

Town of Northfield, VT  
DRAFT Hazard Mitigation Plan Update  
2016  
DRAFT 2

Prepared by the Town of Northfield and CVRPC

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## **2. Introduction**

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The impact of expected, but unpredictable natural and human-caused events can be reduced through community planning. The goal of this Local Hazard Mitigation Plan is to provide a local mitigation plan that makes the Town of Northfield more disaster resistant.

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

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

## **3. Purpose**

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The purpose of this Local Hazard Mitigation Plan is to assist the Town of Northfield in recognizing hazards facing the region and their community and identify strategies to begin reducing risks from acknowledged hazards.

The 2016 Northfield Local Hazard Mitigation Plan is an update of the 2011 plan. The plan has been reorganized and new sections have been updated.

## **4. Community Profile**

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The Town of Northfield is the third most populous community in Central Vermont. It is located in the Southwestern quadrant of Washington County, approximately 10 and 13 miles from the cities of Montpelier and Barre, respectively. Northfield contains three population centers, considerable industrial development, and Norwich University. Norwich University is the nation’s oldest private military college and contains approximately 2,000 Corps of Cadets and civilian students. The University is also home to the recently launched National Center for the Study of Counter-Terrorism and Cyber-Crime (NCatNU).

According to the 2010 US Census, Northfield has a total population of 6,207 people living in 2,101 housing units. The population has increased 6.7% from the 2000 Census. Approximately 26% of

Northfield's workforce is employed within the Town, while the remaining 74% work outside of the community.

The Town's major North-South thoroughfare is Vermont Route 12, which follows the course of the Dog River north of the Village. Vermont Route 12A intersects Vermont Route 12 below the Village and follows the Dog River south towards the Town of Roxbury. Further to the south Vermont Route 12 intersects Vermont Route 64, which provides connection to I-89 at Exit 5.

Housing is widely dispersed both throughout the Town and within the Village, with approximately one-third of the Town's population located within the Village. The Northfield Town Plan seeks to focus future development within the population centers of Northfield Village, Northfield Falls, and Northfield Center. New development has occurred on Fairway Drive, with the building of three new homes.

The Town's commercial development is focused primarily within the Village, which is also a State Designated Village. The Village was designated as such to recognize this value, as well as the historic & cultural resources present there.

These land use patterns are reinforced by current zoning and flood hazard regulations. At the time of writing this plan, no new commercial or residential developments were proposed. The Town is also currently rewriting its zoning regulations.

## **4.1 Community Capacities**

Services provided by the Northfield municipality are overseen by a three (3) member volunteer Selectboard. The volunteer Planning Commission is charged with developing the Municipal (Town) Plan, as well as the community's land use regulations.

The Town employs approximately 30 staff members to carry out services to its residents on a daily basis. The following are the key paid positions involved in hazard mitigation in the Town of Northfield:

- Town Manager
- Town Clerk, Treasurer & Tax Collector, with Assistant
- Zoning Administrator (duty of Town Manager)
- Ambulance Chief (Emergency Management Director) & Paid & Volunteer Squad
- Road Foreman and Crew
- Public Works Supervisor and Staff
- Fire Chief & Paid & Volunteer Squad
- Police Chief & Squad

The municipal budgeting process occurs on an annual basis, planning for a fiscal year from July 1 to June 30. The budget is usually developed between November and January, and put to voter approval in March at Annual Town Meeting Day.

Northfield's Highway Department maintains 80 miles of roadway, including 45 bridges, 800 culverts, along with guard rails, signs and drainage and stormwater infrastructure. Highways are managed according to the adopted 2013 Vermont Road & Bridge Standards.

The Northfield Electric Department provides electricity to most of Northfield and portions of Roxbury, Berlin, and Moretown. The remaining portions of Northfield are served by Green Mountain Power and the Washington Electric Cooperative.

Northfield Village, Northfield Falls, and Northfield Center are served by a municipal water supply dependent upon wells adjacent to Vermont Route 12A and the Dog River. The Northfield municipal water system serves those approximately 4,000 residents and all system users at Norwich University as well. Water is pumped from a well field south of the village at 500,000 gallons of water per day, through approximately 25 miles of water mains. Two reservoir locations provide a back up supply. One location has two 250,000 gallon tanks and the other is a 1,000,000 gallon concrete reservoir. This storage provides about three days of emergency supply. The wells and their recharge areas are managed under a Source Protection Plan approved by the Vermont Agency of Natural Resources.

Community members outside of the four areas served by the municipal water system depend upon groundwater for their domestic water supply and industrial uses.

The Municipality's wastewater treatment facility services the entire village and Northfield Center, including Norwich University. Residents outside of the sewer service area are responsible for disposal of their wastewater through in-ground systems.

Northfield has an approved Local Emergency Operations Plan that was adopted in spring of 2016. The municipality also adopted a Civil Defense Disaster Plan in 2001. The municipality is served by and is a member of Local Emergency Planning Committee #5, which provides Tier II Hazardous Materials Planning.

In the Town, fire coverage is provided by the volunteer Northfield Fire Department. Northfield is a member of the Capital Fire Mutual Aid System, which includes all of the Towns in Washington County. A new front line pumper was also purchased. According to the 2016 Town Report, the Department responded to 114 calls in 2015.

Ambulance service is provided by the Northfield Ambulance Service. In addition to servicing the Town and village, the Ambulance Service also responds to calls in Roxbury, West Berlin and Moretown. According to the 2016 Town Report, the Northfield Ambulance Service responded to 815 calls in 2015. The Ambulance Service is housed in the Town Garage, which is located in the

0.2 percent annual chance floodplain of the Dog River. The Town would like to relocate this function to an area that is not in a flood hazard zone.

Police services are provided by the Northfield Police Department. The Department is staffed by a Chief of Police, 5 full-time officers, and 2 part-time officers. The Department responded to 2,443 calls in 2015. In addition to the Police Department, Norwich University provides private, on-campus security services. Vermont State Police and the Washington County Sheriff's Department are relied upon to provide supplementary support.

The Municipality also has extensive emergency management vehicles and training. The Ambulance Service owns an all terrain vehicle with toboggan for use in off trail rescues. The Municipality also owns a mass casualty incident trailer and mobile command post, which is offered for mutual aid use. Staff in the Fire and Police Department is also trained to use the Jaws of Life.

The Municipal Plan was adopted in 2014 and includes goals, policies, and tasks in regards to environmentally sensitive areas, water resources, earth resources, future land use, wastewater treatment, transportation, and public services.

Northfield has implemented Land Use Regulations which include Subdivision and Zoning Bylaws. The land use regulations set out protections in town for water resource aquifers, wetlands, riparian zones and to manage stormwater, sediment and erosion (2013 State Hazard Mitigation Plan, p. 6-5 & 13). The Zoning Regulations limit development on slopes greater than 25% and elevations greater than 1800 feet.

The Town's Floodplain Zoning Regulation has been in effect since April 2010 and is compliant for the jurisdiction's ongoing participation in the NFIP. Northfield has 54 NFIP policies and began participating in 1978. The flood hazard regulations include no new principal structures, storage, or fill in the floodplain or fluvial erosion hazard zone. Any new development requires project review from the Zoning Administrator, Zoning Board of Adjustments, and/or NFIP Coordinator at the Agency of Natural Resources in order to obtain a permit.

Enforcement actions are administered by the Zoning Administrator. Notices of violations are mailed to the State NFIP Coordinator. If violations remain, the ZA shall submit a declaration to the Administrator of the NFIP requesting denial of flood insurance to the property.

At the time of plan development, Northfield has Interim 17.5% Status under the Vermont Emergency Relief and Assistance Fund (ERAF). The Town has earned this Interim Status by adopting Fluvial Erosion Hazard regulations that prohibit new principal structures. The town is thereby able to receive a 17.5% of total project cost contribution from the State Emergency Relief and Assistance Fund after a Federally Declared Disaster. This status is Interim, however, and will not remain effective in perpetuity. The status expires two years after a Phase 2 Statewide River Corridor Map is published by the Agency of Natural Resources. In order to maintain the 17.5% Status, Northfield will need to alter its bylaw to meet the ERAF 17.5% State Share Criteria.

Northfield's bylaws currently do not meet these criteria. Without this revision, Northfield's ERAF state contribution rate would change to 12.5%.

Northfield's Conservation Commission also promotes and implements natural resource protection measures which often wrap in hazard mitigation. This includes making recommendations regarding the local land use regulations, planting riparian buffers, and planning for management of the urban forest.

### **Ability to Expand Existing Municipal Policies & Programs**

The majority of Northfield's capacity to expand its existing hazard mitigation program is through taking advantage of assistance provided by state agencies and the regional planning commission, as well as collaborating with community organizations, businesses and institutions. State agencies such as the Dept. of Emergency Management and Homeland Security, Agency of Transportation, Agency of Natural Resources, and Agency of Commerce and Community Development provide guidance and technical assistance as well as funding resources which the Town may access to expand its mitigation programs.

Organizations such as the Vermont League of Cities and Towns, the Friends of the Winooski River, and Citizens for a Responsible Railroad can provide expertise, and in some cases direct manpower and/or financial resources to assist the Town with carrying out hazard mitigation programming or projects.

Local businesses, as well as the expertise and student body at Norwich University are another resource for Northfield to access for hazard mitigation capacity. These resources will require the active cultivation of collaborative relationships to take advantage of these resources. Businesses and the University are also important partnerships to expand, as they are major landowners and development interests in the community.

The capital planning and budgeting process is also an important tool through which the municipality may work to incrementally grow revenues designated for specific hazard mitigation expenditures.

The Town has the authority to levy impact fees to support planning and other programs that guide development to be compatible with public interests. Northfield does not currently exercise this authority.

### **Existing Mitigation Programs, Projects and Activities**

The ongoing or recently completed programs, projects and activities are listed by mitigation strategy and have been reviewed for the update of the plan.

Community Preparedness Activities

- Current Local Emergency Operations Plan
- Current Emergency Operations Plan
- Y2K Vulnerable Population Survey (1999)

Hazard Control & Protective Works

- Maintenance Programs (Culvert Survey & Replacement)
- Participant in the Capital Fire Mutual Aid System

Insurance Programs

- Participation in NFIP

Land use Planning/Management

- Conservation and Forestry District
  - Section 603 – All lands within this Town District (generally above 1800 feet, slopes greater than 25%, thin soils or not served by Town highways) shall not have development within 100 feet of any brook or river.
- Floodplain Zoning Regulations
  - Prohibit new structures, storage and fill in the Special Flood Hazard Area and Fluvial Erosion Hazard Areas

Protection/Retrofit of Infrastructure and Critical Facilities

- Dry Hydrant Program – removed one since last plan

Public Awareness, Training & Education

- CPR Trainings/First Aid
- Drug Abuse Resistance Education (D.A.R.E.) Program
- Safety Day
- School Fire Safety Program

The following chart provides an overview of Northfield’s proposed 2011 local hazard mitigation actions along with their current status. Additionally since the 2011 plan, the Town adopted revised flood hazard regulations in April 2010, as described above.

