

# Town of Middlebury, Vermont Hazard Mitigation Plan August 2015

Adopted by Middlebury Selectboard: 01/12/2016

FEMA Approval Date: \_\_/\_\_/\_\_\_\_







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## Introduction

### Purpose

The purpose of hazard mitigation and this plan is to reduce or eliminate long-term risk to people and property from natural hazards and their effects in the Town of Middlebury, Vermont. This plan has been prepared to meet the Disaster Mitigation Act of 2000 (DMA 2000) requirements in order to maintain the Town's eligibility for Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Programs (HMGP). More importantly, this plan and its planning process lay out the strategy that will enable the Town to become less vulnerable to future disaster losses.

The planning process followed a methodology prescribed by FEMA. It began with the formation of a Hazard Mitigation Planning body comprised of key town departments and community representatives. The process examined the recorded history of losses resulting from natural hazards, and analyzed the future risks posed to the Town by these hazards. The Town of Middlebury is at risk to several natural hazards that are identified, profiled, and analyzed in the plan.

The plan identifies several mitigation goals and objectives that are based on the results of the risk assessment. The plan includes specific actions that the Town can implement over time to reduce future losses from hazards. The plan also includes a review of the Town's current capabilities to reduce hazard impacts. This plan will require review and adoption from the Middlebury Select Board and is required to be updated a minimum of every five years.

### Background and Scope

The Town of Middlebury has prepared this hazard mitigation plan to guide hazard mitigation planning and to better protect the people and property of the Town of Middlebury from the effects of hazard events. It demonstrates the Town's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. Other purposes include making the Town of Middlebury eligible for certain federal disaster assistance, specifically, FEMA Hazard Mitigation Grant Program (HMGP), Hazard Mitigation Assistance (HMA) grant program, and Pre-Disaster Mitigation (PDM) program, as well as earning points for the National Flood Insurance Program's (NFIP) Community Rating System (CRS) to lower flood insurance premiums community-wide.

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as “any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event.” The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of \$4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Hazard mitigation planning is the process through which natural hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. The Town of Middlebury Hazard Mitigation Plan covers the Town’s jurisdictional boundaries including two village centers, East Middlebury and Middlebury. It documents the Town’s natural hazards mitigation planning process, identifies natural hazards and associated risks to the Town, and develops a hazards mitigation strategy to lessen vulnerability and improve resiliency to natural disasters, thereby enhancing the Town’s long-term sustainability.

The Town prepared this hazard mitigation plan pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6), finalized on October 31, 2007, and updated in 2012. Hereafter, these requirements and regulations will be referred to collectively as the DMA. While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal

disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the Town of Middlebury is at risk for multiple natural hazards, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the Town and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. Middlebury has been affected by natural hazards in the past and is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

## Plan Organization

The Town of Middlebury's Hazard Mitigation Plan is organized as follows:

- Introduction
- Community Profile
- Planning Process
- Risk Assessment
- Mitigation Strategy
- Plan Adoption
- Plan Implementation and Maintenance

## Community Profile

Middlebury has two village centers, Middlebury Village and East Middlebury, surrounded by dispersed rural development, working farmland and forests. Otter Creek flows north through Middlebury Village and the Middlebury River flows west through East Middlebury before joining Otter Creek, three miles south of the Village. There are five state highways that come together in the Village: Route 7 is the major north/south arterial along the west side of the State and bisects Middlebury; Route 125 traverses the town generally from east to west; Route 116 runs north south at the base of the Green Mountains along the east side of town and Routes 23 and 30 which run north west and south west respectively, from Middlebury. Vermont Railway operates rail/freight service through Middlebury about once a day. Middlebury has a State airport located in East Middlebury off of VT 116.

