City of Barre, VT

Local Hazard Mitigation Plan
January, 2012
Prepared by City of Barre and CVRPC

Contents

1. Introduction

The impact of expected, but unpredictable natural and human-caused events can be reduced through community planning. The goal of this Plan is to provide an all-hazards local mitigation strategy that makes the community of Barre City 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.

2. Purpose

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

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

The 2011 Barre City Local Hazard Mitigation Plan is an update of the 2007 plan. The plan has been reorganized and new sections have been added regarding:

- Plan Update Process
- Plan Maintenance
- Update of dam, flooding, severe storms, winter storm, wind, forest fire, structure fire hazards
- Updates of Local Areas of Concern Map
- Status update of 2007 mitigation strategies
- Identification of new mitigation strategies

3. Community Profile

The City of Barre is the eleventh largest community in Vermont and is located on the eastern edge of Washington County. It is bounded by Barre Town to the north, east and south and shares its western boundary with the Town of Berlin. Located within the Winooski Watershed,

Barre City covers 4.02 squares miles. Residential neighborhoods surround the downtown core, which is nestled at the confluence of two river valleys; the Steven Branch and the Jail Branch Rivers. Like many New England Towns the downtown core, located within the floodplain, is already built-out and a majority of new development is occurring outside of the floodplain in the residential neighborhoods. Residential development since the last plan has been limited. The Main Street and Merchants Row areas of Barre City are undergoing extensive revitalization projects. The development in these areas will be mixed use.

According to the City of Barre Municipal Plan, the valley floor is at approximately 600 feet above sea level and ranges from one-half to one mile in width. Rising above the valley floor are flat-topped, gently rolling to steep hills approximately 400 feet above the valley floor. The City is bisected by Route 302 running east to west and by Route 14 running north to south.

In addition to municipal buildings and other community facilities, the City of Barre hosts the Washington County Court House, various State Buildings, and many regional social service organizations. The City of Barre has a unique and diverse population. According to the 2010Census, the City has a total population of 9,052 people living in 4,504 housing units. The population in Barre City has declined by 2.6% since the 2000 Census. The Municipal Plan indicates that the City has a higher percentage of elderly population than the region and state. According to the Barre City Police Chief, the community has the highest rate of furloughed inmates.

Green Mountain Power (GMP) provides electricity for the entire City. The Barre Waste Water Treatment facility services the City as well as a portion of Barre Town. The City's fire coverage and ambulance service is provided by the Barre City Fire and Ambulance Department. According to the City's 2010 Annual Report, the Department responded to 846 fire related calls and 2,333 calls for emergency assistance. The Barre City Police Department provides its law enforcement services.

The City of Barre has an approved Rapid Response Plan adopted in 2011 and an Emergency Operations Plan, dated 2011.

The Municipal Plan includes a description and proposed implementation strategies in regards to riverbank management, solid waste planning and access management. The City of Barre Zoning Regulations, last amended in 2010, contains Flood Hazard Area Bylaws.

4. Planning Process and Maintenance

4.1 Planning Process

The Central Vermont Regional Planning Commission (CVRPC) coordinated the Barre City Local Hazard Mitigation Plan process. Michael Miller and Steve Mackenzie contacted CVRPC to set up a hazard mitigation meeting. CVRPC sent City-Specific hazard mitigation material for review. After assessing the material, Steve and CVRPC staff held a meeting along with members of the community on 12/29/2012 at the Municipal Offices. The committee for the 12/29/2012 was

formed in an ad hoc manner to update the plan. For the next update, a committee will be formed in a similar manner with members from the planning commission, City Council, road crew, and emergency services. The Barre City Hazard Mitigation Meeting focused on assessing past mitigation projects and compiling information on its current and future hazard mitigation programs, projects and activities.

Attendees included:
- Andrew Marceau – Barre City Police Dept
- Tim Bombardier – Barre City Police/Fire/EMS Chief
- Steve Mackenzie – City Manger
- Reg Abare – City Engineer
- Mike Miller – City Planner
- Jen Mojo - CVRPC

The meeting indicated that the City is most vulnerable to dam failures, earthquakes, flood/flash floods, hurricane/severe storms, and water supply contamination. Moderate threat hazards were identified as extreme cold/winter storm/ice storms and structure fire. Previously identified hazards include hazardous materials, power shortage/failure, winter storms/ice storms and school safety issues. Hazardous materials, power shortage/failure and school safety issues are attached as an appendix. Barre City has an emergency operations plan which deals more specifically with hazardous materials and other emergency situations. Barre City is focusing mitigation efforts on flooding projects as flooding is the most common and damaging event.

Once the draft was updated, CVRPC placed a notice for public comments of the draft update on the CVRPC blog and newsletter, Times Argus, WDEV and Frank Froggy (radio), City Website and Front Porch Forum. The draft update was also available was at Barre City Municipal offices and by request from CVRPC for public review and comments from 1/12/2012 to 2/1/2012 The announcement of the draft update in the CVRPC newsletter reached over 150 people and businesses in the Region's 23 towns, including the adjacent towns of Barre Town and Berlin. No comments were received. Public comments submitted in the future will be reviewed by the Police/Fire Chief (and CVRPC Staff dependant on funding) and attached as an appendix. In the future, the draft plan will be made available during Town Meeting Day and local meetings with State and local officials to allow for more public comment and review. Once the plan is conditionally approved by FEMA, the plan will go before the City Council for adoption.

4.2 Plan Update Process

The Barre City Local Mitigation Plan was originally adopted by the City as an Annex to the Central Vermont Regional Pre Disaster Mitigation Plan in November 2007 and received FEMA final approval in December 2007. The 2011 update is intended to be submitted as a single jurisdiction local mitigation plan.

The current plan is an extensive update of the 2007 plan. Below is a list of the revisions that have been made from the past plan and the appropriate sections for reference. New hazards identified include non worst threat hazards of forest fire and structure fire.

General Updates

- General reorganization/restructuring of the plan according to future FEMA/VEM checklist
- New sections added – 4.2 Plan Update Process, 4.3 Plan Maintenance, 5.2 Worst Threat Hazards – dam failure, flood/flash flood, earthquakes, hurricane/severe storms, water supply contamination 5.3 Non Worst Threat Hazards – extreme cold/winter storm/ice storm/power failure, structure fire
- Update of all data and statistics using 2010 City Report and US Census Data (Section 3)
- Revaluation, identification and analysis of all significant hazards (Section 5)
- Acknowledgment of implemented mitigation strategies since 2007 – see matrix below (section 4.2)
- Identification of on-going mitigation projects and strategies – see Existing Mitigation Programs, Projects and Activities section (section 4.2)

Hazard Analysis Updates (Sections 5 and 6)

- Updated location/vulnerability/extent/impact/likelihood table for each hazard to summarize hazard description (Section 5.1-5.3 – after each hazard)
- Review of Vermont Hazard Mitigation Plan (Section 5 – hazard analysis table)

Maps

- Review of 2007 Areas of Concern map and update of hazard location

Preparation for the meeting included a review of Barre City's planning documents, including the Barre City Municipal Plan, Barre City Rapid Response Plan (2011), flood hazard bylaw, Barre City Annual Report (2010), Jail Branch and Steven's Branch Corridor Plan (2009). Information from these documents is incorporated into the mitigation plan.

The following chart provides an overview of Barre City's proposed 2007 local hazard mitigation actions along with their current status. Additionally since the 2007 plan, the City updated their flood hazard bylaws to maintain NFIP compliance.

2007 Mitigation Action	2011 Status
Improve drainage in proximity to and within City, including improvement of on-site stormwater management and the establishment of riparian buffers.	- Merchants Row/Enterprise Aly – engineered plan - N. Main retention pond built - applied for EPA grant to develop drainage plan for area from RR to river (behind Merchants Row)

Improve City stormwater drainage system to eliminate backfilling and flooding potential during storm events.	- still interested in working with Barre Town - Developed engineering for Main St project
Ensure Main Street reconstruction project include flood-proofing components as mention in Section 7 *Existing Hazard Mitigation Programs, Projects & Activities*.	- still in progress
Install a flash flood / hazardous materials release / all hazards warning system	- had siren dismantled – no longer interested
Develop an all hazards public outreach campaign including evacuation maps and an explanation of warning systems. Ensure campaign is accessible to all residences including elderly, blind and to people of which English is a second language.	- still interested in multimedia campaign
Implement and enforce a fuel tank anchoring ordinance.	- in process of adopting new ordinance
Create local flood hazard maps which indicate flooding potential beyond FEMA's 100-year flood plan.	- in progress – working on new maps and new areas to elevate (zone X)
Develop a School Evacuation and School Crisis Plan and distribute to all Emergency Service Departments.	- in progress of working with both schools – received DHS funding
Adopt and enforce Vermont Agency of Transportation "Codes & Standards for Roads"	- in progress – looking at other codes and standards as VTrans codes are as applicable to Barre City
Establish alternate egress from Public Safety Building	- high priority
Enroll in NFIP's Community Rating System	- in progress