2011 Mitigation Action	2016 Project Status
Review and adapt building code so that new and municipal structures are earthquake resistant	Northfield’s planning priorities have changed to focus on hazards with a documented history of occurrence and higher probability than earthquake
Retrofit bridges along emergency access routes	Fairgrounds Bridge rebuilt with wider span

Earthquake proof Gillespie fuel tanks in downtown Northfield	Containment structures installed surrounding all of the storage tanks. Roof installed as well
Tie downs for mobile home parks	Check land use regulations for adopted tie down requirement?
Public information campaign instructing residents of earthquake dangers and remedies	Northfield's planning priorities have changed to focus on hazards with a documented history of occurrence and higher probability than earthquake
Create an emergency route to the senior living center	The risk to the Mayo Healthcare facility is still relevant and additional preparedness and evacuation planning has been included as an action in this plan.
Relocate the senior living center to a more appropriate area	This vulnerability is still relevant, however, Mayo Healthcare has determined that enhanced preparedness and evacuation planning is more feasible than relocation.
Purchase a rescue watercraft	No longer relevant – Colchester & Woodbury Rescue water crafts are accessible w/in adequate time
Culvert expansion projects – Jarvis Lane and across railroad	South culvert running under the RR bed has been replaced...and upsized? North culvert running under the RR tracks is in poor condition and is undersized. Has not yet been replaced. Another under Jarvis Lane continues to be problematic
Build guard rails around well head protection area to prevent spills	This action is still relevant and will be considered when the Water System Source Protection Plan is next updated.
Select Projects from Dog River Corridor Plan	FWR did plantings in well field next to river bank Water St. projects have engineering plans ready
Extend sewer line to Route 12/12A intersection and north to Norwich University to serve wellhead protection areas	Some engineering, permitting other than Act 250 completed (80%), has been completed, final engineering has been completed, bond vote is next step
Relocate municipal facilities – ambulatory services, waste water treatment facility, town garage, & food shelf	Study currently underway investigating 2 alternate locations (collocate w/FD+upgrade or standalone building in same area) for the ambulance facility. Selectboard needs to revisit. WW treatment & garage, not in next 5 years Food shelf is in process of looking for alternate location

Place cross bars at major Route 12 and railroad intersections	
Work with elected officials, the State ANR and FEMA to correct existing compliance issues and prevent any future NFIP compliance issues through continuous communications, training and education.	No existing compliance issues, check with State Floodplain Manager
Base flood elevation home inspections - inspect foundations at time of completion prior to framing to determine if lowest floor is at Base Flood Elevation	
Public outreach – make and distribute NFIP pamphlets at Town Offices, Fire Department, and Police Department	Pamphlets available at Clerk’s office

## 5. Planning Process

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### 5.1 Planning Process

The Central Vermont Regional Planning Commission (CVRPC) coordinated the Northfield Local Hazard Mitigation Plan process, in partnership with the Town of Northfield. The Town Manager served as the primary point of contact for the planning process. The planning process was conducted over the course of May – December 2016. Primary guidance and oversight of the process was provided by a local hazard mitigation team comprised of the following local officials:

- Peter DeMasi, Highway Superintendent/Fire Chief
- Lawton Rutter, EMS Director
- Patrick DeMasi, Utility Superintendent
- Trent Tucker, Road Foreman
- Steve Fitzhugh, Planning Commission Chair
- Jeff Schulz, Town Manager
- Gail Aloisio, CVRPC Planner

The local mitigation team met over the course of May through October 2016 to review information about hazards and mitigation options in Northfield, and provide local knowledge and

professional opinions. A Kick Off Meeting was held in May, providing an overview of the planning process and schedule, and to brainstorm outreach activities. In June, the team convened again to discuss the hazards that impact Northfield and the town's greatest overall vulnerabilities. At this meeting the team determined the most important hazards for Northfield to plan for, and also started brainstorming potential mitigation projects. CVRPC then worked to develop these mitigation project ideas with team members individually over July and August.

Research and feedback on hazards, community capacities, community assets and potential mitigation projects was also conducted in coordination with other important stakeholders. Phone calls, emails and meetings were exchanged and held to involve the expertise of additional Northfield town staff, various state agency and regional stakeholders, and a few non-profits with a role in resilience and mitigation planning.

The public, as well as neighboring communities, and regional and state entities were involved in the planning process in multiple ways. In July, an information and input table was provided at the Northfield Night on the Common, a community development event coordinated with the weekly farmers market. Participants had the opportunity to ask questions about the planning process, and provide their feedback on hazards of most concern, and the most effective investments to address them. A broader regional audience was solicited for feedback via the July CVRPC Newsletter. This newsletter described the plan and asked the readers for feedback via an online survey. Lastly, the draft plan was distributed directly to Emergency Management Directors in neighboring municipalities, to solicit their comments. These towns are Warren, Waitsfield, Moretown, Berlin, Williamstown, Roxbury and Brookfield.

#### INFORMATION ON PUBLIC COMMENT TO BE INCLUDED HERE

Feedback from stakeholders was incorporated during drafting both before the final mitigation actions were chosen and before the draft was finalized. The local mitigation team was presented with the results of the July tabling event, before finalizing the mitigation actions that would be included in the draft. The team also met to review feedback and comments after the draft was distributed directly for comment to specific stakeholders.

## 5.2 Plan Update Process

The Northfield Local Hazard Mitigation Plan was originally adopted by the Town as an Annex to the Central Vermont Regional Local Hazard Mitigation Plan in October 2005 and received FEMA final approval in January 2006. The 2011 plan was developed as a standalone Town Local Hazard Mitigation Plan. The 2016 plan updates that standalone plan.

Town land-use planning and emergency preparedness documents, as well as the Vermont State Hazard Mitigation Plan, Northfield Stormwater Mapping Report, Dog River Corridor Plan, and Roxbury Local Hazard Mitigation Plan were also reviewed as part of the update process.

## 6. Risk Assessment

### 6.1 Hazard Identification and Analysis

The natural disasters included in the table below were ranked to determine the worst threat hazards to Northfield. Worst Threat Hazards were identified based upon the likelihood of the event and the community’s vulnerability to the event. The methodology used is described in further detail below the table.

Hazards not identified as a “worst threat” may still occur, but due to a low likelihood of the event and/or the community’s vulnerability being limited to a routine emergency, this plan will not address the “non-worst threat” hazards. Greater explanations and mitigation strategies of “non-worst threat” hazards can be found in the State of Vermont’s Hazard Mitigation Plan.

Hazard	Likelihood <sup>1</sup>	Community Vulnerability <sup>2</sup>	Worst Threat
Flash Flood/Flood/Fluvial Erosion	Med	Severe	X
Water Supply Contamination	Med	Severe	X
Railroad Accident	Med	Severe	X
Extreme Cold/Winter Storm/Ice Storm	High	Moderate	X
Hurricane/Tropical/Severe Thunderstorm	Med	Severe	X
Earthquake	Low	Severe	
Ice Jam	Med	Moderate	
Hail	Med	Moderate	
Drought	Med	Moderate	
Infectious Diseases Outbreak	Med	Moderate	
Invasive Species (Emerald Ash Borer, etc.)	Med	Moderate	
Terrorism (campus, school, cyber incident)	Low	Severe	
High Wind	Med	Minimal	
Dam Failures	Med	Minimal	
Structural Fire	Low	Moderate	
Land/Rockslide/Debris Flow	Low	Moderate	
Wildfire/Forest Fire	Low	Moderate	
Tornado	Low	Moderate	
Civil Disturbance	Low	Moderate	
Highway Rock Cuts	Low	Minimal	
Expansive Soils	Low	Minimal	
Extreme Heat	Low	Minimal	

Nuclear Power Plant Failure	Low	Minimal	
Avian (Bird) Influenza	Low	Minimal	
Subsidence	Low	Minimal	
Karst Topography	Low	Minimal	-
Coastal Erosion	Low	Minimal	-
Tsunami	Low	Minimal	-
Volcano	Low	Minimal	-

<sup>1</sup>Likelihood: **High** – Nearly 100% probability of happening in the next year  
**Medium** – will happen at least once in the next 10 years  
**Low** – will happen at least once in the next 100 years

<sup>2</sup>Community

Vulnerability: **Severe** – the hazard presents the threat of disaster  
**Moderate** - a hard hit, but doesn't constitute a disaster nor a routine emergency  
**Minimal** - routine emergency

After being rated for each Likelihood and Community Vulnerability, hazards were ranked according to the most threatening combination of likelihood and community vulnerability. If hazards were tied, the Local Mitigation Team determined which is more threatening by considering the magnitude of the hazard, prior impacts the hazard type has caused, the value of the community assets vulnerable to the hazard, the level of community preparedness or existing mitigation, and resources available to mitigate the hazard.

The Town of Northfield identified the following disasters as presenting the worst threat to the community:

- Flash flood/flood/fluvial erosion
- Water Supply Contamination
- Railroad Accident
- Extreme Cold/Winter Storm/Ice Storm
- Hurricane/Tropical/Severe Thunder Storm

A discussion of each significant hazard is included in the proceeding subsections and a map identifying the location of each hazard is attached (See map titled *Hazard Analysis Map*.) Each subsection includes a list of past occurrences based upon County-wide FEMA Disaster Declarations (DR-#) plus information from national databases, local records, a narrative description of the hazard and a hazard matrix containing the following overview information:

Hazard	Location	Likelihood	Extent (Magnitude)	Risk	Vulnerability
Type of hazard	General areas within municipal territory which	<u>High</u> : 10% to 100% probability within the next	<u>Minimal</u> : Limited and scattered property damage; no damage to public infrastructure contained geographic area (i.e., 1 or 2 communities); essential	Dollar value of community asset(s) susceptible	Types of structures impacted

	are vulnerable to the identified hazard.	year or at least once in the next 10 years. <u>Medium:</u> less than 10% to 100% probability within the within the next year or less than once in the next 10 years.	services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities. <u>Moderate:</u> Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities) essential services are briefly interrupted; some injuries and/or fatalities. <u>Severe:</u> Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.	to the hazard, or percentage of community assets susceptible to damages.	
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## 6.2 Hazard Profiles: Worst Threat Hazards

### Flooding/Flash Flooding/Fluvial Erosion

Northfield lies in the heart of the Dog River valley, which is defined by the Northfield Range to the west and the Irish Hills to the east, both of which have elevations above 2,400 ft. The most significant body of water within the Town is the Dog River, which flows northward along Vermont Route 12 and through Northfield’s three population centers, eventually terminating at the Winooski River in Montpelier. Its tributaries include Cox Brook, Union Brook, Stony Brook, Felcher Brook, Bull Run, Sunny Brook and Robinson Brook.