The population in Middlebury, as of the 2010 census is 8,496, which includes approximately 2,500 resident Middlebury College students, making up nearly 30% of the Town's population. Roughly 62% of homes in Middlebury are single-family units, greater than 30% are multiple-family units and approximately 5% are mobile homes. In Middlebury, power is provided by Green Mountain Power. Water is provided by two separate systems – the Middlebury Town Water System for the downtown and portions of outlying areas, and Fire District #1 for much of East Middlebury. Additionally, many Middlebury residents have individual wells or springs. A municipal sewer system supports the village area and a portion of route 7. The town sewers serve a smaller area than that covered by the municipal water system. East Middlebury and most outlying areas are served by individual on-site septic systems. The total value of the buildings in the Middlebury Grand List is \$974,917,600, of which \$716,277,800 is taxable. The remaining lands and structures are non-taxable due to non-profit educational and religious exemptions.

- In Middlebury, fire coverage is provided by the Middlebury Fire Department which is an all- volunteer fire department. The 2012 State Fire Marshall's report indicates that the fire department responded to 96 fire calls and 12 EMS assists in 2012. Of the 96 fire calls, eight were for structure fires. The town is provided paramedic-level EMS and ambulance service by the Middlebury Regional EMS, a private non-profit ambulance service with its



home in Middlebury. Law enforcement is provided by the Town-operated Middlebury Police Department with 24/7 coverage of the entire town. The town has an appointed Emergency Management Director and an approved Emergency Operations Plan. The plan includes a preliminary hazards assessment that identifies flooding, aviation accidents, power failures, hazardous materials (transport & fixed site), winter storms and high winds/tornadoes as potential hazards to the community. The areas of the community considered most vulnerable in the plan are the village and community water supplies. Essential Facilities identified in the Middlebury Emergency Operations Plan include the Municipal Building, Police Station and Department of Public Works as potential emergency operations centers and the Middlebury Union High School and the Senior Center as community shelters. The municipal building/Senior Center serves as a regional shelter and opened both for Flooding evacuees in 2008 and as a warming shelter for the 1998 Ice Storm.

- The Town has a Town Plan (adopted in 2012) that lays out a vision for future growth and conservation. The Town has adopted zoning by-laws based on past and current plans, to regulate and direct growth into appropriate areas. These zoning bylaws include associated regulations within designated Flood Hazard Areas and Fluvial Erosion Hazard Zones.

Middlebury College is the region's largest employer with 1,000 staff and 2,500 students. The College relies upon the Town's emergency response services. Other large businesses in town include Agri-Mark, Cabot, Porter Hospital, Wood Chuck Cider Company,

## Planning Process

Requirements §201.6(b) and §201.6(c)(1):

An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

1. An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
2. An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and
3. Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

### Review of Existing Planning Documents

Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability from natural hazards. As such, this plan was coordinated with, and builds off of, other related planning efforts that help reduce hazard losses. The Town of Middlebury uses a variety of comprehensive planning mechanisms, such as a Town Plan, an Emergency Operations Plan and Zoning and Subdivision Regulations to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this hazard mitigation plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from the region and state. These plans pre-date this plan and are used to illustrate how the community, the Addison region and the State of Vermont have incorporated mitigation into standard planning mechanisms. As planning efforts move forward, this mitigation plan will inform and be integrated into these and other future planning processes and plans.

At the beginning of each town planning process this and future mitigation plans will be used to provide data and policies that will inform the development of all other town plans. The following are adopted plans, studies, reports and technical information relating to hazard mitigation.

**Middlebury Emergency Operations Plan** (mitigation actions identified in 2015 plan)

- When fire hazards are identified, they should be immediately reported to the fire chief. Follow-up may include an inspection by the state fire marshal or inspections by Labor and Industry.
- Each town department should have an ongoing threat assessment plan to identify risks to operations, utilities, transportation systems, equipment and public welfare. With this assessment should be contingency plans to protect these systems and to identify alternatives in the event of failure.
- Emergency personnel should be trained to handle incidents involving hazardous materials.

**Middlebury Town Plan** (12/11/12) statements supporting hazard mitigation

- Work with East Middlebury residents, the angling community and other interested citizens to develop a long-range management plan for the Middlebury River that both protects public and private infrastructure and maintains a healthy aquatic ecosystem.
- Prepare for increased volume and intensity of storm events by properly sizing road and sewer infrastructure. Size all bridges and culverts to a minimum of the current bank-full width and strongly consider investing in larger sized structures at critical crossings.
- Update zoning to include, where appropriate, Low-Impact design techniques and standards.
- Actively protect all wetlands through enforcement of local and State regulations regarding fill and maintenance of buffers adjacent to wetlands.
- Adopt fluvial erosion hazard zoning and maps.
- Collaborate with the fire department to distribute smoke detectors, carbon monoxide detectors and fire extinguishers.

