schedule and line-clearing program that has reduced the number and severity of power outages in the community. The lack of power and telecommunications throughout the town is especially concerning for the most vulnerable populations; the elderly, disabled and medically dependent. Lack of access to power and telecommunication services can hinder response efforts.

In the event of thunderstorms producing heavy intense precipitation which can cause localized flooding, Barre Town has lessened the impacts and the town's vulnerability to the hazard of flooding/flash flooding/fluvial erosion with mitigation activities and improvements as noted under the Flood/Flash Flood/Fluvial Erosion section of this Plan.

SEVERE STORMS (Lightning, Thunderstorm Winds, High Winds, Hail, Heavy Rain): Overview of Hazard

Hazard	Location	Vulnerability	Extent	Impact	Probability
Severe Storms (Thunderstorm Winds/ Lightning/ High Winds/ Hail)	Town-wide, all roads, public infrastructure utility poles and lines, Town Forest, Private woodlots/ timber stands, private residences and businesses, farms, Fire Districts and other water supply systems.	Elderly, handicapped, medically dependent populations, remote structures, public infrastructure and utilities, telecommunications, trees, school system, Town road infrastructure: bridges, culverts and low lying roads. Existing Homes in SFHA. Farmers and loggers who earn livelihood from forest products and crops. Business Utility Companies, GMP and WEC.	Winds 50 – 61 knots (57 – 70 mph); Hail – 1 inch to 1¾ inch (nickel to golf ball size hail); 20,000 customers without power county wide; Lightning strikes – 1 Barre person; 2 known residential structures; 2-5 inches of rain; DR.4001 VT – Barre Town federal share of obligated funds =$227,485 with 19 projects, DR 1790 VT – Barre Town Federal Share of obligated funds =$66,696 with 12 projects. DR 1715 VT- Barre Town federal share of obligated funds = $420,272.	Numerous trees blown down blocking roads and onto power lines causing power outages. House fires caused by lightning strikes. Personal injury due to lightning strike. Flash flooding damaging public infrastructure and private property. Damage to woodlots, crops, and vehicles.	Likely to Highly Likely

Ice Jams

On a river, an ice jam is when chunks of ice create blockage in the flow of a river and cause areas behind the jam to flood. Ice jams often occur in narrow areas of rivers or where there are bridge pylons or debris collects. Ice jams often occur during winter rain events or during spring thaws when the upper layer of ice begins to melt and crack. The inundation of floodwaters caused by the ice jam can damage private and public property. According to the Vermont State Hazard Mitigation Plan, ice jams will occur in Vermont each year and "they are becoming more and more frequently noted." According to the US Army Corps of Engineers ERDC Cold Regions Research and Engineering Lab (CRREL) ice jam data base, Vermont has 987 recorded events from the earliest Jam number in 1785 to the most recent Jam in February of 2017. (http://rsgisias.crrel.usace.army.mil).

In Barre Town, ice jams tend to occur in a localized spot in the Jail Branch along Route 302. The last recorded ice jam in Barre Town was in March 1992 when a jam occurred in the area of the bridge located near the ambulance station property causing very minor and short term flooding of the Benoit Street area. Specific information on damage does not exist. Although there has been no instances of flooding due to ice blockages since then, the potential for occurrence exists with the right spring conditions. The Town does not keep ice jam records and relies on local knowledge. There is a data gap in the recorded data for Barre Town with respect to ice jams.

The Town continues to work with surrounding landowners to help clear debris so as to help lessen the threat of ice jams. The Town participates in the annual Spring Flood Seminars hosted by Vermont Emergency Management held in February/March to keep alert on spring conditions and ice out predictions by the National Weather Service of Burlington, Vermont. The Town routinely monitors the weather and VEM alerts and assigns the Public Work Superintendent and Fire Chief to monitor the Jail Branch and Stevens Branch as needed. In an effort to increase public awareness and increase the local knowledge of ice jam conditions, using the Town website and newsletter, the Town will annually remind landowners of the risk, what to look for and who to contact to report hazard ice jam conditions. Building on the Town's current work with the landowners along the Jail Branch, an annual letter will be sent out in early to mid-summer asking property owners to identify any large trees or debris collection points in the river that may contribute to the development of an ice jam. The town will review the information and explore its ability and capacity to remove the large trees and debris, taking into consideration but not limited to, state and local permit requirements, topography, safe access, and budget constraints.

During this Plan update, CVRPC's attempts to access the Ice Jam Data Base of the Cold Regions Research and Engineering Laboratory (CRREL) a United States Army Corps of Engineers, Engineer Research and Development Center research facility headquartered in Hanover, New Hampshire were met with limited success. An email response was received in January 2018 from the New Hampshire research center and the Town will continue attempts to access and coordinate information with this resource.

The NOAA data base for the period of January 1, 2012 - June 30, 2017 shows no recorded Ice jams for Washington County Vermont when a search of records is performed. This is not unusual as many ice jams are localized, occur quickly, and go unrecorded.

According to the USACE Ice Jam Database there have been 45 ice jams recorded between 1936 and 1992 along the Jail Branch. Occurrences include:

Jam Date	Gauge Height -feet (East Barre Dam location)
3/10/1992	5.46
3/3/1991	5.69
3/5/1990	7.95
2/3/1988	8.04
3/10/1987	5.5
1/27/1986	4.96
1/6/1982	4.9
2/11/1981	5.82
3/18/1980	5.18
3/6/1979	5.94
1/9/1978	5.89
4/2/1975	5.05
2/23/1974	8.18
1/7/1973	9.48
1/7/1973	9.48
1/27/1972	4.27
2/4/1970	3.72
2/20/1969	5.3
12/12/1968	3.5
3/2/1966	4.18
2/9/1965	n/a
3/13/1963	1.58
2/11/1960	2.93
2/2/1959	2.1
1/23/1958	2.2
4/5/1956	1.79
3/2/1955	2.29
2/22/1954	2.64
3/9/1953	2.3
1/30/1952	3.91
2/14/1951	3.34
2/20/1950	3.11
3/23/1949	2.08
2/16/1948	2.26
3/14/1947	2.59
3/4/1946	2.78
1/3/1945	3
2/25/1943	2.96
3/9/1942	3.92
2/9/1941	22.6
4/1/1940	3.03
2/17/1939	6.35
12/28/1937	3.5
4/6/1937	2.71
3/12/1936	2.68

Ice Jams Overview of Hazard

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Ice jams	Route 302; Jail Branch	Road infrastructure, public and private structures	22.6 feet of flooding (2/9/1941)	$15,000 for road damages	Occasionally - Likely

Hurricanes/ Tropical Storms

Hurricanes and tropical storms are violent rainstorms with strong winds that have large amounts of rainfall and can reach speeds up to 200 mph. The Vermont State Hazard Mitigation Plan further defines a hurricane as, "a tropical cyclone with sustained winds that have reached speed of 74 mph or higher. A storm reaches hurricane status only after strengthening over a period of days or even weeks." In contrast, "a tropical storm has a maximum sustained one-minute wind speed of 39-73 mph. The National Weather Service names a tropical cyclone (hurricane) once it reaches the status of a tropical storm. Many hurricanes are downgraded to tropical storms before they reach Vermont. Hurricanes and tropical storms bring the additional hazards of flooding, high winds, heavy precipitation, and fluvial erosion. According to the Vermont State Hazard Mitigation Plan, severe hurricanes are not considered likely nor pose a recurring threat to Vermont but tropical storms do.