The most significant historic floods occurred in August 2011, November 1927, September 1938, and June 1973.

History of Occurrences (within Northfield and Central Vermont from National Climactic Data Center Website, FEMA Declared Disaster (DR) List and the flood gauge located at Northfield Falls. This gauge is approximately 2.5 miles downstream from Northfield Village, on the Dog River):

The National Weather Service, Burlington Office, predicts the following impacts at various flood stages of the Dog River:

17 ft Devastating flooding throughout the Dog River valley. Route 12 will be inundated, with road damage and bridge washouts. Low structures along the Dog River will be inundated. Flooding will be comparable to Irene in 2011.

9 ft Water will cover low spots of Route 12 between Northfield Falls and Montpelier, and Browns Mill Road in Berlin. Fields and farmland along the Dog River will flood.

8 ft There will be widespread field flooding along the Dog River between Northfield Falls and Montpelier. Water will approach Route 12 in the town of Berlin

<http://water.weather.gov/ahps2/hydrograph.php?wfo=btv&gage=nffv1>

Date	Event	Location	Extent - flood stage is 8 ft
April 15-18, 2014 DR 4178	Severe Storms and Flooding	Countywide	
6/25-7/11/2013 DR 4140	Severe Storms & Flooding	Countywide	Dog River, Northfield Falls Flood Gauge at 7.34 ft
8/28/2011 DR 4022	Tropical Storm Irene	Northfield, Statewide	Dog River, Northfield Falls Flood Gauge at 17.26 ft
5/27/2011 DR 4001	Flash Flood	County Wide	3-5" of rain
4/23-5/9/2011 DR 1995 & 4043	Severe Storms & Flooding	Countywide	
3/23/2010	Flood	Northfield	7.14 ft, 1.5-2 inches of rain across central Vermont, Dog River left its banks and partially covered Route 12 between Northfield and Berlin
10/1/2010	Flood	Northfield	The Dog River left its banks in Northfield, flooding portions of Water Street
7/21 – 8/12/2008 DR 1790	Flash Flood	County Wide	2-5" of rain
7/9-11/2007 DR 1715	Flash Flood	County wide	3-6" of rain in 2 hrs
12/01/2006	Flood	Northfield	8.50 ft, nearly 3" rain in Northfield, minor flooding along Route 12 in Northfield
4/14/2002	Flood	County wide, Northfield	7.67 ft, 1-3" of rain countywide
12/17/2000	Flood	County Wide	3" of rain countywide
5/11/2000	Flash Flood	Countywide	6.52 ft
9/17/1999 DR 1307	Tropical Storm Floyd	County Wide	4.97 ft, 5-7" rain county wide,

6/27/1998 DR 1228	Flash Flood	Northfield, County Wide	6.66 ft, 3-6" rain countywide,
7/15/1997 DR 1184	Flash Flood	County Wide	2-4" of rain
1/19/1996 DR 1101	Flood; ice jam	County Wide	7.41 ft
03/11/1992 DR 938	Flooding, Heavy Rain, Ice Jams	Statewide	
08/05/1989 DR 840	Severe Storms, Flooding	Statewide	10.16 ft
9.84 ft on 03/31/1987			
8/10/1976	Flood	County Wide, Northfield	8.56 ft
9.13 ft on 04/01/1976			
6/30/1973	Flash Flood	Northfield, Countywide	11.57 ft
9.46 ft on 06/01/1952			
9/21/1938	Flood, Hurricane	County Wide, Northfield	11.53 ft
11/03/1927	Flood	County Wide, Northfield	Winooski River-Montpelier gauge downstream at 27.10 ft (flood stage = 15 ft)

According to the National Flood Insurance Program, many properties within the Town are located within the designated 100-year floodplain. Northfield, in fact, is in the top 8% of communities in Vermont with many structures in the Special Flood Hazard Area. (Ranked #20 of 251 Towns) (2013 State Hazard Mitigation Plan, p. 4-132). Based on the results of overlaying the FIRM flood maps with the location of the E911 structures, there are 402 properties (parcels) and 100 structures in the 100 year floodplain. By using median property values from the Northfield grand list, a very general sense of risk of loss can be calculated for 325 parcels that have both land and structures. Many of the structures on these parcels, however, are not in the floodplain. The total value for these properties is \$51,447,500, and the value of the land only is \$3,080,000. As many of the structures represented in the land and structure value are not in the floodplain, this gives only a very broad sense of the value at risk in the Special Flood Hazard Area.

There is 1 documented repetitive loss property in Northfield. It is a residential structure in the Water Street area. The other 2 repetitive loss structures on record have been acquired and demolished by the municipality through FEMA Hazard Mitigation grants since the last FEMA database update. The table below lists available records on repetitive loss structures. Information

on which specific properties have been mitigated is not published to protect the privacy of the homeowners.

<b>Repetitive Loss Properties in Northfield</b>						
	<b>Insured?</b>	<b>Total Building Payment</b>	<b>Total Contents Payment</b>	<b>Losses</b>	<b>Total Paid</b>	<b>Average Payment</b>
	YES	52,280.01	0.00	2	52,280.01	26,140.01
	YES	59,592.25	0.00	2	59,592.25	29,796.13
	YES	179,245.37	0.00	2	179,245.37	89,622.69
2013 State Hazard Mitigation Plan, p.H-6						

It is very likely that there are more residential structures in the Water Street neighborhood that have experienced repetitive losses. The community is currently in the design stages for a floodplain restoration project to protect this neighborhood from future flooding, although it is not designed to mitigate all flood waters from a 100 year level flood. Hydraulic studies have been completed to identify the best flood mitigation options for the neighborhood. Design and identification of implementation funding is currently underway as of the development of this plan. Completing the final steps in the mitigation project have been identified as mitigation actions for this LHMP (see Mitigation Action Table).

As previous events have made clear, even areas beyond the NFIP designated 100-year floodplain may be vulnerable to these types of hazards. Channel adjustments with devastating consequences have frequently been documented wherein such adjustments are linked to 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.

The Statewide River Corridor hazard area in Northfield includes even more parcels and structures than the Special Flood Hazard Area (100 year floodplain). This hazard area is similar to the fluvial erosion hazard area regulated by the town, but also includes a couple other tributaries to the Dog River, a 50 foot buffer on the FEH boundary, and a 50 foot buffer on small streams draining less than 2 square miles. Therefore there may be more properties at risk than are currently regulated by the town. 496 parcels and 202 E911 structures are in the Statewide River Corridor hazard area. 413 of the parcels with both land and structures are valued at \$65,377,900, and the land only at \$3,320,000. Again, many of the structures represented in this value are not actually located in the Statewide River Corridor.

A corridor plan for the Dog River was developed by VT Agency of Natural Resources. The plan assesses the Dog River until its convergence with the Winooski River in Montpelier. The stretch of river in Northfield was rated in “fair” condition; however the river is undergoing “high” to “extreme” bank adjustments and fluvial erosion. The fluvial erosion hazard map of Northfield is located as an attachment. The high rates of adjustment and erosion can be attributed to several

factors – straightening of the river channel, development encroachments, high levels of stormwater runoff, historic gravel mining and dredging activities, undersized culverts and bridges, and lack of riparian buffers greater than 25 feet. In Northfield, there are 7 undersized bridges which should be replaced in order to decrease erosion and restore the River’s health. In addition to bridge projects, the plan identifies 21 projects that could be completed in Northfield to restore and renew the River’s health. The map and associated matrix of projects is located in Appendix B.

The attached Hazard Analysis Map identifies the Special Flood Hazard Area and Statewide River Corridor, and depicts the number and types of structures that are located within those hazard areas.

More specific community assets vulnerable to flooding are the waste water facility, Ambulance Facility, and Town Garage. These facilities are located in the 500 year floodplain (0.2 percent annual chance flood). The Fire Station, as well as other government buildings, are outside the designated floodplain, but near the river. Other facilities identified in the Local Emergency Operations Plan as in flood hazard areas include – Mayo Nursing Home, Tucker’s Trailer Park, Northfield School, Four Seasons Nursing Home, and the Veterans Place. Tropical Storm Irene completely destroyed one home in Tucker’s Trailer Park. (VT State Hazard Mitigation Plan, p.4-67)

Of these, the community has identified the Ambulance Facility as the most important community asset to address with limited mitigation resources. The ability to access the Ambulance Facility during a flood event has immediate impacts on life safety for residents of Northfield. Entities independent of the municipality have been working on their own, and sometimes in collaboration with the Town, to improve preparation and mitigation for future flooding events.

As of writing this plan, no new commercial or residential developments are planned in the floodplain/fluvial erosion hazard zone. Flood hazard/FEH bylaws prohibit development of new principal structures in flood prone and FEH zones.

Bridges and roads are particularly susceptible to damage in the event of a flash flood. The Areas of Local Concern Map identifies four vulnerable bridges that have a rating of “Scour Critical”: Pleasant Street Bridge and West Hill Road Bridge over Union Brook and Route 12A bridges over the Dog River and Sunny Brook. Water Street, Jarvis Lane, Lovers Lane, and the Route 12A Trailer Park are susceptible as well.

Since 2005, Northfield has replaced over 100 culverts, and built 10 new culverts to better control runoff when storms occur. The municipality has had three stormwater studies conducted (DuBois & King 2008 Stormwater Drainage Study of the south end of the Village and Town; Stantec study of Northfield Falls; CVRPC 2011 Stormwater Mapping of the Village). Stormwater disconnection and treatment has been installed at three locations, on Central Street, along N. Main Street in the Kenyan’s Hardware Parking Lot, and behind the Legion Hall off Depot Square. With these

projects completed, staff are prioritizing the next recommendations of these studies in order to seek funding for their implementation.

The DuBois & King report identified 3 culverts which are failing, undersized and poorly designed –Jarvis Street and two railroad culverts. According to State standards, culverts must be able to handle flow rate and water depth of a 25 year storm. Both Jarvis Street and the railroad culverts are only able to handle 2-5 year storm levels. One of the railroad culverts under the railroad bed parallel to Jarvis Lane has been upgraded, helping to alleviate frequent localized flooding in that area. Improvement of municipal stormwater drainage may also be helpful in further mitigating localized flooding.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Flooding	Water St, Dogwood Rd, Dog River Dr, Lovers Ln, Rte 12 A Trailer Park, Along Cox Brook, Union Brook,	Medium	Roads, Bridges, Senior Living Center, Sewer Facility, Fire Station, Town Garage	Moderate to severe depending on level of flooding	\$400,000/bridge >\$1 million per municipal building, treatment facility and senior living center

### Water Supply Contamination

The Source Protection Plan for the Northfield Water Supply outlines multiple hazards to the system, some of which are natural hazards and others which are man-made. The primary concern to the municipality is contamination from failed individual on-site septic systems. The municipality has conducted planning and design for extension of the municipal wastewater system that would reduce the number of on-site systems, and therefore the likelihood of this man-made concern.