- Advocate and support a diverse energy supply portfolio to serve the town, its residents and businesses.
- Consider the effects of road maintenance and emergency vehicles on road design (e.g. purchase snow plows and fire trucks to fit the roads).
- Update the Airport Master Plan and support safety improvements.
- Look for options to move Creek Road farther from the creek and preserve trees along the bank.
- Carefully review new developments to prevent fire hazards, particularly for fuel storage and handling facilities and access.
- Establish fire flow capability for all areas of the Town served by Town water.
- Implement the Well Head Protection Area (WHPA) and Source Protection plans and safeguards to protect public water supplies

#### [Middlebury Zoning \(12/8/2008\) Regulations](#) that support hazard mitigation

##### Section 660 - Shorelands, Riparian Buffers and Fluvial Erosion Hazard Areas

In order to protect water quality, prevent erosion, protect fish and wildlife habitat and preserve the natural beauty of shorelands and riparian buffer areas, there are hereby established shoreland / riparian buffer protection areas abutting all rivers and year-round flowing streams in Middlebury as shown on the Town GIS maps. The protection areas shall extend back from the edge of a river or stream as follows:

- Along the Otter Creek, Middlebury River and Muddy Branch (downstream from Vt. 116 / Case Street):
  1. The protection / buffer areas shall be a minimum of 100 ft., or to the limit of a flood hazard area where such limit is over 100 ft. from the river bank; and
  2. Where embankments forming the edge of the flood hazard area are 25% or steeper in slope, the protection area shall extend to 100 ft. back from the top of the embankment; and
  3. To the limits of the Fluvial Erosion Hazard (FEH) zone that has been prepared by the Agency of Natural Resources and accepted by the Select Board, dated February 8, 2011 (see maps in appendix); hereby adopted by reference.

- Along all other streams shown on the Town GIS maps, the protection / buffer areas shall be the distances provided for the rear setback (see Section 620).

Within the above-defined shoreland/riparian buffer protection areas, the following regulations shall apply:

- Trees which provide shade and hold the soil on banks and other existing natural vegetative growth shall not be removed except that the Administrative Officer may permit specific removal of trees which are dead or which represent an imminent threat to the safety of people or structures, or other vegetative modification / restoration projects as recommended the U.S. Soil Conservation Service or VT Agency of Natural Resources.
- There shall be no dumping or filling, berming or dredging, in these areas

Any land development or other changes in the Special Flood Hazard Areas (SFHA) shall be subject to Section 670. Any land development outside of the SHFA but in the FEH shall be subject to the following:

- New structures or additions shall not exceed 600 sq ft in net additional coverage of the lot, cumulatively from the effective date hereof (January 9, 2013).
- New structures shall be located within 50 feet of the existing primary building and no closer to the top of bank than the existing principal building.
- Development shall not increase the susceptibility of the subject property or other properties to fluvial erosion damage.
- Development shall not increase the potential of materials to be swept onto other lands or into the stream that would cause damage to other properties from fluvial erosion.
- Development shall not cause an undue burden on emergency service providers during and after fluvial erosion events.

This section shall not apply to existing agricultural fields, nor to the CBD or to bridges or Town water or sewer facilities, or other utilities which must cross the river or stream. Also, this section shall not apply to Planned Unit Developments in the VRC where the requirements of paragraph II above would be inconsistent with DRB required improvements and public access to riparian or shoreland areas under Section 550 III(d)(2).

Subject to a determination that the purposes in Section 660 I will be satisfied, the requirements of the subsections above may be waived or reduced, under the conditional use review procedure in Section 540.