Conduct a Culvert Inventory and make repairs and/or upgrades to mitigate flooding.	- performed with CVRPC
Upgrade Barre Civic Center to a Mass Care Facility and equip with back-up generator.	- done
Equip specific City operations with standby capabilities, specifically a mobile dispatch trailer.	- done
Create a satellite police and fire sub-station on the south-side of City for decreased response time and alternate station during North Main Street flooding.	- no longer interested – too expensive
Update Rapid Response Plan.	- done in 2011
Work with the VT DEC River Management Division to remove obstructions in the floodway and develop strategies to decrease sedimentation in river.	- removed RR trestle in river - dredging stretch of river below Berlin St bridge - high interest in developing strategies to decrease sedimentation in river
Develop a Capitol Equipment Plan and include snow removal equipment, flood rescue boat, portable lighting and 6x6 ATV with EMS and fire suppression skids for Public Safety Building.	- no longer interested in boats or swift water rescue operations - working on developing a capital equipment plan to manage flood and other hazard events
Improve access to Wastewater Treatment Facility during flood events to ensure fuel oil delivery to generator.	- use of Route 62 - Bike path to facility is being built and can be used
Create a confidential homebound/elderly/ handicapped contact list in case of power failure and other hazards.	- attempted and no longer interested – service providers not interested
Update stream geomorphic assessment	- Stevens/Jail Branch Corridor Plans developed in 2009

Existing Programs, Projects & Activities

The ongoing or recently completed programs, projects and activities are listed by strategy.

Community Preparedness Activities

- Emergency Operations Plan – 2011
- Rapid Response Plan – 2011
- Evacuation Plans for Housing Authority Buildings

Hazard Control & Protective Works

- Mutual Aid Agreements – 2011 Statewide Agreement

Insurance Programs

- Participation in NFIP

Land use Planning/Management

Municipal Plan, 2005

- Proposed Environmental Strategies:
  - Study and consider possible land use regulation amendments to promote good vegetative management along river fronts.
  - Review regional solid waste plan.
- Proposed Transportation Strategies:
  - Review potential additional access management controls
- Zoning Regulations, 2010
  - Flood Hazard Area Bylaws
- Stevens Branch (Williamstown and Barre City upstream of the confluence with the Jail Branch), Corridor Plan, March 2009
- North Main Street Reconstruction Plans, construction anticipated to commence 2011
  - Hardening/Flood proofing utilities – new utilities and improving surface drainage
  - Installation of back-flow prevention valves in sewers and drains

Protection/Retrofit of Infrastructure and Critical Facilities

- Newly Constructed Public Safety Building outside of floodplain, 2005
- Red Cross Certified Shelters – Barre Auditorium
- Back up generator at Water Filtration Plant and Wastewater Plant

Public Awareness, Training & Education

- Fire safety educational programs
- First responder CPR & hazmat trainings
- CERT program – LEPC run

4.3 Plan Maintenance Process

The Barre City Local Hazard Mitigation Plan will be updated and evaluated annually at a April City Council meeting along with the review of the Basic Emergency Operations Plan. Updates and evaluation by the department heads will also occur within three months after every federal disaster declaration and as updates to City plan/zoning and river corridor plans come into effect. The plan will be reviewed by the department heads, City Council, and public at the abovementioned April City Council meeting. CVRPC will help with updates or if no funding is available, the Police/Fire Chief 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, notice in the municipal building, Times Argus, Washington World, Front Porch Forum, newspaper and CVRPC newsletter and blog inviting the public to the scheduled City Council (or specially scheduled) meeting. Additional stakeholders invited to the meeting will be the Barre Housing Authority, CVCAC, Washington County Mental Health, and Superintendant of schools. Also invited in the future will be the VT Agency of Natural Resources (VT ANR), as they are able to provide assistance with NFIP outreach activities, models for stricter floodplain zoning regulations, delineation of fluvial erosion hazard areas, and other applicable initiatives. These efforts will be coordinated by the Police/Fire Chief

Monitoring of plan progress, implementation, and the 5 year update process will be undertaken by the Police/Fire Chief. Monitoring updates may include changes in community mitigation strategies; new City bylaws, zoning and planning strategies; progress of implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities. If new actions are identified in the five year interim period, the plan can be amended without formal re-adoption during regularly scheduled City Council meetings. After a five year period, the plan will be submitted for re-adoption following the process outlined the schematic found in the Attachments section.

Barre City shall also consider incorporation of mitigation planning into their long term land use and development planning documents. It is recommended the City 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 City shall also consider reviewing future Stevens and Jail Branch River Corridor planning documents for ideas on future mitigation projects and hazard areas.

5. Risk Assessment

5.1 Hazard Identification and Analysis

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

Hazard	Likelihood [1]	Community Vulnerability[2]	Worst Threat
Avalanche/ Landslide	Low	No	
Dam Failures	Low	Yes	X
Drought	Low	No	
Earthquake	Low	Yes	X
Extreme Cold/Winter Storm/Ice Storm/Power Failure	Med	No	
Flash Flood/Flood	High	Yes	X
Fluvial Erosion	Low	No	
High Wind	Low	No	
Hurricane/Tropical Storm/Severe Storms	Med	Yes	X
Structure Fire	High	No	
Tornado	Low	No	
Water Supply Contamination	Med	Yes	X
Wildfire/Forest Fire	Low	No	

The following hazards were found to be most significant in the City of Barre:

- Dam failure
- Earthquakes
- Flash Flood/Flood
- Hurricane/Tropical Storms/Severe Storms
- Water Supply Contamination

[1] High likelihood of happening: Near 100% probability in the next year.
Medium likelihood of happening: 10% to 100% probability in the next year or at least once in the next 10 years.
Low likelihood of happening: 1% to 10% probability in the next year or at least once in the next 100 years.

[2] Does the hazard present the threat of disaster (Yes)? Or is it just a routine emergency (No)?

Moderate threat hazards include:

- Extreme cold/winter storm/ice storm/power failure
- Structure Fire

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

Hazard	Location	Vulnerability	Extent	Impact	Probability
Type of hazard	General areas within municipality which are vulnerable to the Identified hazard.	Types of structures impacted	Magnitude of hazard: -Minimal; - Moderate; or -Severe[3]	Dollar value or percentage of damages	Likelihood of hazard occurring based upon past events: HIGH = 10% to 100% probability within the next year or at least once in the next 10 years. MED = less than 10% to 100% probability within the within the next year or less than once in the next 10 years.

5.2 Worst Threat Hazards

Dam Failure

The dam of concern for Barre City is the East Barre Dam. Although not located within the City, if the dam were to be breached the majority of the City would be inundated. The State of Vermont is responsible for performing dam inspections and maintenance. The dam was built in July of 1933 and is an earth fill dam with stone slope construction. It is 1,460 feet long and 65

[3] -Minimal: Limited and scattered property damage; no damage to public infrastructure contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.
-Moderate: Scattered property damage (more than 50% destroyed); some major infrastructure damage; wider geographic area (several communities) essential services are briefly interrupted; some injuries and/or fatalities.
-Severe: 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.

feet high. The flood storage area of the dam totals 675 acres and extends 2.5 miles upstream through Orange and Washington. The dam can store up to 3.9 billion gallons of water. The extent of flooding that could occur would be the equivalent of 5.8 inches of water covering the drainage area of 38.7 square miles (USACE.) The dam was built in response to the 1927 flood event.

To date, there have been no occurrences of the dam breaching. CVRPC performed a dam inundation model and found that if the dam were to breach, 549.9 acres of Barre City would be flooded. This equates to 1136 properties for a total damage amount of $149,531,680. The map of the inundation area is an attachment.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Dam Failure	Area along Stevens Branch – see map of dam inundation area	Commercial and residential structures, road and culvert infrastructure	5.8" of water over the 38.7 square mile drainage area	$149,531, 680	Low

Earthquakes

An earthquake is a sudden and violent shaking of the ground, sometimes causing great destruction, as a result of movements within the earth's crust or volcanic action. 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 extent and impact of earthquakes in Barre is unknown due to limited past occurrences in the area.

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 Barre City or New England. Hazus reports have been made for several counties in Vermont to determine the impacts of an earthquake. No such model has been made for Washington County; however, a model for Washington County could be a possible future study.