Flooding and fluvial erosion are special natural hazards that are of concern to the municipality regarding the municipal water supply. Two of the well heads are located both in the 100 year flood plain (1 percent annual chance) and in the River Corridor, or Fluvial Erosion Hazard Area (FEH). The other, northernmost well-head coincides with the boundary of the 500 year floodplain (0.2 percent annual chance), as well as the River Corridor (or FEH area) boundary. Much of the primary and secondary groundwater recharge areas for these wells is located in the 100 year floodplain and River Corridor as well.

During Tropical Storm Irene in August 2011, one of the supply wells sustained bacterial contamination. The well was taken offline for a few days while the contamination was treated,

and then brought back online. Municipal drinking water supplies were not directly affected during this incident, as the reservoirs and additional wells provided sufficient supplies for those days. The municipality nevertheless would like to plan for the potential threat that a repeat of this flooding scenario poses to the water supply.

Erosion of the riverbanks along the well field also occurred during Tropical Storm Irene, although this did not cause damage to the well-heads or impact the water supply. The riverbank was repaired within a few weeks of the event. As the well-heads are so close to or inside of the fluvial erosion hazard area and River Corridor, the threat of erosion over time is also a risk for the municipality to consider.

Another important characteristic of Northfield’s sewer system is that it is a combined system. When heavy flooding occurs, the treatment system becomes overwhelmed and releases some untreated sewage into the Dog River. Although the Northfield well head protection area is upstream from the treatment facility, the overflow from the facility could have environmental impacts on downstream users and water supplies. The municipality is working with the Agency of Natural Resources as well as CVRPC to separate and treat stormwater flows to prevent this hazard. Most of the combined flows have been addressed and therefore those remaining are not a priority for this hazard mitigation plan.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Water Supply Contamination	Well head protection areas	Med	Municipal Wells	Moderate	\$2 million

## Railroad Accident

The Central Vermont Railroad runs through Northfield from north to south along the valley floor. This stretch of railroad is a consistent steep downgrade from south to north, causing trains to brake through Northfield going towards Berlin. Rail activity includes both Amtrak passenger service from Boston to Burlington and cargo transport, to and from Canada. Cargo transport includes a variety of freight including hazardous materials including oil and propane. The train route runs along route 12 and 12A through Northfield. The tracks pass through the center of Northfield Village, directly adjacent to several businesses and in proximity to residences as well. There are several major road and trail crossings in the town.

There have been several occurrences of railroad accidents in Northfield. A historic collision occurred in August of 1910 when two freight trains collided causing two oil tanks on the train to explode. Seven railroad employees were killed. The accident happened on a sharp turn, where an accident of similar nature had occurred two years prior. Damages were estimated to be \$50,000. In February 2009, a woman on a snowmobile collided with an Amtrak train on Fairground Road. The snowmobile was damaged; however, no one was hurt.

On October 5, 2015, the Amtrak Vermonter Train 55 derailed after hitting a rock slide lying on the tracks in Northfield near Bull Run Road and Vermont Route 12A. The rock slide is said to have occurred naturally in the early morning hours. Five cars left the track including the engine and coach car which went into the brook below the track. Four passengers and three crew members sustained non-life-threatening injuries in the accident.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Railroad Accident	Area behind sewage treatment plant/ambulance facility, road/trail crossings	Medium	Cars, pedestrians, water system, ambulances,	Severe if large crash	\$2 million for treatment plant/ambulance facility

## Extreme Cold/Winter Storm/Ice Storm

History of Occurrences (county wide)

Snow and/or ice events occur on a regular basis. Recent significant events have included:

Date	Event	Location	Extent
01/09/2011 – 01/10/2011	Winter Weather	Countywide	6” of snowfall in Northfield
01/12/2011	Winter Storm	Countywide	9” of snowfall in Northfield
02/02/2011	Winter Storm	Countywide	10-20” of snowfall across Washington County
02/05/2011-02/06/2011	Winter Storm	Countywide	10 to 15 mins of thundersnows occurred with snowfall accumulations of 6 to 10 inches throughout Washington County
02/07/2011 – 02/08/2011	Winter Weather	Countywide	4-7” of snowfall across Vermont
02/25/2011	Winter Storm	Countywide	6-12” of snowfall across Washington County
03/06/2011 – 03/07/2011	Winter Storm	Countywide	15-30” of snowfall across Washington County. Statewide, nearly 10,000 customers lost electrical power, nearly all

			school districts closed on the 7 <sup>th</sup> .
11/23/2011	Winter Storm	Countywide	5-12" of heavy, wet snow across Washington County.
12/28/2011	Winter Weather	Countywide	2-6" of snowfall across Washington County
02/24/2012	Winter Storm	Countywide	4-18" of snowfall across Washington County
02/29/2012	Winter Storm	Countywide	6-10" of snowfall across Washington County
03/01/2012	Winter Storm	Countywide	4-7" of snowfall in Washington County.
12/26/2012	Winter Storm	Countywide, Statewide	9-18" snowfall in Washington County. 18" in Roxbury.
02/08/2013	Winter Storm	Countywide, Statewide	6-12" of snowfall across Washington County.
03/19/2013- 03/20/2013	Winter Storm	Countywide, Statewide	6-14" of snowfall across Washington County. Unusual high amount of vehicle accidents involving tractor trailers across portions of the State.
12/14/2013- 12/15/2013	Winter Storm	Countywide, Statewide	8-12" of snowfall across Washington County
02/05/2014	Heavy Snow	Countywide, Statewide	6-10" of snowfall across Washington County
02/13/2014 – 02/14/2014	Heavy Snow	Countywide, Statewide	17" of snowfall in Northfield
03/12/2014 – 03/13/2014	Winter Storm	Countywide, Statewide	12-20+" of snowfall across Washington County. 24" in East Roxbury, 20" in Northfield.
11/26/2014 – 11/27/2014	Winter Storm	Countywide, Statewide	12" of snowfall in Northfield.
12/09/2014 – 12/11/2014  DR 4207	Winter Storm	Countywide, Statewide	12" of heavy, wet snowfall in Northfield. Resulted in widespread power outages and vehicle accidents in Washington County.
01/03/2015 – 01/04/2015	Winter Weather	Countywide, Statewide	3-5" of snowfall with ice accumulation up to 1/10" across Washington County.
01/07/2015 – 01/08/2015	Extreme Cold/Wind Chill	Countywide, Statewide	Lows of 15-25 Degrees below 0 in Washington County.

01/18/2015- 01/19/2015	Winter Storm	Countywide, Statewide	2-6" of wet snowfall across Washington County. Isolated power outages, numerous vehicle accidents.
01/27/2015 – 01/28/2015	Winter Weather	Countywide, Statewide	3-7" of snowfall across Washington County.
01/30/2015	Winter Weather	Countywide, Statewide	2-3" of snowfall across Washington County.
02/01/2015 – 02/28/2015  UNDECLARED DISASTER	Cold/Wind Chill	Countywide, Statewide	Average temp was 13 to 17 degrees below normal statewide. Statewide, damage to infrastructure, frozen water mains, etc. totaled at least \$1 million.
02/02/2015  UNDECLARED DISASTER	Winter Storm	Countywide, Statewide	10" of snowfall in Northfield.
12/29/2015	Winter Weather	Countywide, Statewide	4-6" of snow and sleet across Washington County.
02/16/2016	Winter Weather	Countywide, Statewide	2-4" of snowfall with 1/10 <sup>th</sup> of ice accretion across Washington County.
04/06/2016- 04/07/2016	Winter Weather	Countywide, Statewide	Less than 1-2" of snowfall in Washington County.

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, trees, 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.

Other major problems include closed roads and restricted transportation.

By observing winter storm watches and warnings, adequate preparations can usually be made to lessen the impact of snow, ice and sleet, and below freezing temperature conditions on the Town of Northfield. 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. Northfield should plan and prepare for these emergencies. That planning and preparedness effort should include the identification of mass care facilities and necessary resources such as cots, blankets, food supplies and generators, as well as debris removal equipment and services. In addition, Northfield should develop debris management procedures (to include the identification of debris storage, processing and disposal sites) so that the tree and other storm related debris could be handled in the most expedient, efficient and environmentally safe manner possible.

### Hurricane/Tropical/Severe Thunder Storm

History of Occurrences (within Northfield and Central Vermont from NCDC Website and FEMA DR List. Closest flood gauge is located in Montpelier, VT approximately 9 miles downstream on the Winooski River):

Date	Event	Location	Extent
02/29/2016	Strong Wind	County Wide	Wind gusts of 35 to 45 MPH. Isolated to scattered tree limbs and power lines downed by wind.
10/07/2013	Strong Wind	State Wide	Reports of tree branches on utility lines in Washington County.
01/20/2013	Strong Wind	County Wide, State Wide	Winds in excess of 50 MPG. Numerous reports of tree or power line failures statewide. Estimated 10,000 without power statewide
10/29/2012	Hurricane/Superstorm Sandy	Statewide	15 to 30 MPH winds with frequent gusts in excess of 40 MPH. Scattered damage to trees. 35,000 residents statewide without power.
7/4/2012	Thunderstorm Wind, Hail	Northfield, Statewide	50 knot winds. Dime size hail reported. 0.75" total. Several trees downed in Northfield.