In Vermont, the storm season is between the months of June and November. These types of storms originate in the warm waters of the Caribbean and move up the Eastern seaboard where they lose speed in the cooler waters of the North Atlantic. Severe storm events can occur late spring and early summer as temperatures increase in the summer season. The frequency and intensity of hurricanes and tropical storms is expected to increase with climate change.

The Saffir-Simpson Hurricane Wind Scale is used to determine the rating of a hurricane based on sustained wind speed. There are five categories used to classify a hurricane based on the potential for significant loss of life and property damage. Category 1 is very dangerous, Category 2 is extremely dangerous, Category 3 is devastating (major), Category 4 is catastrophic (major), and Category 5, the worst, is catastrophic (major). For further detail on the types of damage due to hurricane winds go to the table 4-15 in the VT State Hazard Mitigation Plan.

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		20-34 kts		
Tropical Storm		35-63 kts		
Hurricane		64+ kts or 74+ mph		

Information to complete the history of occurrences was taken from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center, the FEMA Declared Disasters in Vermont database, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records.

Hurricanes/Tropical Storms
History of Occurrences

Date	Event	Location	Extent
8/27/2011-9/2/2011 DR 3338-VT DR 4022 VT	Hurricane Irene Tropical Storm Irene	State-wide; Barre Town	Montpelier flood gauge at 19.05 feet (flood stage is at 15 feet).; 5" of rain; flash flooding, fluvial erosion; power outages; downed trees; property and crop damage; significant damage to roads and bridges. Winds 43 knots. Town of Barre federal share obligated $52,229.82 with 4 projects. This flood event will likely rank second to the November 1927 flood in the scope of meteorological and hydrological conditions/impacts as well as loss of life (84 in 1927), but likely first in monetary damage ((approx. $500. million statewide vs. $350. million (1927 in 2010 dollars)). There were nearly 2400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene.

Date	Event	Location	Extent
9/16/1999-9/21/1999 DR 1307-VT	Tropical Storm Floyd	Statewide	Tropical storm winds and flooding, Montpelier flood gauge at 9.30 feet, 3 - 6 inches of rain state-wide; 5 1/2 to 6 1/2 County-wide. Strong winds combined with saturated soils from heavy rain resulted in many trees and power lines being blown down with power outages reported. The annual "World's Fair", held in Tunbridge, Vermont was closed due to weather and power outages
8/9/1976	Hurricane Belle		Intense rains over much of the state, numerous power outages. Detailed rainfall and power outage data are unknown for this event. Montpelier flood gauge at 12.31 feet
9/22/1938	Hurricane "Long Island Express"	Statewide	The Great New England Hurricane hit Vermont as a Category 1 storm. High winds severely damaged trees, power lines and buildings. Montpelier flood gauge at 14.11 feet. Detailed rainfall and power outage data are unknown for this event.

The most recent tropical storm to reach Vermont was Tropical Storm Irene in August of 2011. A federally declared disaster resulted (DR 4022 VT). The state saw up to 11 inches of rain with the heaviest rainfall occurring in the mountains of central and southern Vermont. The Town of Barre received 5 inches of rain on August 28 and overall during the storm 7 inches of rain fell on Barre Town. The Orange reservoir was 15 feet above normal levels. The Montpelier flood gauge was at 19.05 feet; flood stage is at 15 feet. Town-wide flooding, fluvial erosion, and flash floods resulted. Winds of 43 knots were reported in Washington County. This tropical storm caused major damage statewide with catastrophic flooding and fluvial erosion causing state and local roads to be devastated, washed out and closed with massive damage to the entire transportation network including bridges and railroads. Major property damage to the public and private sector with the destruction and damage to homes and businesses, infrastructure, and crops. Three deaths resulted from the storm with many people injured. Barre Town received the amount of $52,229.82 in federal share obligated funds with 4 projects. See flood hazard section for further details.

In September of 1999, Vermont was hit with Tropical Storm Floyd and a federally declared disaster resulted (DR 1307 VT). This storm caused flooding and wind damage state-wide. Approximately 3,000 people were without power in the Central Vermont Region. About 5.5-6.5 inches of rain fell in Central Vermont, however, flood impacts were offset by drought conditions from earlier in the year. The Montpelier flood gauge was at 9.3 feet. There was one fatality during this storm.

Hurricane Belle brought intense rains to the state in 1976 resulting in numerous power outages. The Montpelier flood gauge was at 12.31 feet. In 1938, the hurricane known as the "Long Island Express" hit Vermont with devastating winds and up to 4 inches of rain. It was a fast moving hurricane that caused severe flooding, took out power lines, downed trees, and destroyed buildings. The Montpelier flood gauge was at 14.11 feet.

HURRICANE / TROPICAL STORMS OVERVIEW

Hazard	Location	Vulnerability	Extent	Impact	Probability
Hurricane/ Tropical/ Severe Storms	Town Wide -	Large trees, power lines, culverts/bridges, forested areas in town, crops, roads, tall buildings,	Irene - 5.5-6.5" rain, Lower Orange Reservoir – 1147 feet (normal 1132 feet), significant road/ culvert damage, power outages. Floyd – Wind gusts recorded at 31 mph, 7" of rain, Montpelier flood gauge at 14.11 feet	2011: Irene – Federal share obligated $52,229.82 w/4 projects	Likely

6. Mitigation

6.1 Hazard Mitigation Goals and Strategies

The goal of this Plan is to update the local mitigation strategy that makes Barre Town 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 severe storms (thunderstorm winds, lightning, high winds, and hail)
The natural hazard of extreme cold/winter storm/ice storm/heavy snow.
The natural hazard of hurricanes and tropical storms.
The natural hazard of ice jams.

6.2 Barre Town Plan (May 27, 2014 with amendments of October 27, 2016) Goals & Recommendations that Support Local Hazard Mitigation

The Barre Town 2014 Town Plan, as amended, has a five year life span and expires in May 2019. The goals and objectives of the Barre Town Hazard Mitigation Plan will be incorporated into the next municipal plan update. The next time the Town of Barre updates its Town Plan, it may consider adding additional mitigation goals.

Section 1-Introduction, 1.4 page 3.
Ongoing amendments to this Town Plan and existing Zoning Bylaws, Subdivision Regulations and Sewer Ordinances are the best tools to guide the future growth and development of land, public service and facilities. Protection of natural and scenic resources has been addresses herein and will be carried through in future regulations.

Section 1. Introduction, 1.5 page 3-4.
The essence of community planning is choice. Planning in Barre Town is an effort to make public choices, which will shape the future of the community with respect to land use, capital improvements, community design, local finances, and other issues. Planning is a necessary activity if a community is to grow in an orderly and economically productive manner.

The process of planning is continuous... New ideas, values, and conditions have an ongoing effect on the community.