Barre City has had no history of earthquake damage. The age and building materials of many structures in Barre City makes them susceptible to earthquake damage. Unreinforced masonry buildings and buildings with stone and concrete decorative cornices/lintels are the most susceptible. The large public housing apartments and blocks of buildings on Main Street are the most susceptible.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Earthquakes	Main Street, North Main Street	Public housing buildings, Older/taller unreinforced masonry structures	4.1 -6.2 on the Richter scale based on past history in VT and New England – data gap for Barre City	Data gap	Low

Flood/Flash Flood

Flooding/flash flooding/fluvial erosion is Barre City's most commonly recurring hazard. Flooding is the overflowing of rivers, streams, drains and lakes due to excessive rain, rapid snow melt or ice. Flash flooding is a rapidly occurring flood event usually from excessive rain. Fluvial erosion is the process of natural stream channel adjustments. Fluvial erosion causes erosion of sediment in some areas, while causing aggradation of sediment in other. Fluvial erosion processes occur more quickly and severely during flood events.

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

History of Occurrences (within Barre City and Central Vermont):

Date	Event	Location	Extent
8/28/2011	Flood/Tropical Storm	Statewide, Barre City	Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet) – DR 4022
5/27/2011	Flash Flood	Barre City, County Wide	Montpelier flood gauge at 17.59 feet, 3-5" of rain – DR 1995
8/02/2008	Flash Flood	Barre Town, Barre City	No data – route 302 flooded
7/11/2007	Flash Flood	Barre City, County wide	3-6" of rain in 2 hrs, DR 1715
4/14/2002	Flood	County wide	1-3" of rain across the county
12/17/2000	Flood	County Wide	3" of rain, $1 M in damages
9/16/1999	Tropical Storm	County Wide	Montpelier flood gauge at

	Floyd		9.30 feet, 5-7" rain county wide
6/27/1998	Flash Flood	Barre City, County Wide	$2M in damages, 3-6" rain across county
7/15/1997	Flash Flood	County Wide	$500k in damages
1/19/1996	Flood; ice jam	County Wide	Montpelier flood gauge at 14.64 feet
8/10/1976	Flood	County Wide	Montpelier flood gauge at 12.31 feet
6/30/1973	Flash Flood	Barre Town	Montpelier flood gauge at 17.55 feet
9/22/1938	Flood, Hurricane	County Wide	Montpelier flood gauge at 14.11 feet
11/03/1927	Flood	County Wide	Montpelier flood gauge at 27.10 feet

Specific extent data for flood levels in Barre City is lacking as the closest flood gauge is located in Montpelier. During Tropical Storm Irene, flooding in Barre was minimal and the Montpelier flood gauge was 4 feet above flood stage. Flooding was more severe during the May 2011 event and areas in the 150 year floodplain were flooded up to 5 feet (see flood map attached.) The worst flooding event in Barre City's history was the 1927 event; however, exact data from that event is not available. In 1927 event, the Montpelier flood gauge was at 27.10 feet; however, since the 1927 flood a number of flood control dams have been installed in the region to prevent the same flooding extent. Lesser but more regular flooding occurs in Barre City, with generally 1-2 feet of water in the Granite Street area and other low lying areas by the Stevens Branch. These areas are identified on the local areas of concern map. Barre City is very interested in having a river gauge installed so that the City may better monitor flood levels.

The City of Barre is located within the Stevens Branch sub-watershed of the Winooski Watershed. The City is located predominantly within a river valley, surrounded almost entirely by the hills of Barre Town. The most prominent bodies of water in the City are the Stevens Branch River, which flows from southeast to west, followed by the Jail Branch and the Gunners Brook. The two major roads in Barre City, Route 302 and Route 14, parallel these waterways for much of their length within City limits.

A high concentration of Barre's development is located within the floodplain. Based on the results of overlaying its current Flood Insurance Rate Maps (FIRM) with the location of E911 points, 764 properties are located within the National Flood Insurance Program's designated 100-year floodplain. The estimated loss for a severe flooding event for all properties located within the City's 100-year floodplain is approximately $100,565,320. There are 8 FEMA repetitive loss properties in Barre City. Barre City participates in the NFIP. Currently, the City has 239 active policies for a total coverage of $39,963,000. Flood hazard regulations limit

development in the floodplain. The Zoning Administrator is responsible for enforcement of the flood hazard bylaws.

Documented events throughout history illustrate the devastating impact of flooding. One of the most significant flooding events was the Great Flood of 1927, where in November a total of 8.6 inches of rain fell over a 38 hour period, resulting in extensive damages including total destruction of homes, businesses, bridges, and roads. In response to these events, the United States Civilian Conservation Corps (CCC) constructed the East Barre Flood Control Dam in 1935, located within the neighboring Town of Orange. The Dam was redesigned and modified by the Corps of Engineers in the 1950's.

In more recent history, the flood event of December 17 and 18, 2000, where 1.5" to 3" of rain fell and warming temperatures caused snow pack melt causing the Stevens Branch and some of its smaller tributaries to overflow. According to the Damage Reports maintained by the Barre City Fire Chief, 24 private residences on North Main Street, Berlin Street, Vine Street, Smith Street, Granite Street, Third Street, Scampini Street, and River Street experienced furnace, electrical and heating oil problems as a result of the flooding. Other buildings which sustained flood damage included:

- Times Argus Newspaper, 540 North Main Street (regional media facility)
- Ormsby's, 61 North Main Street (electronic and appliance retailer)
- Studio Place Arts, 199-203 North Main Street (non-profit arts center)
- Socials Labor Party Hall, 46 Granite Street (historic community gathering hall)

The City of Barre sustained approximately $1,000,000+/- in direct damage costs to private property, private business property, and public property.

The flood of July 11 and 12, 2007 is one of most significant flooding events in recent history. Approximately 4-6 inches of rain fell in a 24 hour period between noon on July 11 and July 12, causing the Stevens and Jail Branches to overflow their banks resulting in the inundation of downtown businesses and surrounding neighborhoods with up to 5 feet of water. According to Patrick Ross, a stream alteration engineer for VT Agency of Natural Resources, upsized culverts, hillside roads and development in Barre Town contributed to an increased volume and rate of flow of stormwater draining into the receiving waters of the Stevens and Jail Branches. Debris within the river channel became lodged on obstructions, such as bridge abutments, abandoned railroad trusses and deteriorating floodwalls, further compounding the ensuing flood situation. Rising river waters flooded downtown businesses and homes on North Main Street, Granite Street, Scampini Square and Berlin Street. Flood waters on North Main Street inhibited the ability of emergency services vehicles to exit the Public Safety Building to respond to calls.

In addition, as river levels rose above stormwater outlet drains, flood waters backed flowed into the following Barre City neighborhoods. This additional pressure resulted in the collapse and failure of portions of the storm water drainage system. The City of Barre sustained severe

damage, thousands of dollars direct damage costs to private property, private business property, and public property.

In 2011, the May 27 event was much worse than Tropical Storm Irene. During the May 27 event the Granite Street and north were flooded. The attached flood map highlights the extent of the flooding beyond the 100 year floodplain. The flooding was a result of the river overtopping its banks and too much stormwater. 10 culverts were in the highlighted area were damaged. The hills of Barre City were also damaged. Barre City is interested in buying two homes on Hilltop Ave which were damaged in the May floods. The City incurred over $1 million in damages from the May event.

There was minimal flooding during TS Irene. Flooding during TS Irene occurred in the usual flood prone areas such as outlined on the areas of local concerns map.

As previous events have made clear, however, even areas beyond the NFIP designated 100-year floodplain may be vulnerable to flood related 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 Hazard Analysis Map (Attached) identifies areas that have experienced flooding in the past.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Flooding/ Flash Flooding	Floodplain especially North Main Street, Berlin Street, Vine Street, Granite Street, Scampini Square, River Street. Plus Park and East Street Neighborhood.	Commercial and residential structures, historic buildings, Route 302/N. Main Street and City infrastructure and emergency services.	5 feet of flooding during 2007 and 2011 events	2000 flood event = $1,000,000+/- in damages	HIGH

Hurricanes/Tropical Storms/Severe Storms

History of Occurrence (from NCDC website):

Date	Event	Location	Extent
8/28/2011	TS Irene	Statewide	~6" rain, Montpelier flood gauge at 19.05 feet (flood stage

			is at 15 feet)
5/27/2011	Severe Storm, flash flooding	County Wide	1" hail, 3-5" of rain, 50 knot winds
7/21/2008	Severe storms, flooding	County Wide	
8/25/2007	Severe Storms	Barre City, County Wide	55 knot wind gusts, 1" hail
7/9/2007	Severe Storms, hail, flooding	Barre City, 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	Barre City, County Wide	1" hail, 55 knot winds
9/16/1999	Tropical Storm Floyd	Statewide	Tropical Storm
6/17/1998	Severe Storms	County Wide	
5/29/1998	Severe Storms	County Wide	50 knot winds, heavy rains, downed trees and power lines
7/15/1997	Severe Storms	County Wide	
8/4/1989	Severe Storms, Flooding	County Wide	
6/7/1982	Severe Storms	New England	14" of rain, $276 M damages
8/1976	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

Similar to flooding, the extent of severe storms is not well documented in the Barre City. 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 Barre City. Estimates for wind are gathered from county wide data off the NCDC website. In the future, Barre City could consider installing a monitoring station to better gather data for wind events.