8/28/2011 DR 4022	TS Irene	Statewide	~6" rain , Montpelier flood gauge at 19.05 feet (flood stage is at 15 feet)
5/26/2011 DR 4001	Severe Storm, hail, flash flooding	Northfield, County Wide	1" hail, 3-5" of rain, 50 knot winds,
05/26/2011 DR 4001	Hail	Northfield	Dollar size hail reported. 1.5" total.
05/26/2011 DR 4001	Hail	Northfield Falls	Quarter size hail reported along Union Brook Road. 1" total.
7/21/2008	Severe storms, flooding	County Wide	
8/25/2007	Severe Storms	County Wide	55 knot wind gusts, 1" hail
7/9/2007 DR 1715	Severe Storms, hail, flooding	County Wide	1"-2.75" hail,
6/19/2006	Severe storms	County Wide	50 knot winds, downed trees and power lines
8/1/2005	Severe Storm	County Wide	1" hail, 55 knot winds
9/16/1999 DR 1307	Tropical Storm Floyd	Statewide	Tropical Storm,
6/27/1998 DR 1228	Severe Storms	County Wide	\$2M in damages, 3-6" rain across county
5/29/1998	Severe Storms	County Wide	50 knot winds, heavy rains, downed trees and power lines
7/15/1997	Severe Storms	County Wide	2-4" of rain, Not a historical crest
8/4-6/1995 DR 1063	Severe storms, flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
7/23/1990 DR 875	Severe Storms, flash flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
8/4/1989 DR 840	Severe Storms, Flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
6/7/1982	Severe Storms	New England	14" of rain, \$276 M damages
8/5/1976 DR 518	Hurricane Belle	Statewide	Gale force winds, 2 deaths,
7/3/1964	Hail	County Wide	1.5" hail
9/22/1938	Hurricane	Statewide	Category 1 force winds

Hurricanes and tropical storms are violent rain storms with strong winds that have large amounts of rainfall and can reach speeds up to 200 mph. Hurricane season is between the months of June and November. 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. High wind events are sustained winds over 40 mph and/or gusts greater than 58 mph. A severe thunderstorm is a thunderstorm that contains any one or more of the following three weather conditions: hail that is 3/4 of an inch or greater in diameter, winds 58 miles per hour or greater, and/or tornadoes. Severe storm events can occur late spring and early summer as temperatures increase in the summer season. The frequency and intensity of hurricanes, tropical storms, and severe storms is expected to increase with climate change.

Similar to flooding, the extent of severe storms is not well documented in Northfield. The impact of storms is usually flood related. See extent for flooding in the above flood section. Wind extent from storms is not well documented as there is no monitoring station in Northfield. Estimates for wind are gathered from county wide data off the NCEM website. An estimate of the worst anticipated wind extent based on past occurrences would be Category 1 force hurricane winds. In the future, Northfield could install a monitoring station or train spotters to better gather data for wind events. Data for wind and storm events can be evaluated using the following scales to ensure continuity of records:

# Beaufort Scale

Beaufort number	Wind Speed (mph)	Seaman's term		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1-3	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	4-7	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	8-12	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	13-18	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	19-24	Fresh Breeze		Small trees begin to sway.
6	25-31	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	32-38	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	39-46	Fresh Gale		Twigs and small branches broken off trees.
9	47-54	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	55-63	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	64-72	Storm		Very rarely experienced on land; usually with widespread damage.
12	73 or higher	Hurricane Force		Violence and destruction.

## 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

<b>Tropical Depression</b>	20-34kts
<b>Tropical Storm</b>	35-63kts
<b>Hurricane</b>	64+kts or 74+mph

Hazard	Location	Vulnerability	Extent	Impact	Probability
High Winds/Hurricane/Tropical Storm/Severe Storm	Town wide for wind, other impacts – see above for specific road damages	Large trees, power lines, culverts/bridges, mobile home	4 feet above flood stage on Montpelier flood gauge during Irene, 4-5" of rain in 24 hrs	To be determined for Irene; \$700,000 in past FEMA claims	Medium

## 7. Mitigation

### 7.1 Town Plan (2014) Goals & Policies that Support Local Hazard Mitigation

#### Natural Resources

##### *Goals:*

- Protect life and property from flooding and related natural disasters. (pg 24)

*Policies:* Generally, development should be regulated to achieve the goals above. Specifically, the following policies regarding sensitive areas and water quality protection, shall be implemented.

- Sensitive areas
  - .1. Carefully sited, designed and managed in upland areas (e.g., over 1800 ft) to avoid steep slopes and shallow soils, and adverse impacts to headwaters and groundwater recharge areas;
- Water quality protection
  - .1. Carefully managed on slopes of 15-25% to minimize surface water runoff and erosion, and prohibited on slopes of 25% or more
  - .2. Sited to avoid and/or minimize impacts to designated source and surface water protection areas that supply community or municipal water systems
  - .3. Sited to avoid flood hazard areas to the extent feasible, or where necessary, be designed to minimize flood damage and the loss of life and property.
  - .4. Sited and designed to preserve or restore pre-construction runoff conditions
- Other Natural Resource Policies:
  - New development in identified flood hazard, fluvial erosion, and river corridor protection areas is prohibited. Improvements to existing development in vulnerable areas must not exacerbate flooding and fluvial erosion.

- Encourage the protection and restoration of floodplains and upland forested areas that attenuate and moderate flooding and fluvial erosion.
- Maintain high-quality flood emergency preparedness and response plans.

## **Transportation**

### *Policies:*

- Town road systems should continue to be maintained in a manner that maintains safe and efficient traffic conditions for current and future demand. Town Road and Bridge Standards should be maintained to ensure ERAF eligibility.

## **Community Facility and Services**

### *Policies*

- Operate the municipal wastewater system in a manner that ensures the highest practical level of protection to the Dog River
- Manage the municipal forest, including land associated with the municipal water supply, for dispersed outdoor recreation in a manner that is consistent with other functions of the property (e.g., water supply, forest management) with the assistance of the Conservation Commission.
- Protect the Paine Mountain area for its recreation, wildlife habitat, biodiversity, watershed, and forestry value.
- Maintain an up-to-date emergency management plan that addresses both potential natural disasters and man-made disasters (e.g., flooding, multi-building fire, major accidents). The emergency management planning process should consider coordinating the use of existing public and private infrastructure (e.g., school, senior center, Green Mountain Family Practice) to provide emergency care, shelter, and relief.
- Ensure that the E-911 emergency response system is maintained on an annual basis and that addresses are accurate and current.
- Encourage the development and maintenance of state of the art telecommunications infrastructure, including broadband internet access, provided such infrastructure, especially telecommunications towers and related facilities, is developed in a manner which minimizes or mitigates potentially adverse impacts to public health and safety and scenic resources.

## **Land Use**

### *Policies*

- Development in the Conservation and Forestry District should be carefully controlled in order to avoid adverse impacts to water quality from erosion and storm water runoff. Consider developing an overlay district to protect ecologically sensitive resources (see Chapter 2, Task 2).
- Residential development and associated land subdivision in rural districts should ensure that it occurs in a manner that does not result in an undue adverse impact to natural and cultural resources described in Chapter 2.

## **7.2 Proposed Hazard Mitigation Programs, Projects and Activities**

The Hazard Mitigation Activities Matrix below lists mitigation activities in regards to local leadership, partners, possible funding resources, timeframe for completion, and prioritization.

The projects were selected by considering them according to the particular hazard addressed, its overall risk to the community, the likely benefit of the proposed project for mitigating that risk, and the cost of the project. Other factors such as financial resources available, community support, and available staff capacity for project implementation were also weighed by the local hazard mitigation team.

Following public comment and receipt of feedback from the Northfield Selectboard and other key stakeholders and groups, the projects will be prioritized according to importance to the community.

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

DRAFT

## Hazard Mitigation Activities Matrix

Hazards Mitigated	Mitigation Action	Local Leadership	Partners	Possible Funding Resources	Time Frame for Completion
<b>Stormwater Planning</b>					
Flooding, Localized Flooding	Stormwater Treatment installation (bio-retention) between Wall St. Bridge & Union St. and collection system upgrade in Union St. catchment area	Public Works	CVRPC	VT ANR Clean Water Funds	Fall 2018
<b>Land Use Regulations</b>					
Flood/Flash Flood/Fluvial Erosion	<p>During the Town Plan update, conduct appropriate analysis and public outreach to determine if the community wants to augment its Floodplain Zoning Regulation to maintain its 17.5% ERAF state contribution rate, by updating the bylaw to meet ANR criteria. Criteria include (but are not limited too):</p> <ul style="list-style-type: none"> <li>adopt small streams setback to be regulated as River Corridor for streams draining &lt;2 sq. mi. Setback must be minimum 50' from top of bank.</li> </ul>	Planning Commission, Selectboard	CVRPC, ANR River Scientist & Floodplain Manager, ACCD	Municipal Planning Grant, CVRPC Technical Assistance, Planning Commission Budget	Deadline 2 years after release of Phase 2 River Corridor data - likely <b>Dec. 2018</b>
Flood/Flash Flood/Fluvial Erosion	If community elects to bring Floodplain Regulation into conformance with ANR Criteria, make and adopt necessary revisions.	Planning Commission, Selectboard	CVRPC, ANR River Scientist & Floodplain Manager, ACCD	Municipal Planning Grant, CVRPC Technical Assistance, Planning Commission Budget	Deadline 2 years after release of Phase 2 River Corridor data - likely <b>Dec. 2018</b>
<b>Non-Regulatory Flood Mitigation Measures</b>					
Flood/Flash Flood/Fluvial Erosion	Evaluate flood and fluvial erosion mitigation and risk management measures for both the municipal water supply well-heads and well-fields as part of the next Source Protection Plan update.	Public Works	ANR Drinking Water & Groundwater Protection	Municipal Budget	September. 2019

Flood/Flash Flood/Fluvial Erosion	Propose bond at the March 2017 Town Meeting for construction of new ambulance facility out of the floodplain and in a safer location near or attached to the Police/Fire Station	Town Manager, Selectboard, EMD, Ambulance Supervisor	DEMHS	Municipal Revenue	March. 2017
Flood/Flash Flood/Fluvial Erosion: Flooding in Village & Northfield Falls	Develop project scope(s) of work for flood modeling between Cross Bros. Dam and the Dog River Drive Facilities to define potential project components, their products, and their uses.	Town Manager, Planning Commission, Conservation Commission, Selectboard	ANR, DEMHS, Friends of the Winooski River	ERP, HMGP	18 month Project Period
Flood/Flash Flood/Fluvial Erosion	Implement designs to restore floodplain parallel to Water St. to reduce flooding in the Water Street neighborhood. This action provides mitigation benefits for the one documented repetitive loss structure in Northfield.	Selectboard, Town Manager, Hazard Mitigation Grants Manager	Friends of the Winooski	CDGB, Ecological Restoration Program	Fall 2017
Flood/Flash Flood/Fluvial Erosion	Floodplain restoration downstream of Union Brook, following completion of Water Street restoration project	Selectboard, Hazard Mitigation Grants Manager	Friends of the Winooski	Ecological Restoration Program	