## Section 670 – Special Flood Hazard Area Regulations

### Statement of Purpose

It is the purpose of these regulations to:

- Implement the goals, policies, and provisions in the Middlebury Town Plan;
- Avoid and minimize the loss of life and property, the disruption of commerce, the impairment of the tax base, and the extraordinary public expenditures and demands on public services that result from flooding related damages;
- Ensure that development in hazard areas is reasonably safe and accomplished in a manner that is consistent with public well being, does not impair stream equilibrium, flood plain functions, or river/stream corridors;
- Manage all flood hazard areas designated pursuant to 10 V.S.A. Chapter 32, the municipal hazard mitigation plan; and make the Town of Middlebury, its citizens, and businesses eligible for federal flood insurance, federal disaster recovery funds, and hazard mitigation funds as may be available.

### Other Provisions

- Precedence  
The provisions of these regulations shall not in any way impair or remove the necessity of compliance with any other local, state, or federal laws or regulations. Where the provisions of these regulations impose a greater restriction, these provisions shall take precedence.
- Validity and Severability  
If any portion of these regulations are held unconstitutional or invalid by a competent court, the remainder shall not be affected.
- Warning of Disclaimer of Liability  
These regulations do not imply that land outside of the areas covered by this Section will be free from flood damages. These regulations shall not create liability on the part of the Town of Middlebury or any municipal official or employee thereof, for any flood damages that result from reliance on these regulations, or any administrative decision lawfully made hereunder.

### Applicability

- Regulated Flood Hazard Areas

These regulations shall apply to the Special Flood Hazard Area (SFHA) in the Flood Insurance Study dated July 3, 1984 and as shown on Flood Insurance Rate Maps (FIRM) and Floodway (FLOODWAY) Maps dated January 3, 1985, published by the Department of Homeland Security, Federal Emergency Management Agency (FEMA), National Flood Insurance Program, as provided by the Secretary of the Agency of Natural Resources pursuant to 10 V.S.A. Chapter 32 § 753.

- Base Flood Elevations and Floodway Limits in Special Flood Hazard Areas

Base flood elevations and floodway limits provided by the National Flood Insurance Program (NFIP) and in the Flood Insurance Study and accompanying maps shall be used to administer and enforce these regulations. In Special Flood Hazard Areas where base flood elevations and/or floodway limits have not been provided in the Flood Insurance Study and accompanying maps, it is the applicant's responsibility to develop the necessary data. Where available, the applicant shall use data provided by FEMA, or State, or Federal agencies. The two areas in Middlebury where current FEMA maps do not show floodway boundaries are on Otter Creek, downstream of the falls below Pulp Mill Bridge, and on the Middlebury River upstream of the VT 125 Sand Hill Bridge.

[Addison County Regional Planning Commission Regional Plan](#) (2011) goals that support hazard mitigation

- Work to restore and maintain stream equilibrium by developing and implementing river corridor plans.
- Reduce flooding and related damages through appropriate mitigation techniques.
- Encourage watershed based cooperation and educate towns and the general public about water quality and stream dynamics
- Provide communities the support they need to be proactive in reducing flood and erosion hazards by adopting appropriate zoning regulations to limit development in hazardous areas.
- Encourage proper maintenance and sizing of bridges, culverts and other structures to accommodate flow from storm events and to mitigate flood

hazards.

- Reduce the loss of life and injury resulting from all hazards.
- Mitigate financial losses incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters.
- Reduce the damage to public infrastructure resulting from all hazards.
- Recognize the connections between land use, storm-water, road design/maintenance and the effects from disasters.
- Ensure that mitigation measures are sympathetic to the natural features of the region's rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.
- Encourage hazard mitigation planning as a part of the Municipal Planning Process.
- Encourage municipalities and landowners to consider VT Agency of Natural Resources riparian guidelines for habitat and flood protection.

[State of Vermont Hazard Mitigation Plan](#) (2013) goals that support hazard mitigation

- Ensure that current and proposed legislation and regulatory policies require effective hazard mitigation practices throughout the State.
- Ensure that grant-related funding processes allow for expedient and effective mitigation actions to take place at the municipal and State level.
- Provide timely and accurate technical assistance that supports hazard mitigation activities to regional and local jurisdictions as well as private sector partners.
- Identify state-level risks and vulnerabilities and protect or harden state infrastructure against hazards.