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. 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.

The impacts associated with hurricanes and severe storms are mainly associated with flooding impacts. Damage locations from TS Irene and the May 28, 2011 storm events are outlined in the Flood/Flash Flood/Fluvial Erosion hazard section. There were no high wind impacts associated with the 2011 events.

In 1999, Tropical Storm Floyd passed through Vermont. The primary impact from Floyd was downed trees and power lines due to high winds. Approximately 3,000 people were without power in the Central Vermont Region. About 7" of rain fell over Barre City; however, flood impacts were offset by drought conditions from earlier in the year.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Hurricane/ Tropical/ Severe Storms	City Wide for Wind impacts, Roads; Flooding - Floodplain especially North Main Street, Berlin Street, Vine Street, Granite Street, Scampini Square, River Street. Plus Park and East Street Neighborhood.	Large trees, power lines, culverts/bridges, fire station, village buildings	7.4" rain from Irene; Floyd – Wind gusts recorded at 31 mph; 7" of rain	2011 damages – over $ 1million	Medium

Water Supply Contamination

Barre City has concerns regarding water supply contamination. The concern comes from the fact that the supply is an open source. The reservoir is located in Orange. To date, there has not been any water supply contamination. However, the City worries that the supply is susceptible to contamination through hazardous materials and bioterrorism. A car once was found in the inlet of the supply, but did not cause contamination. Also, a plane once landed on the reservoir. There are no guard rails to protect the reservoir. The extent and capacity of the reservoir averages 1070 acre feet, with a maximum capacity of 2280 acre feet. The city supplies water to 4,140 accounts or 16,000 people.

The Barre City treatment plant is also susceptible to damage from car accidents as it is located on a busy road. If the treatment plant were damaged, downriver residents in Berlin and Montpelier would be affected by possible contamination.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Water Supply Contamination	Reservoir, Sewer Treatment Facility	City residents, Downriver users	2280 acre feet of water; 16,000 people	$2 million	Medium

5.3 Moderate Threat Hazards

Winter Storm/Ice Storm

History of Occurrences (within Central Vermont, City specific data not available):

- January, 1998 – DR 1228
- December 31, 2000
- January, 2001 – DR 1428
- March 22-23, 2001
- January 4, 2003
- October 24, 2005
- February 14, 2007

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

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

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 City of Barre. Providing for the mass care and sheltering of residents left without heat or electricity for an extended time and mobilizing sufficient resources to clear broken tree limbs from roads, are the primary challenges facing community officials. Shelter locations include the Barre Auditorium. The City encourages residents who are in remote locations to be equipped with generators and backup fuel supplies in the event of prolonged power outages and travel restrictions.

Despite frequent occurrences of significant winter/ice storms, a majority of City residents are adequately prepared to face these types of events.

During the February 14, 2007 snow storm event, the Barre City Fire Department responded to 17 EMS calls and 9 Fire calls, some requesting assistance with shoveling. Major snow storms resulting in deep snow drifts can block heating vent pipes causing carbon monoxide poisoning. Hazardous materials pose a severe threat to a large percentage of Barre's population as elderly person within the City are limited in their ability to shovel roofs and clear around vent pipes. During this snow storm the Fire Department experienced difficultly reaching customers as the roads had not been cleared due to the city road crews busy with snow removal in other areas of the City.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Winter Storm/Ice Storm	Entire municipality	Sensitive populations - elderly	12+" of snow on March 2011 event; 22+" on Feb. 2006 event	18% of City population. Depends on severity for additional sheltering/ plowing/ emergency services costs for City.	Medium

Structure Fire

Structure fire is when a building is partially damaged or destroyed by a fire. About one third of the calls received in 2010 by Barre City's fire department were fire related incidents – chimney fires, smoke alarms, and carbon monoxide alarms. Although many structures in Barre City are less than 100 years old, many residents heat their homes with wood or pellet burning stoves. The density and closeness of buildings and homes also increases the likelihood of a spreading from building to building.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Structure Fires	Town Wide	Wood structures, especially older than 100 yrs, homes that use wood burning stoves for heat	Data gap	$150, 000 per home based on median grand list value	High

6. Mitigation

6.1. Municipal Plan (2010) Goals that Support Hazard Mitigation

- Preserve remaining open space area where environmental and access issues make development undesirable. (Land Use Goal)
- Provide for the adequate and safe disposal of residential waste. (Environmental Goal)
- Restore and maintain river frontage and improve river bank stabilization, appearance and public access. (Environmental Goal)
- Provide adequate fire, police and emergency medical services in a cost-effective manner. (Utilities and Facilities Goal)
- Promote and improve safe vehicular access with new development and redevelopment. (Transportation Goal)

The next time the City of Barre updates its City Plan, it may consider adding additional mitigation goals. Additional mitigation goals could include:

- To take actions to reduce or eliminate the long-term risk to human life and property from dam failure, flooding/flash flooding, earthquakes, hurricanes/tropical storms, severe storms, and water supply contamination.

  Specific hazard mitigation strategies related to the goals of the plan include:
  - Ensure existing and future drainage systems are adequate and functioning properly
  - Ensure that all residents and business owners are aware of the hazards that exist within Barre City and ways they can protect themselves and insure their property
  - Ensure that emergency response services and critical facilities functions are not interrupted by natural hazards
  - Provide adequate communication systems for emergency personnel and response units
  - Provide residents with adequate warning of potential hazards

6.2 Proposed Hazard Mitigation Programs, Projects & Activities

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

Hazard Mitigated	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
Flooding, Severe Storms,	Expansion and upgrade of culverts on Beckly St, Firewall St, Onward St (outlet), East St (rebuild box), Montpelier Rd, Packard St, City Place/Depot Sq (box culvert),	City Council, City Manager, City Engineer	High	HMGP, City Funds	1-2 years
Flooding, Severe Storms	Buyout 2 private properties on Hill Top Ave	City Council, Property Owners	High	HMGP	1 year
Flooding, Severe Storms	Mapping study of underground streams through City center	City Manager, City Planner	Med	City Funds, EPA	2-3 years
Flooding, Severe Storms	Reengineer RR trestle on Vanetti Place	City Engineer, VTrans	Med	City Funds, VTrans	3 years
Flooding, Severe Storms	Stormwater mapping/closed pipe system study	City Planner, City Engineer, CVRPC	Med	City Funds, MPG, EPA	3-4 years
Flooding, Severe Storms	Develop alternate egress to Elementary School	City Planner, City Manager, City Engineer	High	City Funds	2-3 years
Flooding, Severe Storms	Install “trash racks” on Gunner Brook	City Planner, City Engineer, ANR	Med	City Funds	2-3 years
Flooding, Severe storms	Implement selected projects from Stevens/Jail Branch Corridor plan (see attachments)	City Planner, Friends of the Winooski,	Med	City Funds, EPA	2-3 years

		ANR			
Water Supply Contamination	Installation of guard rails around reservoir	City Engineer	Med	City Funds, EPA	3 years
Dam Failure	Work with Barre Town to keep debris around dam spillway clear	City Engineer	Med	City Funds	2-3 years
Earthquakes	Review and adapt building code so that new structures are earthquake resistant	City Engineer, City Planner	Low	City Funds	4-5 years
NFIP Compliance	Work with elected officials, the State and FEMA to correct existing compliance issues and prevent any future NFIP compliance issues through continuous communications, training and education	City Council, City Planner	Med	City Funds, USDA	2-3 years