Planning can also help a community to identify areas where development may not be appropriate due to environmental conditions. This may be due to conditions evident at the site such as excessive slope, aquifer recharge areas, erosion of stream banks or to the existence of other natural resources such as an important wildlife habitat.

Section 2. Land Use Plan, 2.1 page 7.
Land use growth and development in Barre Town should be planned to balance market needs and demands with the capacity of the land, municipal services, and infrastructure network to accommodate it. … Land use planning should always seek to make the most effective and efficient use of existing infrastructure.

Section 2. Land Use Plan, 2.10 Land Use Goals, page 10.
Development and growth should be encouraged in areas where municipal water, sewer, and roads are available. Growth should be done in ways that do not burden existing systems and costs of operating those systems on the taxpayer.

When Planning, balance market needs and demands with the capacity of the land while at the same time recognizing the need for standards and regulations.

Section 3. Transportation, 3.1 Highway Plan, page 12-14.
Highways form the backbone of the transportation system in Barre Town. Proper location, design, construction and maintenance of this important public investment are essential if economic vitality, environmental preservation and quality of life are to be assured for the Town' s citizens.

The Selectboard maintains an ongoing five-year highway improvement plan that contains specific projects and priorities….updated on a yearly basis…

Town Highway Bridges: Adequate periodic maintenance of bridges is essential to avoid catastrophic or costly loss. There are two bridges and 22 major culverts on Barre Town highways. The two bridges are both located in South Barre, one on Snowbridge Road the other on Bridge Street. Long in need of replacement, the Bridge Street Bridge was replaced by the State of Vermont in 2013. Barre Town paid 5% of the total cost.

Continued maintenance and inspection of bridge and culverts is necessary to ensure an adequate and safe transportation network.

Town Highway System Deficiencies: The Town Plan identifies deficiencies on page 14 of the plan and as shown on Map 6 found in the Town Plan. ...Top priority should be placed on projects which will preserve the existing facilities and enhance safety.

Section 3. Transportation, 3.4 Transportation Goals, page 19.
Preserve existing roads, bridges, and culverts by regular maintenance and continued inspections.
Maintain the formal road plans to ensure good quality roads and to help make optimal use of limited resources.
Explore whenever practical ways to help reduce deficiencies as noted herein.

Section 4. Facilities, Utilities, and Public Safety, 4.10 Emergency Services, page 35-36.
Emergency Management is charged with carrying out the basic government functions of maintaining the public peace, health, and safety during an attack or disaster. The Town of Barre has an operating Emergency Operation Center and disaster plan. The operation center is located in the basement of the Municipal Building in Lower Websterville.

Section 5, Preservation, 5.7 Recommendations, page 40.
Encourage stream bank preservation and buffer zones.

Section 5, Preservation, 5.10 Natural Resources, page 42.
All natural resources warrant careful consideration in the Town Plan and review of future development in a continued effort to maintain and improve the quality of air, water, wildlife and land resources.

Section 5, Preservation, 5.11Climate, Topography, Soil, and Earth Resources, page 43.
It is important to consider the best mitigation measures when repairing and planning Town infrastructure.

Section 5, Preservation, 5.14 Groundwater Resources and Geology, pages 49 - 50.
Surface Waters: Barre Town should take measures whenever possible to protect rivers and streams.

Surface Water Protection Goals:
... proper stormwater management and erosion control should be considered for all development ...
a minimum of a 50 foot buffer from significant stream banks should be maintained to help protect them.

Section 5, Preservation, 5.14 Special Surface Water Concerns, Flood Hazard Areas and Floodways, page 50-52
... controlling runoff may be a manageable way to help slow erosion. Development, where stormwater runoff is collected and travels through these ravines should be reviewed for stormwater management, controlling the rate of runoff (East Barre location).

Recommendations regarding Water Runoff and Drainage:

- The Development Review Board should review plans regarding storm water management for new subdivision proposals to ensure that new development will not adversely affect the community.
- Allowable volumes of stormwater run-off need to be calculated using State standards...
- Town should consider a no disturbance buffer/setback area around steep slopes of 20% or greater.
- Buffer areas for streams and wetlands.
- Consider a fluvial erosion plan.

Section 5, Preservation, 5.15 Natural Resources Goals and Objectives, page 52-53.
To assure long-term, sound stewardship of natural resources through reliable planning and management practices.

To ensure that development is in harmony with the natural features of each site and limited where development is imprudent and/or questionable.

The Town will encourage and enlist the assistance of residents, landowners, schools, businesses and other entities to study inventory, manage, preserve, protect and enhance natural assets.

The Town should enlist existing organizations and boards such as; the Recreation, and Housing Committees; Development Review Board and Planning Commission, and the Traffic Safety Committee to propose and implement policies to protect natural resources and enhance natural features throughout Barre Town.

The town should take a proactive approach to prioritization of natural resources in the interest of expanded development amenities, respect of property rights, and incentives of developers and landowners. These may be reflected in ordinances, pursuit of planning and implementation project funds, community demonstration programs, and/or open space/recreation/tax/site design incentives, for example.

The Town should encourage protection of mature landscapes and geological features..., seasonal and indigenous waterways, ..., etc. to serve the goals of the Town Plan while increasing marketability of developments and confidence in applicant planning capacity.

Applicants should be advised to incorporate mitigation measures to protect natural resources, rather than to delay proposals strengthening planning considerations.

Section 8.5 Renewable Energy, Recommendations, page 68.

- Continue to inform the public, through zoning, of State Residential Energy Standards and the requirement that new construction meet those standards.
- The development Rive Board should encourage developers (residential and commercial) to utilize energy efficient insulation, weatherization, heating and lighting in all projects.
- The Town should encourage the use of the Energy Efficient Mortgage Program which helps home owners finance energy efficiency improvements and at lower than normal interest rates. The town also encourages use of the CVCAC Weatherization Programs for eligible residents.
- Encourage homeowners to have a whole house energy audit performed to review: lights, insulation, weatherization, heating and appliances.

Section 9 Housing, 9.5 Housing Rehabilitation, page 74.
In reference to the town's housing revolving loan fund -
While funds available for lending fluctuate, the Planning Commission recommends studying ways in which it can increase the supply of funds available to lend to Town residents, as well as explore other opportunities to secure public monies that can be used to retrofit and/or improve the energy efficiency of private housing units locally.

Section 9 Housing, 9.6 Housing Goal and Recommendations, page 75.
Fund the Town's existing housing rehabilitation program with additional monies to assist low-income families.

Section 11 Implementation, page 81.
This Plan is intended to carry out the General Purposes of the Planning and Development Act and should be implemented in conjunction with Title 24, Chapter 117 in its entirety.

The Planning Commission is the body responsible for preparing the Town Plan. While the plan expires in five years after adoption, planning is an ongoing process, this plan should be continuously reviewed for updates, and relevant amendments incorporated as warranted. The plan should be regularly consulted for implementation of goals, objectives, policies, and recommendations.

6.3 Proposed Hazard Mitigation Programs, Projects & Activities

The state 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.

All mitigation strategies identified and considered by the Town are included in this Plan. The mitigation strategies identified by the Town are listed in regards to local leadership, possible resources, implementation tools, and prioritization. Prioritization was based upon the economic impact of the action, the feasibility of the action, the Community's need to address the issue and its capacity to address the issue, the action's cost, and the availability of potential funding.