Flood/Flash Flood/Fluvial Erosion	Bring in outside technical assistance to help Municipal Emergency Responders and Mayo Health & Senior Rehab expand their evacuation & (potentially) All Hazards Planning to possibly include: <ul style="list-style-type: none"> <li>• conducting a mock evacuation exercise</li> <li>• work w/Mayo's licensing agency to ensure all plans meet agency requirements and best practices</li> <li>• work with hospitals that Mayo might evac. too, to determine capacity and best procedures</li> <li>• Coordinate with Red Cross Southern District to support Norwich's process of determining if Armory can support special needs sheltering, or other potential shelter sites</li> <li>• Assist Mayo with obtaining sample evacuation plans or other guidance from the Dept. of Public Safety</li> </ul>	EMD, Fire Dept.	Mayo Health, CVMC, Gifford Medical Center, VT Red Cross Southern District, Dept. of Public Safety, CVRPC	Technical Assistance from Partners	Dec. 2020
<b>Transportation</b>					
Flood/Flash Flood/Fluvial Erosion & Hurricane/ Tropical/Severe Thunder Storm	Request that AOT enlarge the culvert that crosses under Rt. 12 at intersection of Gould Rd.	Road Foreman	AOT	AOT State Infrastructure Programs	Fall 2016 and Ongoing
<b>Railroad</b>					
Railroad Accident	Participate in next Rail Car Incident Response Course offered by State Fire Academy	EMD, Fire Chief, Police	State Fire Academy	n/a	Fall 2017
<b>Extreme Cold/Winter Storm/Ice Storm</b>					
Extreme Cold/Winter Storm/Ice Storm	Identify contractors in the LEOP that Northfield or emergency response partners/agencies can call upon for assistance with debris clearing and removal during an event	EMD, Road Foreman, Fire Dept., Town Manager	Local Contractors, Mutual Aid Partners, DEMHS & State Support Functions	FEMA Public Assistance (after Fed. Declared Disaster)	Fall 2018

Extreme Cold/Winter Storm/Ice Storm	Incorporate Siting, permitting and designating a local disaster debris disposal facility along with designation and permitting of a new facility for yard waste and tree debris, to ensure proper disposal and a lower cost vs. hauling out of town	EMD, Road Foreman, Public Works, Town Manager	CVRPC, DEMHS		Fall 2019
<b>Partnership Building</b>					
All Flooding, & Water Supply Contamination	Invite closer collaboration & offer municipal &/or financial support for the work of the Friends of the Winooski River on river, watershed science & flood risk education, well-field protection, stormwater management, and riverbank restoration & beautification <ul style="list-style-type: none"> <li>Selectboard public support of FWR work on Water Street River Park</li> </ul>	Selectboard, Public Works Director	Friends of the Winooski, ANR	MPG, ERP, Better (Back) Roads, HMGP	March 2017 and Ongoing
Flood/Flash Flood/Fluvial Erosion	Take steps to grow the collaborative relationship between Norwich Physical Education, Geology, Engineering & Architecture professors and the community to further flood resilience and sustainability awareness	Selectboard, Town Manager, Planning Commission, Conservation Commission	Friends of the Winooski, Norwich University	MPG, ERP, Better (Back) Roads, HMGP	Fall 2016 and Ongoing
<b>Other Potential Projects</b>					
Earthquake	Determine if earthquake retrofitting would be feasible during Brownfields redevelopment of the Mayo Block or Northfield Savings Bank Block	Town Manager, Selectboard, Economic Development Ctte.	CVRPC, DEC Brownfields, CVEDC, Dept. of Public Safety	CDBG, VHCB Feasibility Funds	Summer 2021

## 7.3 Plan Maintenance & Integration

The Northfield Local Hazard Mitigation Plan will be updated and evaluated annually at a September meeting of the Department Heads. This will allow monitoring of project status and planning for project implementation within the upcoming budget cycle.

Updates and evaluation by the Select Board will also occur within three months after every federal disaster declaration and as updates to town plan/zoning and river corridor plans come into effect. CVRPC will help with updates or if no funding is available, the Town Manager will update the plan.

The process of evaluating and updating the plan will include continued public participation through public notices posted on the municipal website, town newsletter and CVRPC newsletter and blog inviting the public to the scheduled Select Board (or specially scheduled) meeting. These efforts will be coordinated by the Town Manager.

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 5 year interim period, the plan can be amended without formal re-adoption during regularly scheduled Select Board meetings.

Northfield shall also consider incorporation of mitigation planning into their long term land use and development planning documents. It is recommended the Town review and incorporate elements of the Local Hazard Mitigation Plan when updating the municipal plan, zoning regulations, and flood hazard/FEH bylaws. The incorporation of the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing future Dog River Corridor planning documents for ideas on future mitigation projects and hazard areas.

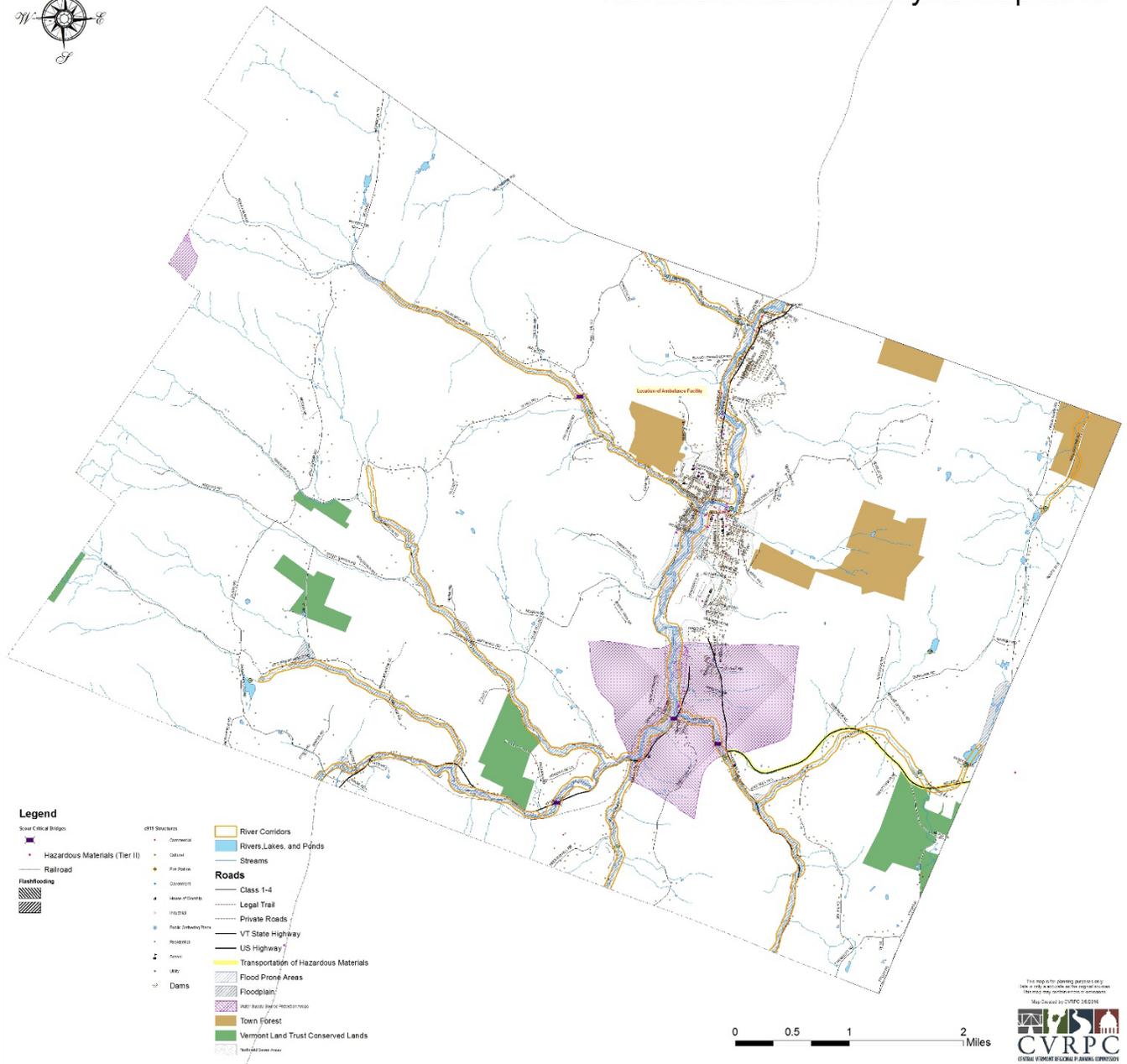
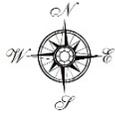
## Attachments

- Appendix A - Hazard Analysis Map
- Appendix B – Dog River Corridor Plan Project Matrix and Map
- Appendix C – Hazards from Previous Mitigation Plans
- Appendix D – Public Engagement Documentation
- Certificate of Adoption

DRAFT

# Appendix A - Hazard Analysis Map

## Northfield Hazard Analysis Map 2016



# Appendix B – Dog River Corridor Plan Projects and Maps

**Table 7.2. Dog River Site Level Opportunities for Restoration and Protection – Town of Northfield**

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#1 M09-B	Good F I	Large breached dam structure on top of bedrock grade control	Remove dam structure	Moderate priority for improve aquatic organism passage at high cost	Improve aquatic organism passage	High cost for design, permitting and construction	None	VDEC, Vermont Fish & Wildlife Department
#2 M09-B	Good F I	Runs along residential properties on both sides	Improve riparian buffers and near bank vegetation next to managed lawns	Moderate priority due to multiple landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#3 M10-A	Good F I	Narrow valley channel	Protect river corridor	Moderate priority due to multiple landowners		Potentially high costs due to multiple landowners	No additional structures in corridor	Landowners
#4 M11-A	Good D II c	Segment runs along VSHA housing development with mowed lawns	Improve riparian buffer	High priority due to one landowner (Vermont Housing Authority)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	VSHA
#5 M11-C	Fair F II	Old agricultural field along east bank that looks like it has not been used in a few years	Natural revegetation	High priority due to one landowner	Improved habitat and geomorphic stability	Low cost for natural revegetation	Agricultural land to forested buffer	Landowners
#6 M12-B	Fair F III	Runs through downtown Northfield with urban development along banks	Manage stormwater	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield
#7 M13	Fair D II c	River close to houses and development along Water Street on west bank	Implement FEH zones	Low priority due to multiple landowners and existing building restrictions	Flood and sediment attenuation asset	Unknown cost for FEH implementation	No additional structures in corridor	ANR
#8 M13	Fair D II c	Runs through Norwich University athletic fields	Improve riparian buffers	High priority due to one landowner (Norwich University)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Recreational land to forested buffer	Norwich University
#9 M14	Fair D II d	Runs along Northfield town wellfield	Improve riparian buffers along wellfield	High priority due to one landowner (Town of Northfield)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Managed town land to forested buffer	Town of Northfield
#10 M14	Fair D II d	Natural Attenuation reach	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Town of Northfield, ANR