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

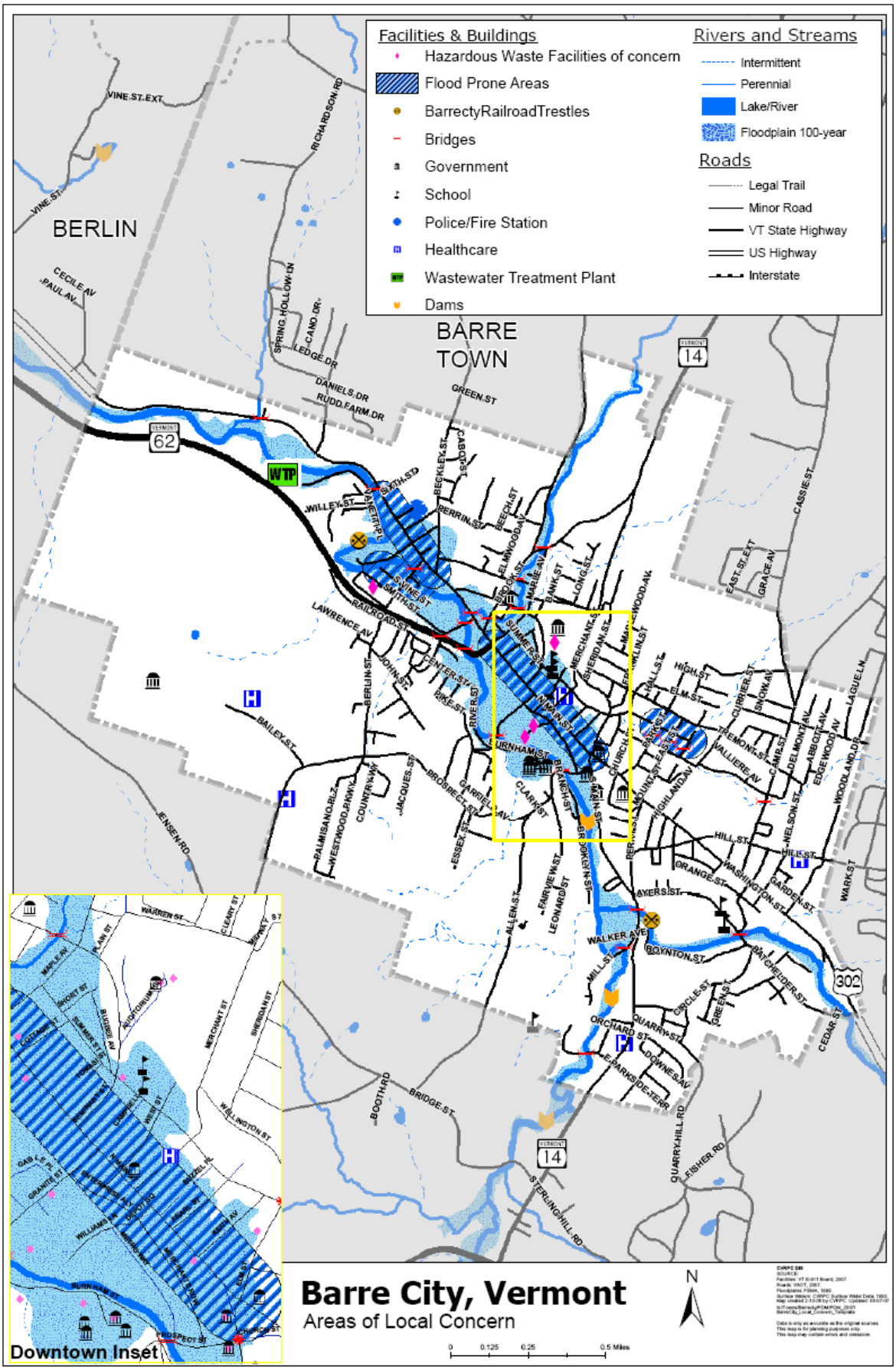
The mitigation activities are listed in regards to local leadership, possible resources, implementation tools, and prioritization. Prioritization was based upon the economic impact of the action, the Community's need to address the issue, the action's cost, and the availability of potential funding. The action's cost was evaluated in relation to its benefit as outlined in the STAPLEE guidelines.

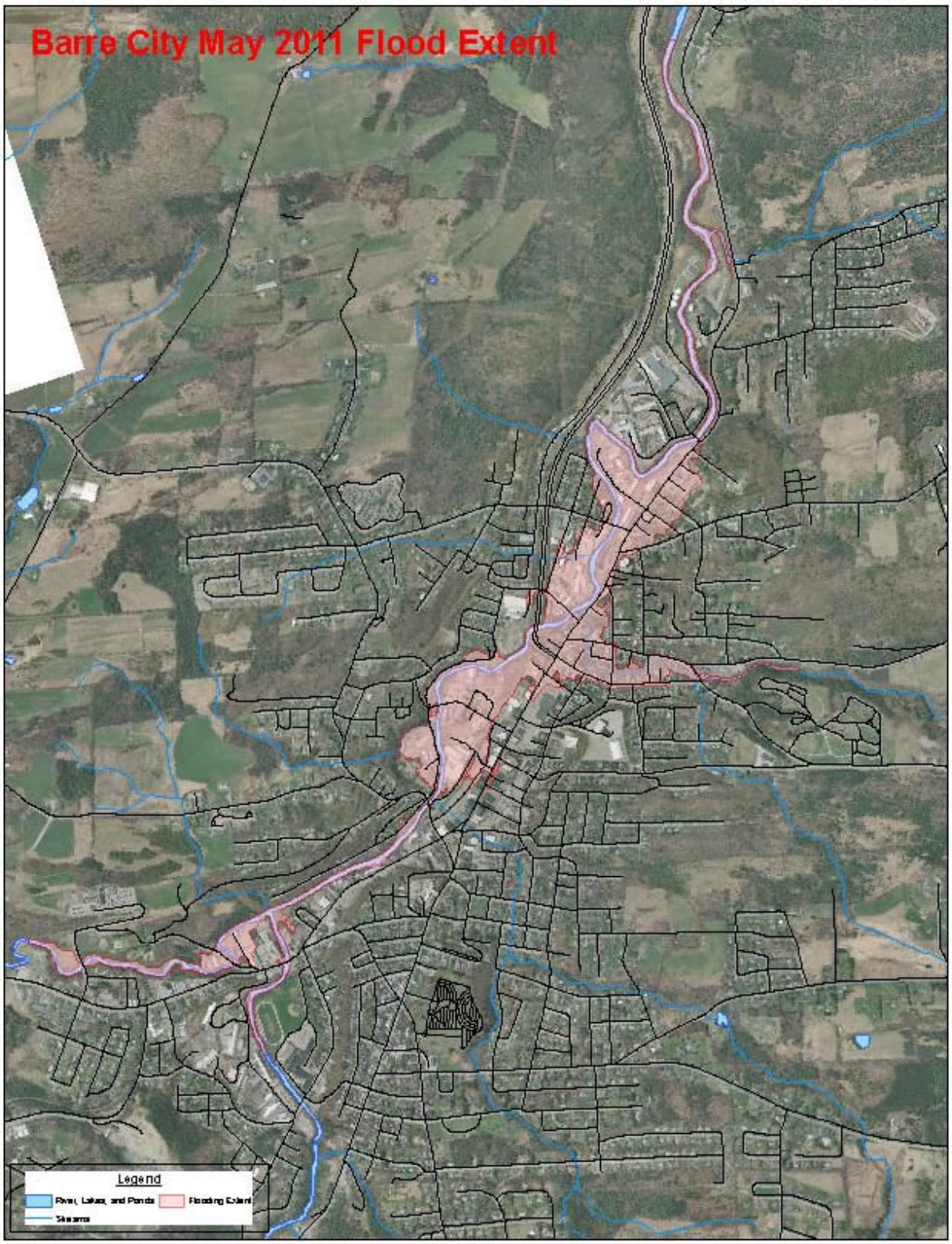
Barre City understands that in order to apply for FEMA funding for mitigation projects that a project must meet FEMA benefit cost criteria. The City must also have a FEMA approved Hazard Mitigation Plan as well.