The planning team used a mitigation action matrix worksheet to help evaluate and prioritize each mitigation action being considered. The template is attached to this plan. In evaluating potential benefit and or likelihood of successful implementation the team ranked each criteria as to being highly effective or feasible, neutral, or ineffective or not feasible. The Team considered each prioritization in the scope of the other projects, LHMP priorities and overall community priorities.

A High prioritization denotes that the action is either critical or potential funding is readily available and should have a timeframe of implementation of less than two years. 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. 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. Highest priority projects also enjoyed strong community support and staff capacity was available to carry them out. Lowest priority projects were of lower risk to the community, had solutions that did not mitigate very much of the problem, or were extremely expensive or with no financial assistance available. Projects for which there was little community support or available staff capacity would also be low priority.

During the course of this Plan development, some identified and listed mitigation actions were started and a couple projects have been completed. These actions that were identified for implementation and have since been started or have been completed during this Plan development remain on the *Hazard mitigation programs, projects and activities* chart that follows.

Barre Town 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 in effect.

The Planning Team considered actions to address all profiled hazards. The actions below in the following *Hazard mitigation programs, projects and activities chart*, represent what the Planning Team found to be feasible over the next five years.

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

Hazard	Possible Action MA=mitigation action PA= preparedness action	Local Leadership	Prioritization	Possible Resources	Time Frame
Flood/ Flash Flood/ Fluvial Erosion/, Hurricane/ Tropical Storm Severe Storms	MA - Nuissl Road -perform erosion control work along road and brook to stabilize area and mitigate repeated storm damage. From the intersection of Anderson Road and Nuissl Rd down to the arch plate culvert. Additional work to protect the road from further fluvial erosion will take place in the future.	SB, Town Manager, Town Engineer, Public Works Superintendent	High	Municipal Roads Grant, Better Roads CVRPC, AOT, local funds	Work started in September 2017 during this Plan development and is expected to be completed by December 2017 during the Plan review process
Flood/ Flash Flood/ Fluvial Erosion/, Hurricane/ Tropical Storm Severe Storms	MA -Replace and upgrade culvert on Peloquin Road per 2007 Hydraulics Study	SB, Town Manager, Town Engineer	High	Work commenced 9/5/2017 under contract; AOT VTrans Local Structure Grant (bridges & culverts)	Work started in September 2017 during this Plan development and is expected to be completed by October 31, 2017
Flood/ Flash Flood/ Fluvial Erosion, Hurricane/ Tropical Storm Severe Storms	PA Maintain training re: Administration of Flood Hazard regulations in accordance with local, state and NFIP standards. Attend trainings as they are offered.	Administrative Officer/ZA	High	Local funds, ANR, CVRPC	Annually, 2018 - 2023 over the next five years as trainings are offered

Hazard	Possible Action MA=mitigation action PA= preparedness action	Local Leadership	Prioritization	Possible Resources	Time Frame
All hazards	PA- Explore Town participation in VTAlert as a notification system for use in emergency management.	Town Manager, Town Engineer, ANR, All Town Management staff, SB	High	local funds, VEM - technical support	March 2018 – March 2020
Flood/ Flash Flood/ Fluvial Erosion, Hurricane/ Tropical Storm; Severe Storm	MA - Purchase and install generator at the Barre Town Middle and Elementary School on Websterville Road to upgrade and increase shelter capacity. Wiring completed; transfer switch and generator needed.	SB, Town Manager, School Board	High - Medium	EMPG, HMGP, local funds	January 2019 – January 2022
Flood/ Flash Flood/ Fluvial Erosion/, Hurricane/ Tropical Storm, Severe Storm	MA -Develop water retention area at intersection of Sterling Hill Road and Graniteville Road. Currently under a study. Town will implement recommendations as appropriate,	SB, Town Manager, Town Engineer	High - Medium	HMGP, Friends of the Winooski, Town Funds	January 2019 – January 2022
Flood/ Flash Flood/ Fluvial Erosion/, Hurricane/ Tropical Storm Severe Storms	MA -Develop water retention area on upstream side of McLeod Hill Road culvert to address flash flood breach, inundation of basements, run off. Apply and Secure funding for Engineering Study to look at hydrology of area and develop recommendations and solutions for the problem.	SB, Town Manager, Town Engineer,	Medium	HMGP-Planning, local funds	January 2020 – January 2022
Winter Storms/ Severe Cold/ice storm	PA - Provide educational materials to residents and sensitive populations on how to insulate homes (pipes, attics) for extreme cold spells; protect against snow loads; Inform residents about the BT Housing Revolving Loan Fund Program; access services of Capstone Community Action	SB, Town Manager	Medium	local funds	Annually, Jan 2018 – December 2023 over the next five years
Winter storms/ extreme cold/ice storms, hurricane/ tropical storms/ severe storms/High Winds	PA - budget for tree removal/dead limbs/disease and perform visual assessments to identify problem locations.	PW Superintendent, SB, Town Manager	Medium	local budget	Annually, Oct.- May, 2018 - 2023 during the town budget process