**Table 7.2. Dog River Site Level Opportunities for Restoration and Protection – Town of Northfield**

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#11 M16	Fair F II	Runs very close to Route 12A	Improve near bank vegetation along road	Low priority due to limited room for planting	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Bar's stream bank to vegetated stream bank	Town of Northfield
#12 M17-A	Fair F III	Natural attenuation reach downstream of channelized golf course	Corridor Easement	High priority due to channelized segments upstream contributing sediment	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Landowners, ANR
#13 M17-B	Good F II	Runs through golf course at Northfield Country Club	Improve riparian buffers	High priority due to one landowner (Northfield CC)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Commercial to forested buffer	Northfield Country Club
#14 M18-B	Fair F III	Upper end of segment runs near agricultural land	Improve riparian buffers on small areas of north bank near farm	Low priority due to small area and channel widening	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners, CREP
#15 M18-B	Fair F III	Natural attenuation reach	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Landowners, CREP, ANR
#16 M20-B	Fair F III	Runs along residential property	Improve riparian and near bank vegetation on west bank	Low priority due to channel widening	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#17 T1.01-B	Fair F III	Runs along Cox Brook Road with a driveway bridge crossing channel	Replace undersized driveway bridge	Moderate priority due to private ownership	Improved geomorphic compatibility	High cost for design, permitting and replacement	Wider span may take up more space	Landowners
#18 T1.01-C	Fair F II	Runs along Cox Brook Road and residential properties	Improve riparian buffers	Low priority due to 2 landowners and channel adjustment	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#19 T2.01	Fair F II	Runs through downtown Northfield with urban development	Manage stormwater	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield
#20 T3.01	Fair F II	Runs along Lovers Lane and Route 12	Manage stormwater	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield

**Table 7.2. Dog River Site Level Opportunities for Restoration and Protection – Town of Northfield**

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#21 T3.01	Fair F II	Breached dam structure causing upstream deposition	Remove breached dam	High priority to improve aquatic organism passage; unknown historic preservation status	Improve aquatic organism passage	High cost for design, permitting and construction	None	Landowners
#22 T5.01-B	Good F I	Runs along Stony Brook Road near covered bridge	Manage stormwater to control road washout	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield
#23 T6.01-A	Good F I	Channelized segment that runs through agricultural land	Improve riparian buffer	Moderate priority due to 2 landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners, CREP
#24 T6.01-B	Good Not Evaluated	Bedrock gorge segment	Conservation	Low priority due to only 2 landowners; not a concern for geomorphic stability	Conserve bedrock gorge	Moderate cost for conservation	No additional structures in corridor	Landowners
#25 T6.01-C	Good F I	Runs along Little Northfield Road	Conservation	Moderate priority due to only 2 landowners		Moderate cost for conservation easement	No additional structures in corridor	Landowners

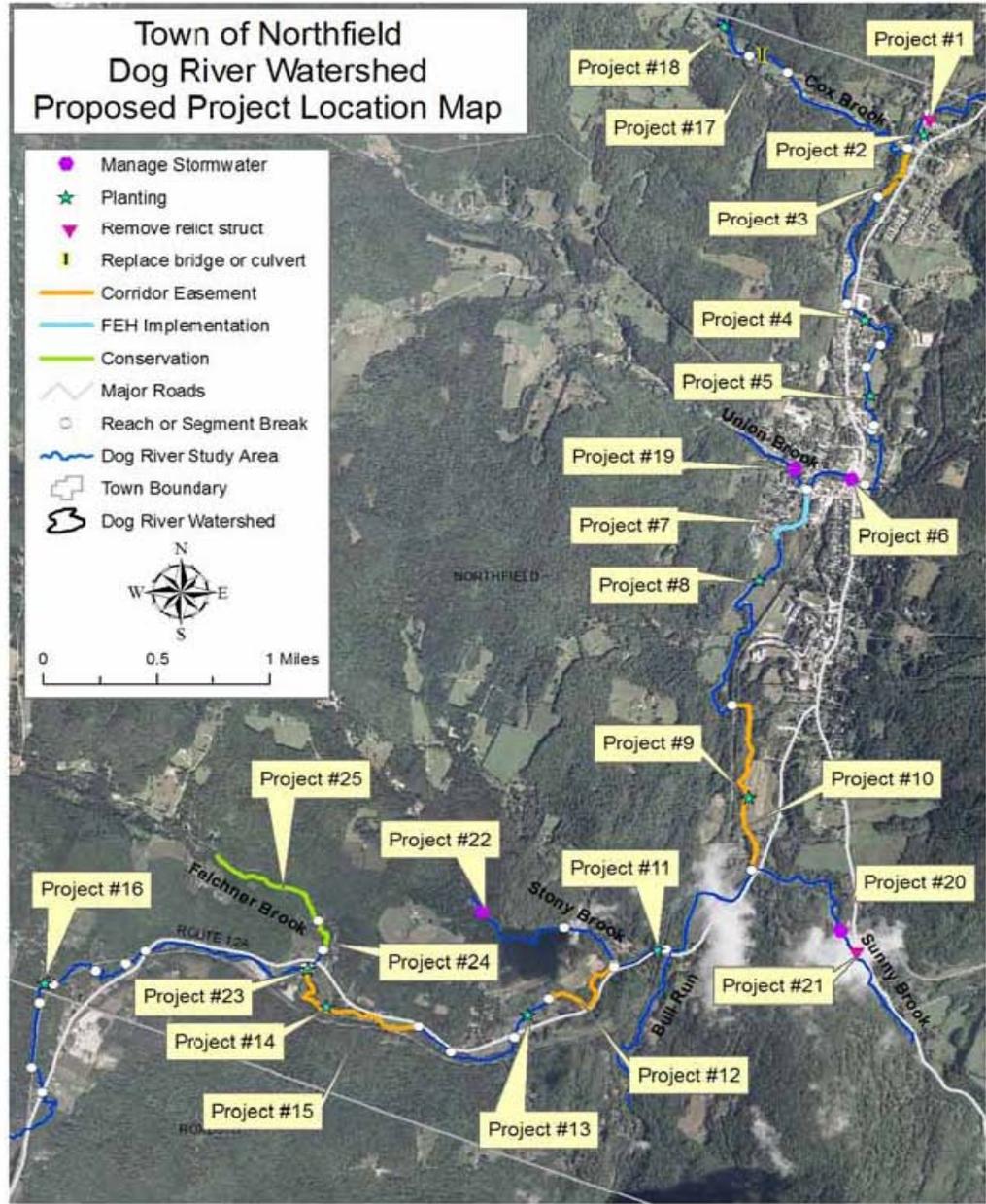
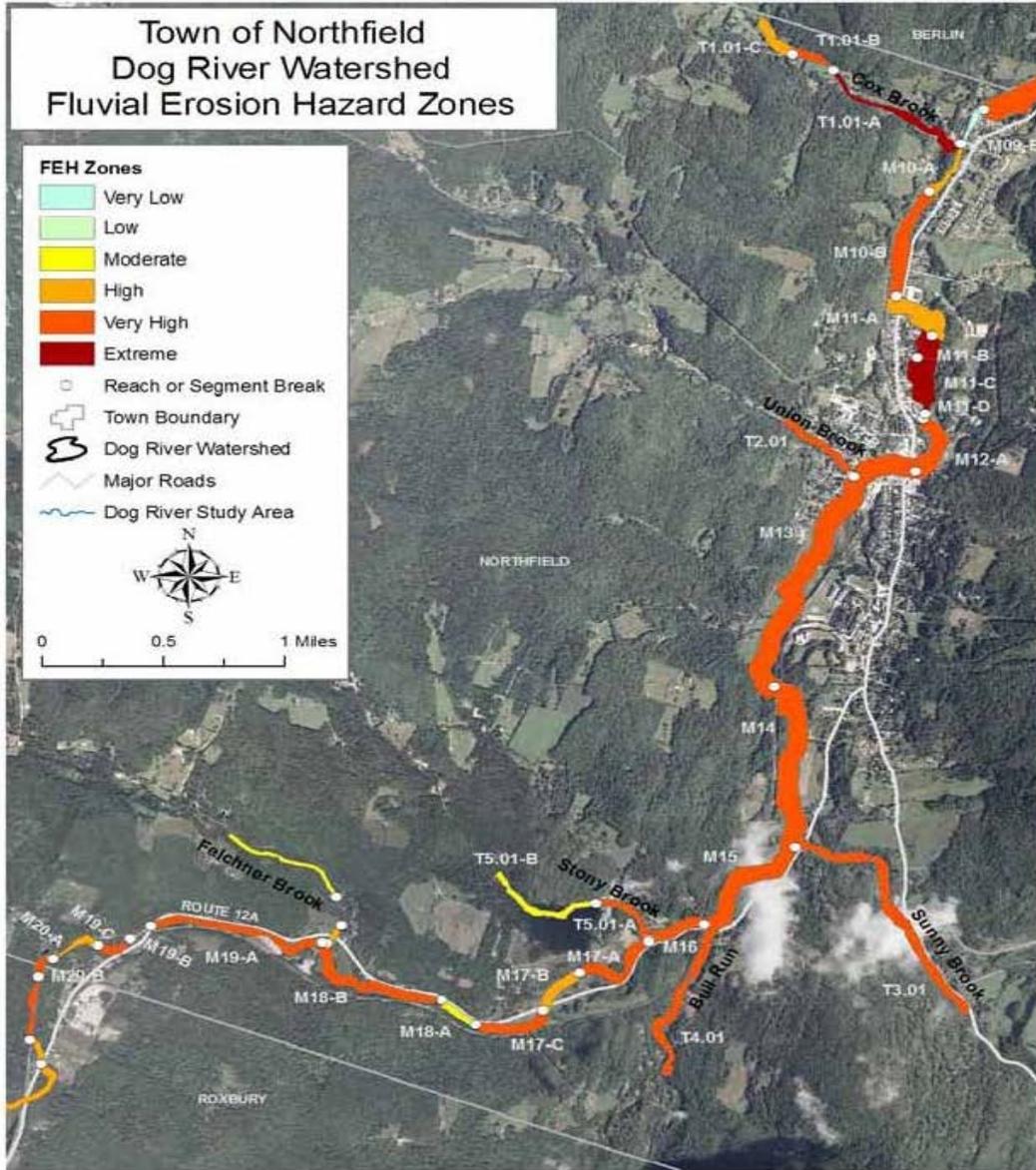


Figure 7.5 Proposed project location map for the Town of Northfield, Dog River watershed

**Fluvial Erosion Hazard Zone Map (source Dog River Corridor Plan, 2008, Bear Creek Environmental)**



**Figure 7.2. Draft Fluvial Erosion Hazard Zone Map for the Town of Northfield - Dog River watershed**

## **Appendix C – Hazards from previous Hazard Mitigation Plan which are no longer considered a significant hazard**

### **Structure Fire**

The Northfield Fire Department responds to approximately 10 structural fires per year. Since the 1940s Northfield has not experienced a major multi-building structure fire. Despite the infrequency of incidents, the risk is increased due to the density of wood-constructed properties within the Town's population centers. Due to the close proximity between properties, a fire within one of these sections of Northfield has the potential to spread and create a hazardous situation. Approximately 1,183 buildings are located within Northfield's three population centers (Northfield Village [including Norwich University], Northfield Falls, and Northfield Center). Using Northfield's average grand list property value for 2003 (\$150,721), the approximate total value of properties at risk of fire within the Town's three population centers is \$178,302,943. This represents 89% of the grand list.