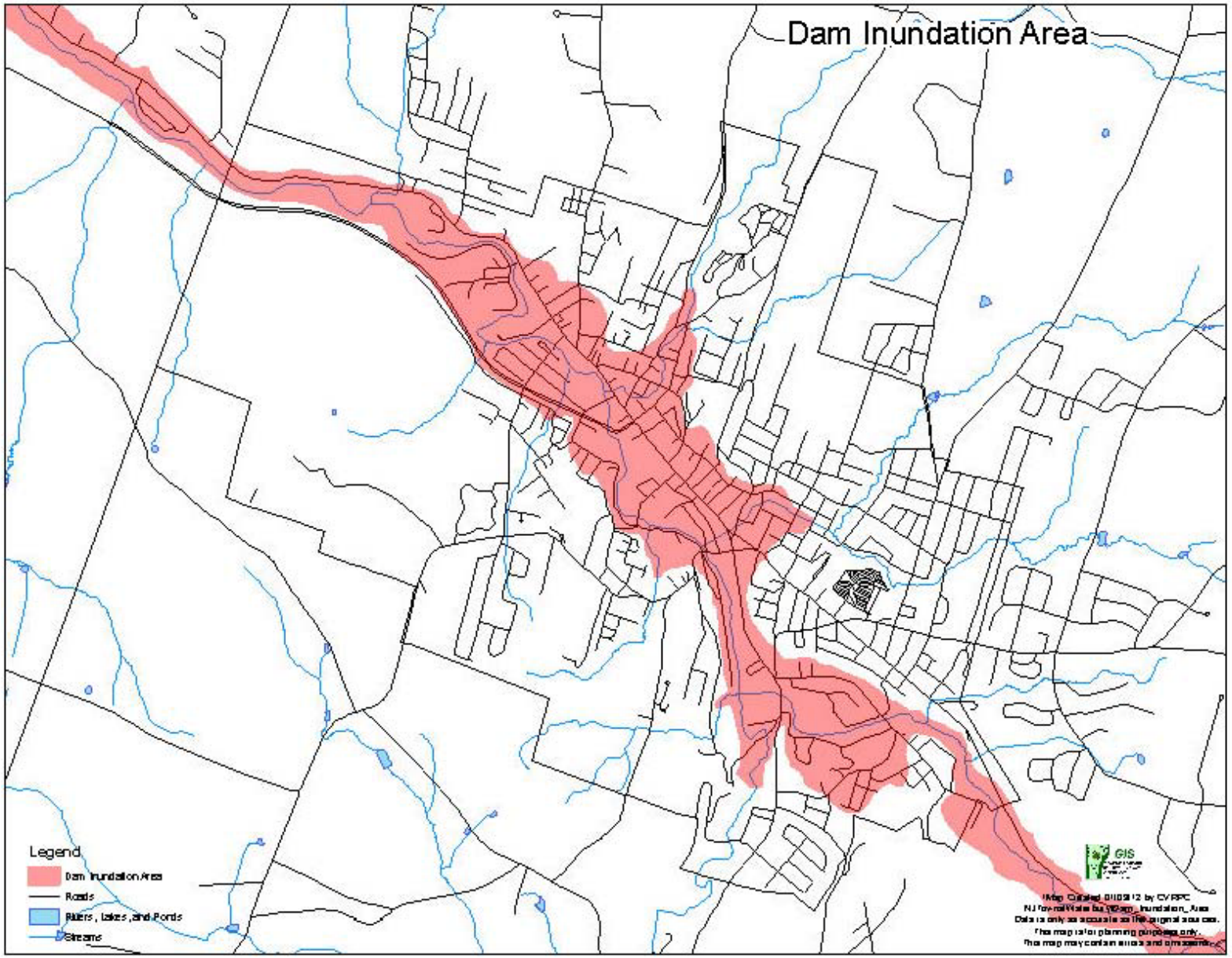
A High prioritization denotes that the action is either critical or potential funding is readily available and should have a timeframe of implementation of less than two years. A Medium prioritization is warranted where the action is less critical or the potential funding is not readily available and has a timeframe for implementation of more than two years but less than four. A Low prioritization indicates that the timeframe for implementation of the action, given the action's cost, availability of funding, and the community's need to address the issue, is more than four years.

Attachments

- Areas of Local Concern Map
- May 2011 flood extent and damage maps
- Dam Inundation Area Map
- Stevens/Jail Branch Corridor Plan Maps and Projects
- Hazards from previous mitigation plan
- 5 year Plan Maintenance and Review Process
- City Resolution Adopting the Plan


Facilities & Buildings
Hazardous Waste Facilities of concern
Flood Prone Areas
BarrectyRailroadTrestles
Bridges
Government
School
Police/Fire Station
Healthcare
Wastewater Treatment Plant
Dams
Rivers and Streams
Intermittent
Perennial
Lake/River
Floodplain 100-year
Roads
Legal Trail
Minor Road
VT State Highway
US Highway
Interstate
BERLIN
BARRE TOWN
WTP
Downtown Inset
Barre City, Vermont
Areas of Local Concern
N
0 0.125 0.25 0.5 Miles


Barre City May 2011 Flood Extent
Legend
Rivers, Lakes, and Ponds
Flooding Extent
Streams


Dam Inundation Area
Legend
Dam Inundation Area
Roads
Rivers, Lakes, and Ponds
Streams
GIS

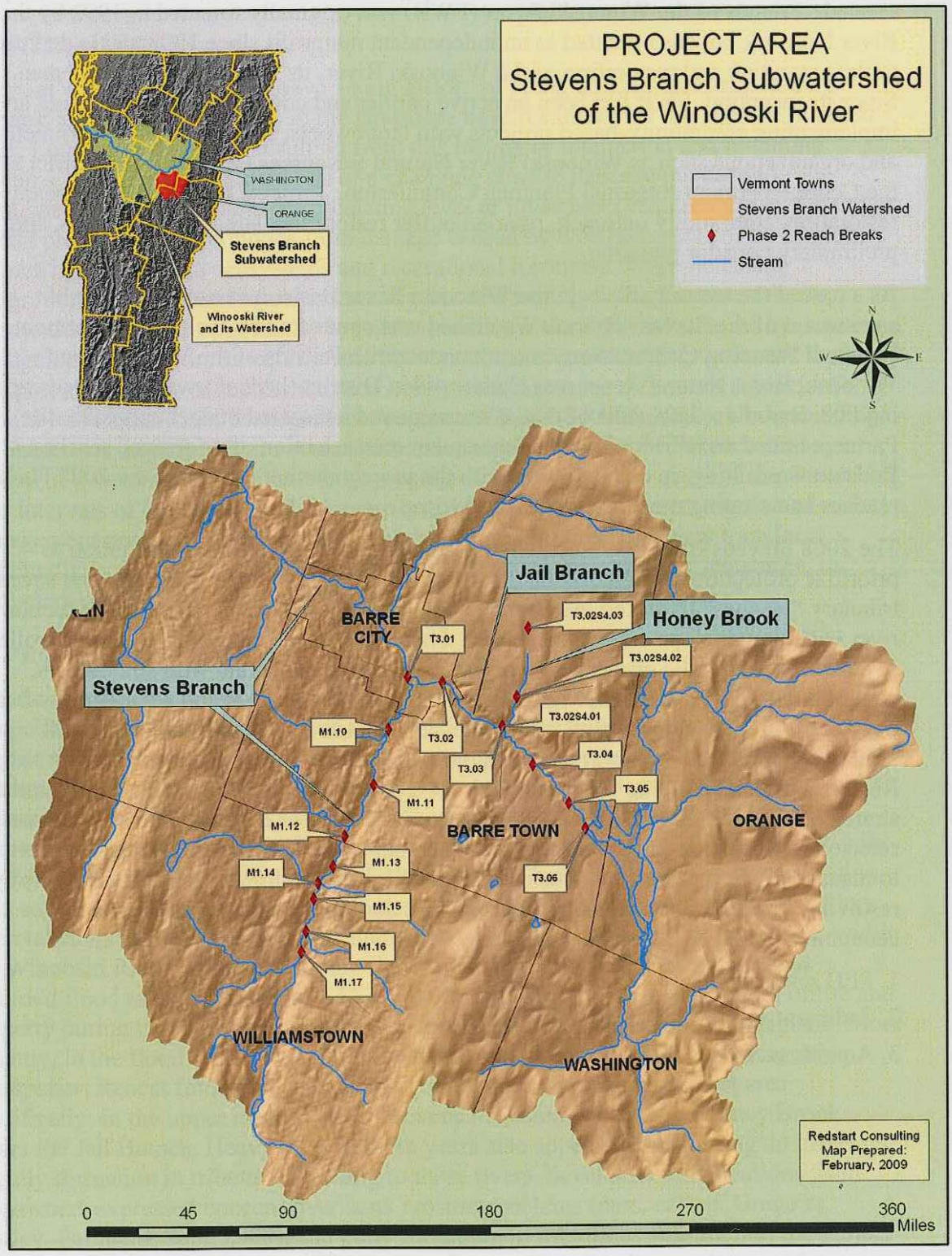


Figure 1. Six mainstem and seven tributary reaches included in the Stevens Branch Corridor Planning process. Inset shows the location of this area in terms of the entire State.

Stevens Branch Watershed 2008 Phase 2 Prioritized Project and Strategy Summary (from Stevens Branch Corridor Plan 3/13/2009)								
Project No.	Reach/ Segment Condition Sensitivity	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitment	Potential Partner Commitments
1	All of project area	Extensive straightening and frequent loss of floodplain access, escalating erosion conflicts due to increased stream velocity.	FEH and belt-width-based corridor planning, protection of attenuation assets.	Feasible, high priority; delineation process largely developed Development pressures in watershed likely to continue, upstream impacts affect success of projects	Flood hazard reduction, fisheries protection, prime farmland protection, viewshed preservation, water quality protection, oversight of management activities affecting stream function	Development of FEH corridor; outreach and educational materials; policy development and implementation	Depends on options chosen; see VT ANR Municipal Guide to Fluvial Erosion Hazard Mitigation (Literature Cited section of this report)	Towns of Barre, Barre City, and Williamstown FWR;CVRPCVT ANR-RMP
2	Numerous reaches High Priority (In order of priority): M1.11-A, M1.11-B, M1.11-C, M1.15-A, M1.10-A, M1.18-B, M1.18-C, M1.19-A	Bank erosion, encroachment leading to bank destabilization and increased flows	Buffer protection and enhancement and corridor easement projects	Feasible, high priority; data available; cheap; easy to promote with landowners; funding available for easement projects	Water quality protection, fisheries protection, flood hazard reduction	Outreach; materials and planting costs; easement development costs	Landowner commitment critical. Potential land use conversion of buffer areas.	Private Landowners; FWR, CVRPC, VT ANR-RMP, CREP