[East Middlebury Village Flood Resiliency Survey and Engineering Design Services Technical Report](#), Milone and MacBroom, Inc 2014.

An engineering analysis, including hydraulic modeling, was completed that included an alternatives analysis of different mitigation strategies.



The proposed mitigation projects are intended to prevent damages to town bridges and roads, state highways and private residences in East Middlebury by implementing an holistic approach that utilizes current river science to reduce the volume of water and sediment during high flow events, provide adequate floodplain storage while also employing more conventional management strategies at the Grist Mill Bridge and at the edge of the flood plain forest to protect human investments.

- Floodplain Reconnection: Restoring the floodplain upstream of the Grist Mill Road Bridge improves sediment transport and flood capacity and reduces the risk to infrastructure during flooding over the long term. This alternative will reduce the frequency that gravel removal may be required following large floods to reduce next-flood risks. Floodplain restoration is recommended as it is a way to reduce long-term flood risks by increasing the area available for sediment deposition during large floods and subsequent transport during smaller floods.
- Reinforce Ossie Road Berm with stone armoring. The Ossie Road berm protects structures from floodwaters as the Middlebury River widens, loses slope, and flows toward Vermont Route 7. Sediment deposition does take place in the channel and floodplain in this area, yet the increased width allows the material to spread out and safely move through the system during future floods. Water did flow along the Ossie Road berm during Irene, and signs of floodplain deposition and scour remain in the floodplain next to the berm.
- Grist Mill Floodwall: Repairing the floodwall with concrete, installing tie-back anchors, and installing a cutoff wall at the base of the existing wall are recommended (Figure 7.3). The wall is located in a scour-prone area and needs repair or replacement. The repair saves cost over wall replacement.

## Local Government Participation

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

1. Participate in the process,
2. Detail areas within the planning area where the risk differs from that facing the entire area,
3. Identify specific projects to be eligible for funding, and
4. Have the governing board formally adopt the plan.

For those participating in the Town of Middlebury Hazard Mitigation Planning, "participation" included:

- Attending and participating in the planning meetings,
- Providing available data requested of the Town,
- Reviewing and providing comments on the plan drafts,
- Advertising, coordinating, and participating in the public input process.

## The 10-Step Planning Process

To reinforce that the paper document is not as important as the process of planning, Dwight D. Eisenhower said, "Plans are worthless. Planning is essential." The Town of Middlebury hazard mitigation planning process is evidence of this statement as the Town worked with all sectors of the community to educate and to assimilate information that would be useful in the identification and assessment of hazard risks for future risk reduction and elimination.

FEMA recommends a 10-step planning process that provides a framework with which local officials, residents, engineers, technical experts and others can work out the details and reach agreement for hazard mitigation planning. The Town of Middlebury's plan was developed using the Disaster Mitigation Act planning requirements and FEMA's associated 10-step planning process.

1. Organize the Planning Effort
2. Involve the Public
3. Coordinate with Other Departments and Agencies
4. Identify the Hazards
5. Assess the Risks
6. Set Goals
7. Review Possible Activities
8. Draft an Action Plan
9. Adopt the Plan
10. Implement, Evaluate and Revise the Plan

During the planning process, individuals, groups and departments engaged in formal in-person meetings, corresponded through email and posted draft documents in Dropbox for document review and drafting. The following represents the planning process schedule of events timeline of events that took place during the development of Middlebury's Hazard Mitigation Plan.