### **Hazardous Materials**

History of Occurrences:

- January 19, 2004 - #2 Heating Oil – 3-4 Gallons
- September 18, 2003 - #2 Heating Oil – 25-100 Gallons
- September 11, 2003 - #2 Heating Oil – 20 Gallons
- September 5, 2003 –#6 Heating Oil – 2,600 Gallons
- March 15, 2003 - #2 Heating Oil – 200 Gallons
- May 6, 2002 – Hydraulic Oil – 5 Gallons
- April 4, 2001 – Kerosene – 200 Gallons
- January 23, 2001 – Ether – 8-10 Pints

The majority of Northfield's hazardous material spills take place in relation to the prevalence of #2 heating Oil in residential and commercial heating systems. Occasional hazardous material spills occur in the act of transportation, such as the 2,600 gallon spill of #6 heating Oil on Route 64 in September 2003. The steep grade of Route 64, and its connection between the Town and I-89, results in a high vulnerability to these types of events. Another location vulnerable to a hazardous materials spill is the New England Central Railroad corridor, which travels through the central portions of the Town and Village along Vermont Route 12 and Vermont Route 12A.

### **Terrorism**

The Northfield Local Hazard Mitigation meeting highlighted a few of the Town's assets as vulnerable to a terrorist attack. Fortunately, Northfield has no history of any terrorism event.

Northfield is home to the National Center for the Study of Counter-Terrorism and Cyber-Crime at Norwich University (NCatNU). NCatNU is the nation's leading center for the study of counter-terrorism. Its functions include the development of related educational and training programs;

execution of rapid research, development and deployment of needed technologies; and advancement of the nation's capability for preparedness and response through the generation of related policy, information management and technology issues. Ironically, the nature of the Center makes it an attractive target for terrorism.

A second asset vulnerable to a terrorist act is Northfield's water supply. Northfield Village, Northfield Falls and Northfield Center are served by a water source which includes a 1,000,000 gallon reservoir on Garvey Hill and two 250,000 gallon reservoirs on the Cheney Farm east of the Village off Hill Street. Despite precautions, such as fencing and regular patrolling, above ground water supplies represent a potential target for terrorist activity through deliberate contamination.

## Earthquake

Vermont is located in a moderate hazard earthquake region. Since 1843, there have been 63 earthquakes which have had epicenters located in Vermont. The strongest of these earthquakes measured 4.1 on the Richter scale in Swanton (1943) and Middlebury (1962.) Stronger earthquakes originating in NY have also been felt in Vermont. In 1988 and 2002 quakes originating in Saguenay, Quebec (6.2) and Plattsburg, NY (5.2) were felt in Vermont.

The Vermont State Hazard Mitigation Plan ranks earthquakes as the 3<sup>rd</sup> most threatening hazard to Vermont, based on the potential adverse impact.

A 1995 report titled [A Report on the Seismic Vulnerability of the State of Vermont](#) by John E. Ebel, Richard Bedell and Alfredo Urzua, states that it is very difficult to predict earthquakes in all of New England. No active faults have been identified in Northfield or New England.

A computer earthquake damage simulation (HAZUS program) analyzing the State of Vermont as a whole has been conducted by the Vermont State Geologist's Office. It suggests that there is "little earthquake risk in Vermont at 100-year and 250-year recurrence intervals; however, there is a potential risk at the 500-year recurrence level." (VT State Hazard Mitigation Plan, p. 4-91) No such model has been made specifically for Washington County; however, a model for Washington County could be a possible future study.

According to the HAZUS simulation, five 500-year earthquake epicenter locations could cause ground shaking in certain parts of Vermont sufficient to result in tens to hundreds of millions of dollars in damage. (Vermont State Hazard Mitigation Plan, p. 4-91 & 4-92)

A 2016 analysis of critical facilities in Vermont for vulnerability to earthquakes recommends that the National Guard Regional Readiness Training Center, located on the Norwich Campus, have a seismic evaluation of the building. Using aerial images, photos, assessors information, soils data and other readily available information, the screening noted seismically vulnerable features of facilities and gave them an overall score indicating need for further evaluation. The analysis screened 26 facilities in the state of Vermont, and 22 were recommended for further seismic evaluation. ([Seismic Screening and Analysis of Selected Critical Facilities in Vermont](#), p.13, 17)

Northfield has had no history of earthquake damage. The age and building materials of many structures in Northfield makes them susceptible to earthquake damage. Unreinforced masonry buildings and buildings with stone and concrete decorative cornices/lintels are the most susceptible. In downtown Northfield, there are several larger 4-5 story apartment buildings, which are older in age. Large buildings identified to be the most susceptible are Norwich University campus buildings, the senior living center, Mail Block Apartments and the Guest House Apartment. Gillespie's – a fuel dealer – also has several above ground fuel tanks, which may be a concern. There are also several mobile home parks which if a mobile home is not tied down, could be greatly impacted. The Town has identified 5 wooden bridges, which connect major roads that could be susceptible to failure if an earthquake were to occur.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Earthquake	Village area, mobile home parks	Low - 500 year probability measure	Older/taller unreinforced masonry structures, mobile home parks, 5 priority bridges	maximum 4.1 Richter scale w/ epicenter in Vermont	\$400,000/bridge >\$5 million for buildings

## Drought

Drought is a normal, recurrent feature of climate and occurs almost everywhere. Droughts originate from a deficiency of precipitation over an extended period of time resulting in a water shortage for some activities, groups or environmental sectors.

Droughts can reduce crop and forest productivity, increase fire hazard, damage fish and wildlife, and increase livestock/wildlife mortality rates. The impacts on these resources can have devastating economic effects. To date, there have been no drought events in Northfield. If an event were to occur it would be town wide.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Drought	Town Wide	Medium	Farms, forest, fisheries, private/public water supplies	Varies depending on severity of event	Varies depending On severity of event

## High Wind

Thunderstorms can generate high winds and down hundreds of large trees within a few minutes. The State can also experience tornadoes, which are capable of damaging or destroying structures, downing trees and power lines and creating injuries and death from collapsing buildings and flying objects. Tornadoes are less common than hail storms and high winds, but have occurred throughout Vermont. Across the State, however, 34 tornadoes have been recorded between 1950 and 1999, injuring 10 people and causing over \$8.4 million dollars in estimated property damage. Nearly all of these incidents occurred from May through August with most of occurring in the afternoon. To date, no high wind events have occurred in Northfield.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
High Wind	Town Wide	Medium	Power lines, trees, structures	Depends on severity of event	Depends on severity of event

## Ice Jams

Ice Jams are usually a result of heavy periods of rain in the winter months of February and March. Rain falls on frozen rivers and causes river ice to break into sheets. The large pieces of ice can cause blockages in the river and cause localized flooding until the pieces of ice are broken up or melted. Ice jams occur infrequently in Northfield along the Dog River. It is difficult to predict the location of ice jams; however, they tend to occur where the river is constricted. To date, there have been no occurrences of major ice jams that caused flooding. Mitigation for ice jams is similar to that of flood prevention. The appendix has suggestions from the Dog River Corridor plan for projects and locations of mitigation strategies.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Ice Jam	Constricted points of Dog River – Village area	Medium	Low lying, flood prone areas	Minimal	<5%

## Wildfire/Forest Fire

FEMA indicates there are three classes of wildland fires – surface fires, ground fires and crown fires, with the most common type indicated as a surface fire. Surface fires burn slowly along the forest floor, killing and damaging trees. Ground fires burn on or below the forest floor and are usually caused by lightning. Crown fires move quickly by jumping along the tops of trees. Crown fires can spread quickly during windy conditions. In Northfield, there have been no known occurrences of wildfires; however, changing landuse patterns and weather conditions may increase Northfield’s vulnerability. The rural nature and vast tracts of forested land can make Northfield susceptible to forest fires. During rare drought occurrences, fire danger may be high.

The State of Vermont does have a Forest Management plan in place which addresses forest fire concerns. The 2010 State Forest Management Plan includes several goals regarding forest fire prevention. The Plan states that although the risk of forest fire is low in the State of Vermont, that the State still performs controlled burns on a small basis during the spring season. To help prevent local forest fires, the State works with local planning commissions to develop Community Wildlife Protection Plans. These plans help towns to identify and mitigate wildfire risk. A common mitigation measure prescribed in the plan is through controlled burns with onsite State support.

The Forest Division also runs the Town Forest Fire Warden program. This program requires towns to have appointed fire wardens. The forest fire program focuses on prevention, fire awareness and fire fighter safety.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Wildfire	Town Wide – areas outside Village development	Medium	Large Parcels of forested land, homes near urban forest interface, power lines	Depends on severity of event	Depends on severity of event

Hazard	Location	Vulnerability	Extent	Risk	Likelihood
Winter Storm/Ice Storm	Town Wide	Utilities, trees, roads, old/under insulated structures	Minimal to Moderate depending on severity	5-10% damages –routine emergencies	Medium

## **Appendix D – Public Engagement Documentation**

TO BE INCLUDED AFTER PUBLIC COMMENT

DRAFT

# Certificate of Adoption

The Town of Northfield  
Select Board  
A Resolution Adopting the Local Hazard Mitigation Plan  
\_\_\_\_\_, 2017

WHEREAS, the Town of Northfield has worked with the Central Vermont Regional Planning Commission to identify hazards, analyze past and potential future losses due to natural and manmade-caused disasters, and identify strategies for mitigating future losses; and

WHEREAS, the Northfield Local Hazard Mitigation Plan contains several potential projects to mitigate damage from disasters that could occur in the Town of Northfield; and

WHEREAS, a duly-noticed public meeting was held by the Town of Northfield Select Board on \_\_\_\_\_, 2017 to formally adopt the Northfield Local Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that the Northfield Select Board adopts the Northfield Local Hazard Mitigation Plan Update.

\_\_\_\_\_  
Chair of Select Board

\_\_\_\_\_  
Member of Select Board

ATTEST

\_\_\_\_\_  
Northfield Clerk