3	Numerous reaches High Priority (In order of priority): M1.10-B, M1.11-B, T3.01-A, T3.01-B, T3.02B, T3.03-A, T3.04-D, T3.05-A, T7.01-A, M1.18-A	Increased flow, downstream reaches incised	Collect and assemble stormwater input data for reaches; develop plan for mitigating flow	Feasible, high priority; data available; towns may have model inventories and budgeting/resources?	Water quality protection, fisheries protection, flood hazard reduction	Data assembling; outreach and education; alteration costs where appropriate	Private landowners are key to success	Towns of Barre, Barre City, and Williamstown Private landowners; FWR;CVRPC VT ANR-RMP
4	Numerous reaches High Priority (In order of priority): T2S4.01-A, T3.01-A, T3.01-B, T2S4.01-B, T2S4.02-A, T2S4.02-B, M1.14-0, M1.15-B, T3.02S4.01S1.01-A, T3.02S4.01S1.01-B, T7.01-B	Downstream reaches incised, sediment discontinuities reducing movement of larger bedload sediments to help rebuild meanders and floodplain access	Collect and assemble geomorphic data for bridges and culverts; develop and disseminate sizing recommendations and/or requirements for private installations and help towns with inventory, prioritization, and capital budgeting	Feasible, high priority; data already available; some towns may have model inventories and budgeting	Flood hazard reduction; fisheries protection	Data collection and assembling; replacement costs where appropriate		Towns of Barre, Barre City, and Williamstown FWR; CVRPC VT ANR-RMP
5	M1.10B	RB mass failure exacerbated by stormwater outflow.	Re-location of stormwater input	Feasible, should fit in with City stormwater management priorities.	Protect fisheries and water quality from increased sediment	Landowner outreach and education; relocation of stormwater flow	Land use conversion minimal; landowner will need to commit to project	Landowners, Barre City Engineers, FWR, RMP

6	M1.10D	Extensive tributary erosion and head cut that has moved up to Route 14. Arrest headcutting [more?]	Arrest headcutting at Route 14	Feasible, should fit in with City stormwater management priorities.	Protection of State Highway, improved water quality, protection of fisheries	Replacement of culvert and other structures for arresting headcut	Land use conversion minimal; City road engineer must be on board	Barre City Engineers, VTrans, FWR, RMP
7	M1.15B	Floodplain not accessed on right bank due to berm presence; recent flooding over left bank into developed area	Remove berm	Feasible, should be further evaluated but is possibly simple solution to problematic flooding	Return area of non floodplain habitat to floodplain habitat	Landowner outreach and education, equipment for berm removal and site restoration	Some land conversion of flood-protected land to non-flood-protected land; will need landowner commitment	FWR, RMP, CREP, EQIP
8	T3.01B	Mass failure RB; upstream of bridge is threatening house above	Stabilize stream bank; redirect stream flow with rock vein	Feasible; financial responsibility needs to be worked out	Water quality protection	Riprap and vein boulders, installation costs.	Landowner commitment needed, City commitment needed.	Barre City, Landowner at site, FWR, RMP
9	T3.03A	Gully formation on left valley wall is adding sediment to Jail Branch and is headcutting.	Arrest head cut in tributary gully	Potentially feasible; needs further evaluation to determine source, assess future erosion risk, and consider value of intervention	Landowner education, protection of water quality and fisheries.	Landowner outreach and education, materials and installation costs.	Minimal land use conversion; needs landowner commitment.	Site landowners, Barre Town, FWR, RMP CREP, EQIP

10	T3.01B	Lack of flood attenuation in city.	Remove berm	Potentially feasible; needs further evaluation to assess value and issues involved	Landowner education; reduced flood hazard downstream	Landowner outreach and education would be extensive considering potential flooding over school playing fields; cost of removing berm and stabilizing the site.	Land use conversion possibly; landowner and citizen commitment would have to be high	Barre City Government, Barre City citizens, landowners, FWR, RMP.
11	T7.01A	Possibly unnecessary barrier to attenuation.	Remove berms	Potentially feasible; needs further evaluation to assess value and issues involved	Landowner education; reduced flood and erosion hazard downstream	Landowner outreach and education, materials and installation costs.	Minimal land use conversion; needs landowner commitment.	Site landowners, Williamstown Town, FWR, RMP CREP, EQIP

6.2 Hazardous materials (fixed & transport)

Date	Material	Amount	Unit	Location
9/3/2000	Diesel Fuel	Unknown	N/A	3-4 mile spill from Smith Street, Barre to CVH on RT 62, Barre City and Berlin
2/15/2001	Unknown	Unknown	N/A	58 Granite Street, Barre City
7/31/2001	Degreaser/Solvent	Unknown	N/A	Clark's Transfer Service, Boynton Street, Barre City
9/25/2001	#2 Heating Oil	2-5	Gallons	134 Elm Street, Barre City
10/19/2001	White Powder	dust	N/A	Barre City Post Office, Barre City
10/25/2001	Brown Manila Folder	Unknown	N/A	Dept. of Employ. & Training, Barre City
10/29/2001	Mercury	Small Amt.	N/A	Private Residence, Barre City
10/31/2001	Suspicious Package	Unknown	N/A	Capital City Press, Barre City
11/2/2001	White Powder	Unknown	N/A	Spaulding High School, Barre City
11/5/2001	White Powder	Unknown	N/A	Cochran's Inc., 15 Blackwell Street, Barre City
2/21/2002	Kerosene	250	Gallons	11 Paddock Street, Barre City
7/22/2002	Hot Asphalt	Unknown	N/A	Through out city and RT 63, Barre City & Berlin
8/12/2002	Mold	Unknown	N/A	Private Residence, Barre City
10/21/2002	Anhydrous Ammonia	120	Pound/s	Barre Civic Center, 20 Auditorium Hill, Barre City
2/3/2003	#2 Heating Oil / Gasoline	200	Gallon/s	Long Street, Barre / 11 E. State St. Montpelier
5/1/2003	Petroleum of some sort	Unknown	N/A	Gunner Brook
6/2/2003	Gasoline	12.0	Gallons	524 North Main Street, Barre City
6/26/2003	Petroleum	Unknown	N/A	In river behind Cumberland Farms, 524 Main Street, Barre City
9/25/2003	Diesel Fuel	Unknown	N/A	Granite Importers yard, Barre City
10/13/2003	Radiator Coolant	4	Cups	McFarland House State Office Building, Barre City
11/17/2003	Unknown	Unknown	N/A	Interstate 89 South-bound, East of East Barre Exit, Berlin
11/26/2003	#2 Heating Oil	27	Gallon/s	Granite Industries of Vermont, Vanetti Place, Barre City
1/10/2004	#2 Heating Oil	20-30	Gallon/s	#4/#6 Kent Street, Barre City
3/15/2004	Kerosene	Unknown	N/A	21 Berlin Mobile Home Park
12/13/2004	#2 Heating Oil	3	Gallon/s	195 Route 302, Barre
12/24/2004	#2 Heating Oil	>25	Gallons	15 Maple Grove to Eastern Avenue, Barre City

1/3/2005	#2 Heating Oil	15	Gallon/s	Berlin Street, Barre
2/22/2005	#2 Heating Oil	Unknown	N/A	Multiple locations in Barre City.
1/13/2006	Hydraulic Fluid	Unknown	N/A	Mid State Dodge, 1365 US Route 302, Barre
3/3/2006	Unknown	Unknown	N/A	Stephens Brook from Prospect Street to Boynton Street.
3/13/2006	Potassium Permanganate		3	Gallon/s Behind the Barre City Post Office, 3 South Main Street
4/17/2006	Hydraulic Fluid	5-7	Gallon/s	Casella Truck, Salvation Army, Barre City
4/25/2006	Gasoline	3 to 4	Gallons	Cumberland Farms, 524 Main Street, Barre City
5/5/2006	Oily Smell	Unknown	N/A	Private Residence
5/6/2006	Water	Unknown	N/A	City of Barre
6/2/2006	Gasoline	3-4	Gallon/s	520 North Main Street, Barre City
11/9/2006	Gasoline	30.0	Gallons	Cumberland Farms, 524 North Main Street, Barre City
11/9/2006	Sewage	Unknown	N/A	147/151 Berlin Street, Barre
11/14/2006	#2 Heating Oil	Unknown	Unknown	11 Mount Street, Barre City
2/1/2007	Human Waste	Unknown	N/A	Quarry Hill Mini Storage, 170 Quarry Hill Road, Barre
4/4/2007	sewage	Unknown	N/A	11 Mount Street, Barre City
4/6/2007	Used Motor Oil	2-3	Gallon/s	Bulk Facility, 24 Smith Street, Barre City
4/12/2007	Mercury	1	Bottle	Barre City Fire Department, Barre City

Information from 2001 - 2005
Provided by Hazardous Materials Compliance Officer, Vermont Emergency Management

There are 52 Tier II sites within the City of Barre. (See *Hazard Analysis Map*) Tier II sites are locations where hazardous substances, pollutants, or contaminants are stored and their release has caused, or if released would cause, contamination of drinking water, surface water, air, or soils which are likely to cause exposure to nearby populations, or is likely to contaminate sensitive environments. Major Tier II sites of concern in the City are three fuel oil depots: one located on Smith Street and two located on Williams Lane. While these locations have not experienced a release and do have hazard control measures in place, the potential for a release does exists. (See *Area of Local Concern Map*) The closest hazmat truck is located 42 miles away at the IBM Facility in Essex Junction. The Barre City Fire Department has a hazmat de-contamination trailer at the Greater Barre Public Safety Building located at 15 Fourth Street.