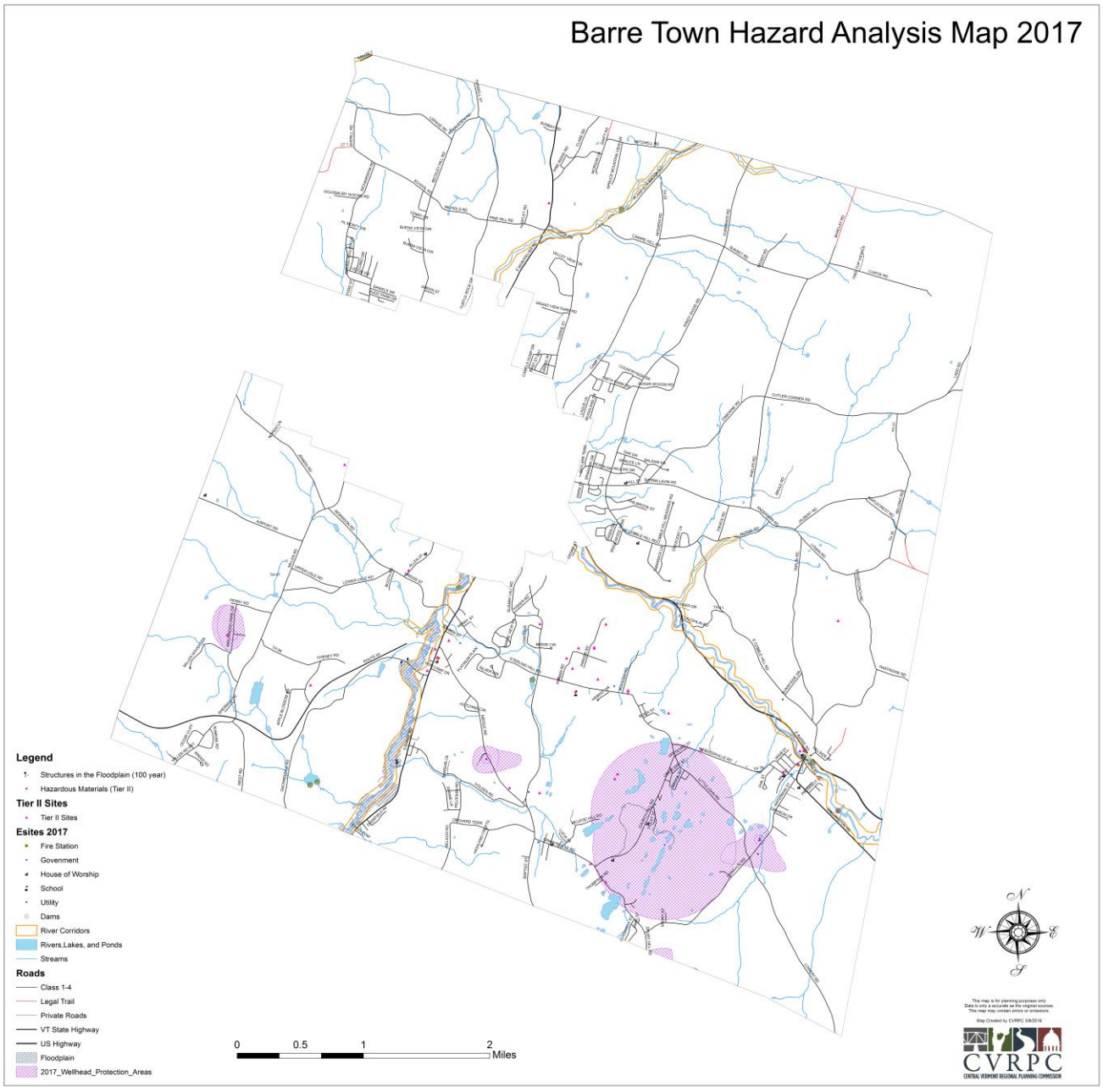
Hazard	Possible Action MA=mitigation action PA= preparedness action	Local Leadership	Prioritization	Possible Resources	Time Frame
Hurricane/ Tropical storms/ Severe storms, high winds, Ice storm	PA- Develop a citizen volunteer group with a Coordinator to activate volunteers as needed to assist with town wide emergencies such as traffic control, help open roads where debris, trees have blocked roadways, and similar matters.	Town Manager, EMD/EMC, SB, Department Heads, Town Management staff	Medium	VEM, local funds,	March 2019 – March 2021
Flood/Flash flood/Fluvial erosion	MA - Holden Road install stone armoring of ditch to upgrade, improve and prevent erosion and ditch failure.	SB, Public Works Superintendent, Town Engineer, Town Manager	Low	AOT, Better Roads, local funds	June 2022 – November 2023
Flood/ Flash Flood/ Fluvial Erosion, Hurricane/ Tropical Storm Severe Storms	MA - Develop water retention area behind Barre Town School - Action is dependent upon outcome of Friends of the Winooski study.	SB, Town Manager, Town Engineer	Low	HMGP, Town funds	January 2022 – December 2023
Flood/Flash flood/Fluvial erosion	MA - Holden Road: Identify areas of concern along road edge where excessive side slopes go down to brook and threaten stability; very steep slopes-erosion and bank failure; will require study	SB, Public Works Superintendent, Town Manager, Town Engineer,	Low	AOT, local funds	October 2022 – December 2023

Hazard	Possible Action MA=mitigation action PA= preparedness action	Local Leadership	Prioritiza-tion	Possible Resources	Time Frame
Ice Jams	MA/PA – Establish access to USACE CRREL (U.S. Army Corps of Engineers Cold Region Research and Engineering Laboratory) website as a resource for ice jam information, data gathering and recording. Also use website as a resource for historical records.	Town Manager, Emergency Management Director/EMC, VEM	Medium	Local funds, VEM technical support, USACE CRREL	January 2019-December 2020
Ice Jams	PA – Town participation and attendance at VEM Annual Spring Flood Seminar	Town Manager, EMD/EMC, PWD, Town Engineer	High	Local funds, VEM	Annually Feb./March 2018 - 2023
Ice Jams	MA – Ask property owners to report ice jams and adverse changes in the river conditions. Provide information to owners for how to report sightings and conditions to town officials. This will include the development of a process to receive and disseminate the information to the designated town officials.	Town Manager, PWD, Town Engineer	Medium	Local Funds; Technical assistance from CRREL, VEM and ANR;	January 2019 – December 2023
Ice Jams	PA –Public Work Superintendent and Fire Chief assigned to monitor Jail Branch and Stevens Branch river conditions during spring flood season as needed.	Town Manager, PWD/Fire Chief	High - Medium	Local funding	Annually as needed; Jan-March, 2018 - 2023
Ice Jams	MA /PA – Annual Letter to property owners along Jail Branch to assist with identification of large trees and or debris collected in river that has potential to contribute to the development of an ice jam. Town will explore ability and capacity to remove identified trees/debris from river. Continue removal of debris, as appropriate, along Jail Branch.	Town Manager, PWD, Town Engineer	Medium	Local Funding	Annually – (early/mid-summer letter). June 2018 – October 2023
All Hazards	MA- Public Outreach and Education. Develop Emergency Preparedness announcements and public educational information news releases in the Town quarterly newsletter and on the Website that are theme based and seasonally appropriate.	Department Heads; Town Manager	High to Medium	Local Funding	Annually each Quarter July 2018 – December 2023