An additional Tier II site of concern is the storage and use of anhydrous ammonia at the Barre Civic Center. Ammonia continues to be used as a refrigerant in large industrial processes and is

used at the Civic Center for maintenance and operation of the ice rink. On October 21, 2002 the Barre City Fire Department responded to a spill of 120 pounds of ammonia at the Barre Civic Center located at 20 Auditorium Hill. The incident cost the City of Barre approximately $60,000 in indirect damage costs and response and operational costs. Between 2001 and 2005 there were 42 other hazardous material spills or incidents within Barre City. (See chart above) While damages costs were not explicitly recorded, these incidents no doubt affect the City of Barre financially and also pose a threat to public and environmental health and safety.

Flood events and winter storms can also increase the liability of hazardous materials within the City. During the flood of July 2007 and December 2000, the Barre City Fire Department witnessed propane and oil tanks that became buoyant and unhooked from supply lines due to rising flood waters. This repeating scenario poses a threat to public safety and environmental health. Major snow storms resulting in deep snow drifts can block heating vent pipes cause carbon monoxide poisoning. Hazardous materials pose a threat to a large percentage of Barre's population; many elderly persons within the City do not have the ability to shovel roofs and clear around vent pipes. (See Section 6.1 *Flash Flooding* & Section 6.4 *Winter Storm/Ice Storm* for more information.)

Route 14 and Route 302 are major transportation routes in Central Vermont and pass through the City of Barre's downtown and adjacent neighborhoods. Varieties of hazardous materials are transported along these roads on a daily basis and pose a threat to business and public health and safety. The extent of hazardous materials spills pose a moderate threat to Barre City as past events have resulted in major property damage; some minor infrastructure damage; and essential services were briefly interrupted.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Hazardous Materials	Floodplain including facilities on Williams Land. Plus facility on Smith Street and the BOR.	Commercial structures plus densely populated adjacent neighborhoods.	Moderate	2002 spill at the BOR = $60,000 in direct and indirect costs.	HIGH

6.3 Power Shortage/Failure

The City of Barre is served by one energy utility, Green Mountain Power (GMP). GMP power generation is based upon substations, which are not set by jurisdictional lines. As a result,

frequency and specific dates of power shortage/failure could not be attained. This level of detail could be provided in the future by working directly with the utilities in order to research this data. According to the Barre City PDM meeting, a variety of situations such as high winds, winter and ice storms plus rodent damage can cause power shortages / failures; the direct location of such events are difficult to predict.

Power shortage / failure can prove moderately hazardous if it occurs during the winter, particularly in conjunction with another hazard, such as a winter storm / ice storm or extreme cold. Vulnerable populations, such as the elderly and handicapped, are of greatest risk to this hazard. The City contains three nursing homes and assisted living facilities. Approximately 18% of the City's population is over 65 years of age and according to the Municipal Plan, Barre has a higher percentage of elderly population than the region and state. Elderly residents live in the above mentioned facilities or in private residences. These facilities, and much of the elderly population, depend on a reliable source of energy to power life support systems. While the nursing homes and assisted living facilities are equipped with generators many of the private residents do not have access to back up power.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Power Failure	Entire municipality	Sensitive populations - elderly	Moderate	18% of City population.	Unknown – data deficit

6.5 School Safety Issues

There are three schools in the City of Barre enrolling approximately 2,000 students. They are:

- The Barre City Elementary / Middle School – enrolling 900 students and located on the south side of the City on Parkside Terrace.
- Barre Technical Center / Spaulding High School – enrolling a total of 1,115 students and located in the south eastern quadrant of the City on Ayers Street.
- St. Monica Church School – a private elementary school with enrollment of 180 students located adjacent to downtown on Summer Street.

The Barre City Police Chief indicated during the PDM meeting past occurrences, such as students bringing fire arms on to school property, school safety issues are a concern of the Barre City community.

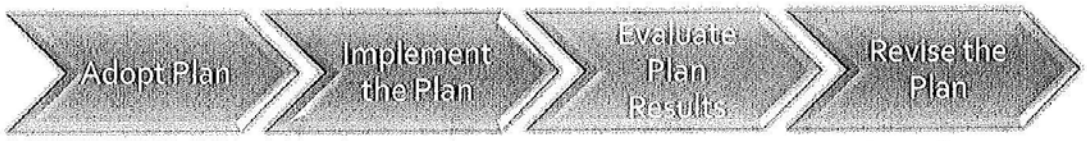
While no data was available about specific occurrences or extent of occurrences at the time of this PDM draft the Police Chief stated the need for all city emergency response departments to plan for and be prepared for future events. As recent events across the county from the school shooting in Essex Junction, VT in August 2006 to the Virginia Tech school shooting in April 2007

have highlighted the need for increased communication between departments and emergency preparedness plans.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Probability
School Safety Issues	Barre City Elementary / Middle School on Parkside Terrace, Barre Technical Center / Spaulding High School on Ayers Street, St. Monica Church School, Summer Street. Plus adjacent neighborhoods.	Sensitive populations – children/ students. Plus faculty.	Moderate	Approximately 2000 +/- Students.	Unknown – data deficit

5-Year Plan Review/Maintenance



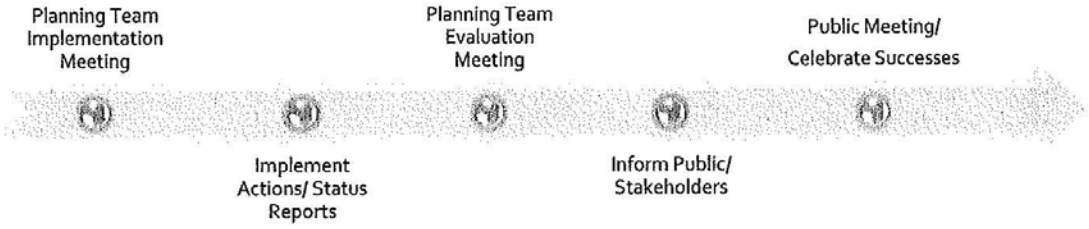
- Brief local leadership on plan approval
- Formally adopt plan
- Publicize plan approval and adoption
- Celebrate success

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

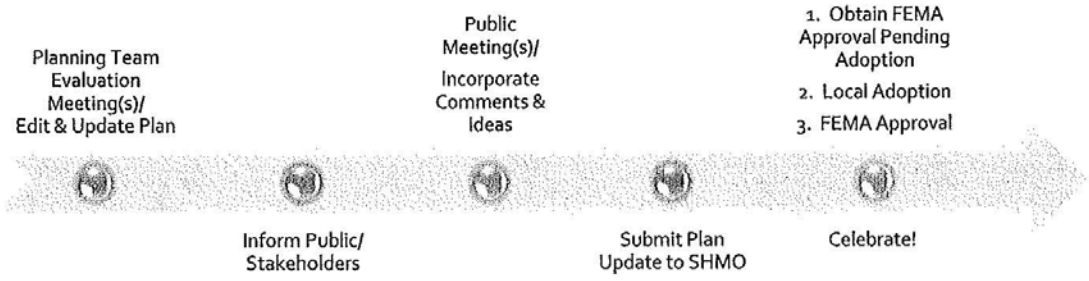
- Effectiveness of planning process
- Effectiveness of actions
- Document success & challenges of actions
- Update and involve community
- Celebrate successes

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

After Plan Adoption-Annually
Implement and Evaluate



Fifth Year, and After Major Disaster
Evaluate and Revise



CERTIFICATE OF ADOPTION

The City of Barre
City Council
A Resolution Adopting the Local Hazard Mitigation Plan
_____ __, 2011

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

WHEREAS, a duly-noticed public meeting was held by the City of Barre City Council on _____ __, 2011 to formally adopt the Barre City Local Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that the Barre City City Council adopts the Barre City Local Hazard Mitigation Plan.

_____
Mayor

_____
Member of City Council

ATTEST

_____