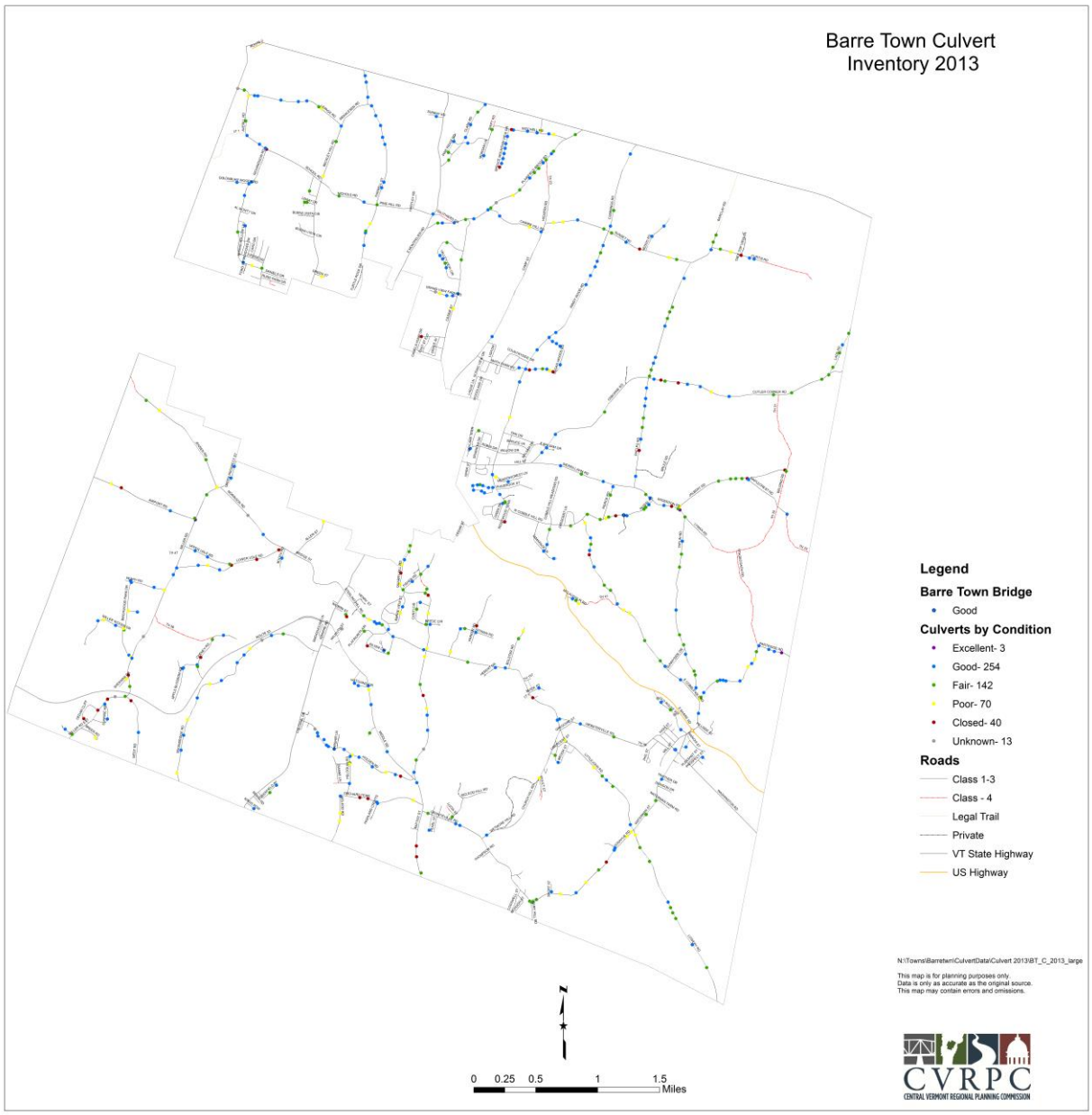
Attachments

Page

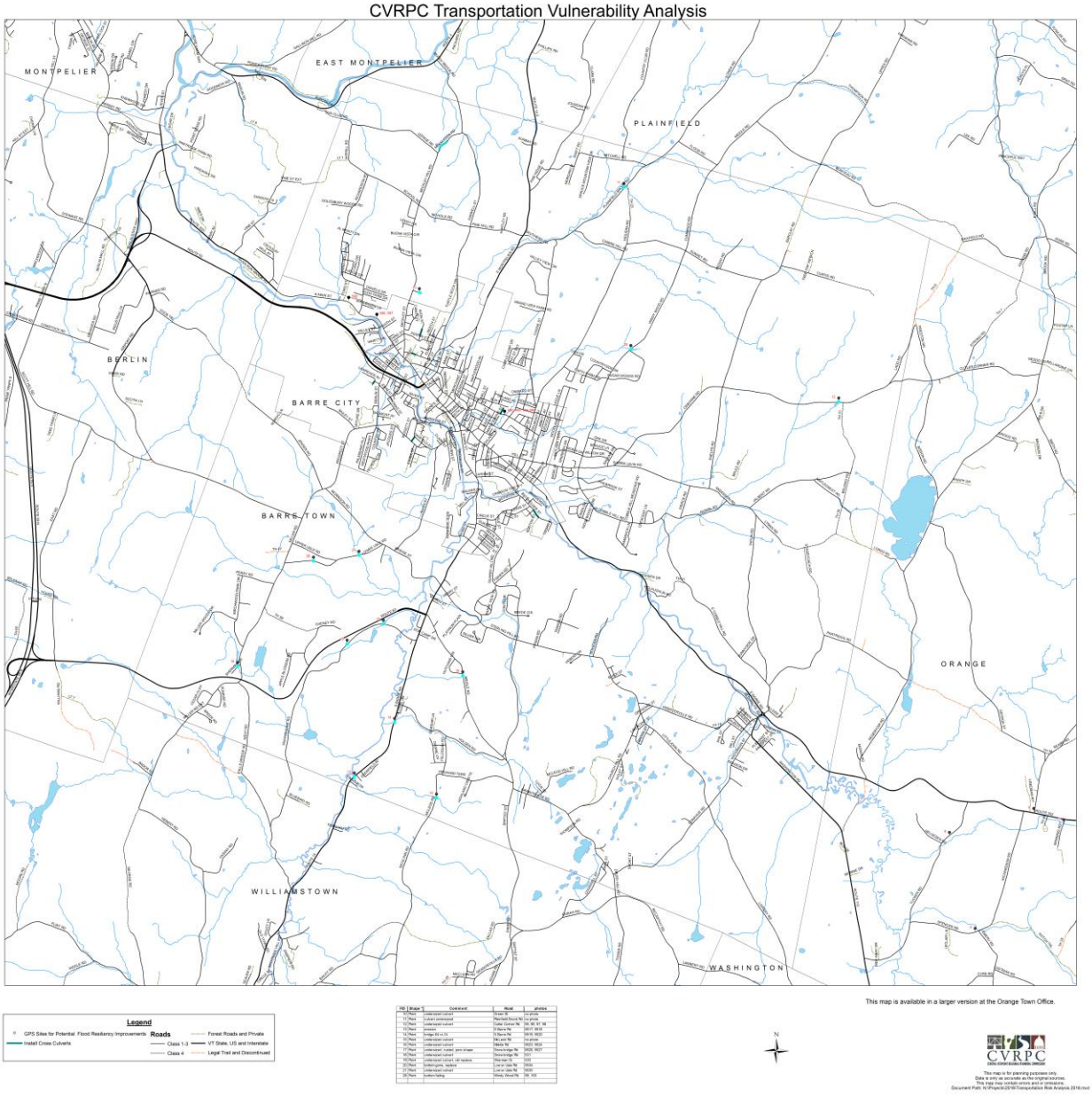
Hazard Analysis Map 2017



Town of Barre Culvert Inventory Map 2013



Transportation Vulnerability Assessment Map 2016



Hazard Ranking Methodology

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

Mitigation Action Evaluation Table

Use this worksheet to help evaluate and prioritize each mitigation action being considered by the planning team. For each action, evaluate the potential benefits and/or likelihood of successful implementation for the criteria defined below.

Rank each of the criteria with a -1, 0 or 1 using the following scale:

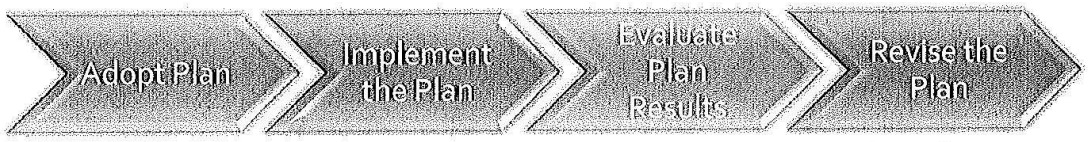
1 = Highly effective or feasible
0 = Neutral
-1 = Ineffective or not feasible

Mitigation Strategy	Effective-ness	Technically Feasible	Business Impacts	Political	Cost	Funding Resource Available	Admin-istrative Capacity	Community Capacity	Outside Assistance Available?	Regulatory & other restrictions	Total Score

Developed by Northeastern Vermont Development Association from the FEMA Mitigation Action Evaluation Worksheet (Appendix A-31) provided in the FEMA Local Mitigation Planning Handbook March 2013. G. Aloisio

Mitigation Action Evaluation matrix template

5-Year Plan Review/Maintenance



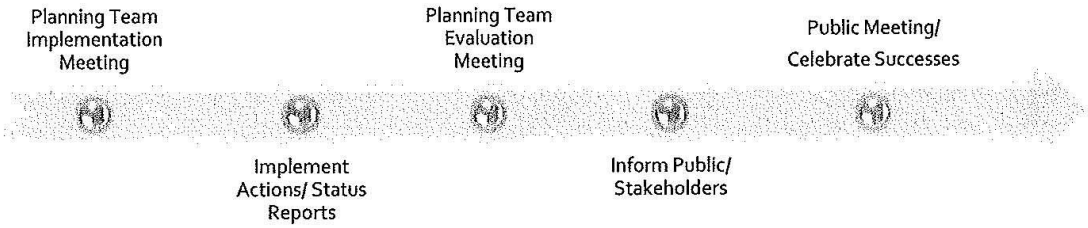
- Brief local leadership on plan approval
- Formally adopt plan
- Publicize plan approval and adoption
- Celebrate success

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

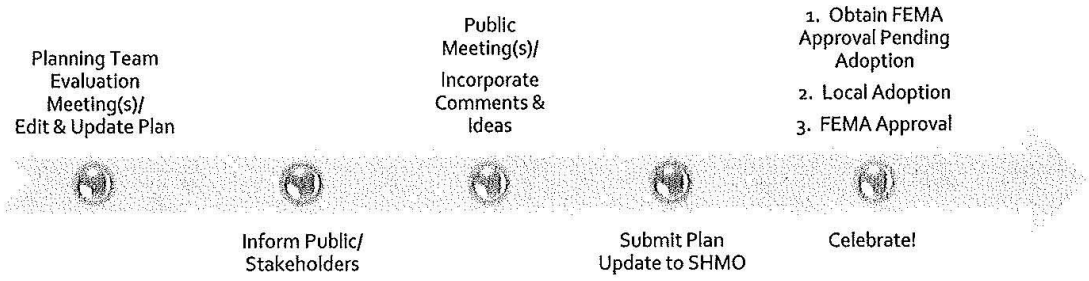
- Effectiveness of planning process
- Effectiveness of actions
- Document success & challenges of actions
- Update and involve community
- Celebrate successes

- 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



Glossary of Terms and Acronyms

The following terms and acronyms are defined as used in this plan.

Base Flood Elevation (BFE) - the elevation of the water surface elevation resulting from a flood that has a one percent chance of equaling or exceeding that level in any given year. On the Flood Insurance Rate Map the elevation is usually in feet, in relation to the National Geodetic Vertical Datum of 1929, the North American Vertical Datum of 1988, or other datum referenced in the Flood Insurance Study report, or the average depth of the base flood, usually in feet, above the ground surface as defined in Vermont DEC Flood hazard Area and River Corridor Protection Procedures December 5, 2014.

Central Vermont Regional Planning Commission (CVRPC) – an organization serving the 23 communities in Central Vermont including all of Washington County and the three towns of Orange, Williamstown, and Washington in Orange County. The mission of the CVRPC is to assist member municipalities in providing effective local government and to work cooperatively with them to address regional issues. The CVRPC works with area non-profits, other regional organizations, State and Federal agencies, and the general public. The CVRPC implements a variety of projects and programs tailored to local and regional needs, and also completes projects of statewide importance and interest.

Critical facilities -facilities that provide services or functions related to public health and safety during emergency response and recovery and facilities that must be protected to a higher standard to protect public health and safety.

Declaration - Presidential finding that a jurisdiction of the United States may receive Federal aid as a result of damages from a major disaster or emergency.

Emergency - Any occasion or instance for which, in the determination of the President, Federal assistance is needed to supplement State and Local efforts and capabilities to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States. Defined in Title V of Public Law 93-288, as amended, Section 102(1); The Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Federal Emergency Management Agency (FEMA) - The lead Federal agency with responsibility for responding to Presidential emergencies and major disasters. FEMA's mission is to reduce loss of life and property and protect our Nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of hazard mitigation, preparedness, response, and recovery.

Flood Insurance Rate Maps (FIRMS) - The official map of a community prepared by FEMA, showing base flood elevations along with the special flood hazard areas and the risk premium zones.

Flood Mitigation Assistance Program (FMA) - Provides pre-disaster grants to State and local governments for both planning and implementation of hazard mitigation strategies. Each State is awarded a minimum level of funding that may be increased depending upon the number of NFIP policies in force and repetitive claims paid. Grant funds are made available from NFIP insurance premiums, and therefore are only available to communities participating in the NFIP.

Fluvial Erosion Hazard (FEH) - those hazards related to the erosion or scouring of riverbeds and banks during high flow conditions of a river as defined in Vermont DEC Flood hazard Area and River Corridor Protection Procedures December 5, 2014.

Hazard – an emergency or disaster resulting from– (A) a natural disaster; or (B) an accidental or man-caused event. Defined in Title VI, Emergency Preparedness of Public Law 93-288, as amended, Sec. 602. Definitions (42 U.S.C. 5195a); The Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Hazard Mitigation - Sustained actions taken to reduce or eliminate the long-term risk to people and property from hazards and their effects.

Hazard Mitigation Grant Program (HMGP) – a program authorized under Section 404 of the Stafford Act, 42 U.S.C. 5170c that provides funding for cost-effective hazard mitigation projects in conformance with the post-disaster hazard mitigation plan required under Section 409 of the Stafford Act.

Hazard Mitigation Plan - The plan resulting from a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in society that includes the actions needed to minimize future vulnerability to hazards.

Hazardous Materials (HazMat) – all petroleum and toxic, corrosive or other chemicals and related sludge included in any of the following: (a) Any substance defined in CERCLA § 101(14); (b) Petroleum, including crude oil or any fraction thereof; or (c) Hazardous waste. Defined in Vermont statute Title 10, Chapter 159, Waste Management, Subchapter 001, section 6602 definitions. Note: "Hazardous material" does not include herbicides and pesticides when applied consistent with good practice conducted in conformity with federal, state and local laws and regulations and according to manufacturers' instructions.

Hazardous waste - means any waste or combination of wastes of a solid, liquid, contained gaseous, or semi-solid form, including but not limited to those which are toxic, corrosive, ignitable, reactive, strong sensitizers, or which generate pressure through decomposition, heat or other means, which in the judgment of the Secretary may cause, or contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, taking into account the toxicity of such waste, its persistence and degradability in nature, and its potential for assimilation, or concentration in tissue, and other factors that may otherwise cause or contribute to adverse acute or chronic effects on the health of persons or other living organisms, or any matter which may have an unusually destructive effect on water quality if discharged to ground or surface waters of the state. All special nuclear, source, or by-product material, as defined by the Atomic Energy Act of 1954, as amended, codified in 42 U. S. C. § 2014, is specifically excluded from this definition. Defined in Vermont statute Title 10, Chapter 159, Waste Management, Subchapter 001, section 6602 definitions.

Invasive Species - The National Invasive Species Council defines an invasive species as one that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Major Disaster - Any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States that, in the determination of the President, causes damage of sufficient severity and magnitude to warrant major disaster assistance under the Stafford Act, above and beyond emergency services by the Federal Government, to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby defined under Public Law 93-288.

Mitigation - One of the four phases in emergency management. Preventing future emergencies or minimizing their effects. Includes any activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies. Example: Buying flood and fire insurance for your home is a mitigation activity. Mitigation activities take place before and after emergencies.

National Flood Insurance Program (NFIP) - Provides the availability of flood insurance in exchange for the adoption and enforcement of a minimum local floodplain management ordinance. The ordinance regulates new and substantially damaged or improved development in identified flood hazard areas.

Natural disaster - The term "natural disaster" means any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, or other catastrophe in any part of the United States which causes, or which may cause, substantial damage or injury to civilian property or persons. Defined in Title VI, Emergency Preparedness of Public Law 93-288, as amended, Sec. 602. Definitions (42 U.S.C. 5195a); The Robert T. Stafford Disaster Relief and Emergency Assistance Act.

NOAA's National Centers for Environmental Information (NCEI) – a consolidation of the former National Climatic Data Center, the National Geophysical Data Center, and the National Oceanographic Data Center. NCEI is responsible for preserving, monitoring, assessing, and providing public access to the Nation's comprehensive atmospheric, coastal, oceanic, and geophysical data.

Preparedness - One of the four phases in emergency management. Preparing to handle an emergency. Includes plans or preparations made to save lives and to help response and rescue operations. Example: Evacuation plans and stocking food and water are both examples of preparedness. Preparedness activities take place before an emergency occurs.

Recovery - One of the four phases in emergency management. Recovering from an emergency. Includes actions taken to return to a normal or an even safer situation following an emergency. Activities necessary to rebuild after a disaster. Recovery activities include rebuilding homes, businesses, and public facilities; clearing debris; repairing roads and bridges; and restoring water, sewer, and other essential services. Recovery includes getting financial assistance to help pay for the repairs. Recovery activities take place after an emergency.

Response- One of the four phases in emergency management. Responding safely to an emergency. Includes actions taken to save lives and prevent further property damage in an emergency situation. Response is putting your preparedness plans into action. Examples: Seeking shelter from a tornado or turning off gas valves in an earthquake are both response activities. Response activities take place during an emergency.

River corridor - the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition and for minimization of fluvial erosion hazards, as delineated by the Vermont Agency of Natural Resources in accordance with the ANR River Corridor Protection Procedures. 38 10 V.S.A. § 1422(12).

River corridor protection area - the area within a delineated river corridor subject to fluvial erosion that may occur as a river establishes and maintains the dimensions, pattern, and profile associated with its dynamic equilibrium condition and that would represent a hazard to life, property, and infrastructure placed within the area. The river corridor protection area is the meander belt portion of the river corridor without an additional allowance for riparian buffers. As delineated by the Vermont Agency of Natural Resources in accordance with the ANR River Corridor Protection Procedures. 38 10 V.S.A. § 1422(12).

Special flood hazard area - is synonymous with "flood hazard area" and "area of special flood hazard" (44 C.F.R. § 59.1) and is the floodplain within a community subject to a one percent or greater chance of flooding in any given year. This area is usually labeled Zone A, AO, AH, AE, or A1-30 in the most current flood insurance studies and on the maps published by FEMA.

Sustained action – to support and continue for an extended time or without interruption; to maintain, to keep in existence, to continue.

Vermont Agency of Commerce and Community Development (ACCD) – state agency with three main departments and a variety of programs to support economic and community development needs of Vermont. The three departments are: Department of Economic Development, Department of Housing and Community Development, and the Department of Tourism and Marketing.

Vermont Agency of Natural Resources (VT ANR) – state agency that promotes the sustainable use of Vermont's natural resources, protects and improves the health of Vermont's peoples and ecosystems, and promotes sustainable outdoor recreation.

Vermont Agency of Transportation (VT AOT) – state agency that provides for the safe and efficient movement of people and goods by planning, developing, implementing, and managing a statewide transportation network - including roads, bridges, railroads, airports, park-and-rides, bicycle and pedestrian facilities, and public transportation facilities and services.

Vermont Department of Environmental Conservation (VT DEC) – a department in the state Agency of Natural Resources whose mission is to preserve, enhance, restore and conserve Vermont's natural resources and protect human health for the benefit of present and future generations.

Vermont Emergency Management (VEM) – part of the Department of Public Safety, Division of Emergency Management and Homeland Security (DEMHS). VEM provides support and aid to Vermont's Local Emergency Management Directors, Local Emergency Planning Committees, Regional Planning Commissions, Community Emergency Response Teams, state agencies, and emergency response providers in an effort to ensure the state's resilience to disasters.

"Vermont addresses emergencies and disasters through two statutes. The Civil Defense Act created the state Emergency Management Division, and gives the governor emergency powers, authorizes the rendering of mutual aid, and declares that all emergency management functions be coordinated with the federal government. The Internal Security and Public Safety Act provides for a declaration of a state of emergency and activation of an emergency disaster preparedness plan for the state and counties. Financial and other aid is provided by the state emergency relief and assistance fund, and through grants and loans from both federal and private sources. The governor is authorized to declare a state of emergency, and the state emergency board and local legislative boards may vote to terminate emergencies."

CERTIFICATE OF ADOPTION
RESOLUTION #6-18
7-18
A RESOLUTION OF
THE TOWN OF BARRE, VT
ADOPTING THE 2017
HAZARD MITIGATION PLAN
DEEMED APPROVABLE BY FEMA
ON MARCH 19, 2018

WHEREAS, the Town of Barre has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the Town of Barre, Vermont 2017 Local Hazard Mitigation Plan, which result in loss of property, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Barre has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its 2017 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 Barre, and

WHEREAS, the Plan recommends several hazard mitigation actions (projects) that will provide mitigation for specific natural hazards that impact the Town of Barre 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 Barre eligible for funding to alleviate the impacts of future hazards; and

WHEREAS, a duly-noticed meeting was held by the Town of Barre Selectboard on April 24, 2018 to formally adopt the Barre Town Local Hazard Mitigation Plan; now therefore be it

RESOLVED by Town of Barre Selectboard:

1. The Town of Barre, Vermont 2017 Local Hazard Mitigation Plan is hereby adopted as an official plan of the Town of Barre;

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 as town capacity and funding allows;

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 Town Manager and Emergency Management Director.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Barre this 1st day of May, 2018.

Selectboard Chairman

Member of Selectboard

Member of Selectboard

Member of Selectboard

Member of Selectboard

ATTEST:

Donna J. Kelty, Town Clerk-Treasurer