### Planning Process Schedule

Date	Activity (All referenced minutes and documents including attendees can be found chronologically in Appendix B)
10/27/2011	Following Tropical Storm Irene (DR4022) the Middlebury Select Board called a special public meeting to hear resident's concerns about flooding in the Town of Middlebury. (See 10/27/11 Special Select Board Meeting Minutes and highlights)
11/22/2011	Residents of East Middlebury submit petition to Selectboard requesting planning for future flooding on the Middlebury River (See 11/22/11 East Middlebury Petition)
12/22/2011	The Select Board authorizes initial mitigation planning efforts by Landslide Natural Resources Planning Inc. including the creation of a River Task Force to address flooding issues in the Middlebury River (See 11/22/11 Landslide Scope of Work)
12/2011	Middlebury River Task Force established (See Middlebury River Planning and Restoration Report)
1/10/2012	Initial meeting of Technical Advisory Committee for engineering study of Middlebury River
3/22/2012	Middlebury River Public Information Meeting (No minutes available)(See 3/22/12 meeting notes and Planning process document)
4/27/2012	Initial organizational meeting of the River Task Force (See 4/27/12 River Task Force Initial Meeting Minutes)
10/3/2012	The Town of Middlebury and Landslide Natural Resource Planning entered into an agreement to complete a Town wide Hazard Mitigation Plan and Process.
10/19/2012	River Task Force Meeting to discuss the development of a Hazard Mitigation Planning Team (See 10/19/12 Task Force minutes)
11/27/12	Selectboard meeting with Task Force/Planning Team update (See Selectboard minutes)
12/3/12	Task Force Mtg to choose consultant (see 11-27-12 Selectboard minutes)
2/22/13	hazard Mitigation Planning Process adopted as proposed on 3/22/12
3/7/2013	Hazard Mitigation Planning Team kickoff meeting

## Planning Process Steps

4/4/2013	Second Hazard Mitigation Planning Team meeting (no minutes available)
4/10/2013	River Task Force and Third Hazard Mitigation Planning Team meeting, development of risk rating (see 4-10-13 minutes and Draft Risk Matrix)
5/15/2013	Task Force meeting alternatives presentation (See 5/15/13 minutes)
5/2013	First Public Input Meeting
6/24/13	Task Force Meeting to discuss consultant findings (See 6/21/13 alternatives and 6/24/13 minutes)
7/8/13	Task Force meeting to discuss BCA development (See 7/8/13 minutes)
9/18/2013	River Task Force Meeting to discuss HMGP application (See 9/18/13 minutes)
3/31/2014	River Task Force Meeting and discussion of Public outreach meeting for HMP (See 3/31/14 meeting minutes)
4/21/2014	Middlebury Public Safety Committee Review and Comment of Draft Plan
5/8/2014	Public Input Meeting at the Ilsley Library to Discuss Hazard Mitigation Draft Plan
5/12/2014	River Task Force Meeting and discussion of Public meeting on 5/8 (See 5/12 meeting minutes)
5/19/2014	Public Safety Committees Review Draft Plan (See 5/19/14 PSC meeting minutes)
5/21/2014	Public Television Interview to discuss Middlebury Hazard Mitigation Draft Plan
6/5/14	Public Works Committee review of draft plan (See 6/5/14 meeting minutes)
9/8/14	Plan Draft complete and sent to DEMHS for referral to FEMA
2/20/15	Draft returned from FEMA with corrections needed
5/18/2015	Draft plan uploaded to town website and neighboring communities are asked for comments via e-mail.

### Planning Step 1 – Organize the Planning Effort

The Town of Middlebury Select Board kicked off mitigation planning following flooding damages caused by TS Irene in East Middlebury. As part of this effort, a special Selectboard meeting was held in East Middlebury to gather public input. That meeting resulted in the formation of a River Task Force which slowly morphed into the town's hazard mitigation planning team. The Town of Middlebury Planning Department, Addison County Regional Planning Commission and Landslide Natural Resource Planning worked to establish the framework and organization for development of the plan. In addition to the core hazard mitigation planning team, draft review and comment from a larger multi-disciplinary planning group, included the following: The core planning team consisted of:

- Kathleen Ramsay – Town Manager
- Susan Shashok – Selectboard Member \*
- Ted Dunakin – Town Planning and Zoning Director \*

- Bob Wells – Town Wastewater Operator \*
- Amy Sheldon – Consultant and River Scientist \*
- Dan Werner – Director of DPW \*
- Pete Diminico – President- New Haven River Anglers
- Jack Brown – Resident \*
- Eric Blair – Town Planner
- Tim Bouton – Addison County Regional Planning

Note: \* indicates Town Resident

In addition to the Core Planning Team, the following organizations and committees were asked to give input and review the plan in draft stages. Their input was included in the multiple drafts that resulted in the current plan.

- Town of Middlebury Public Safety Committee
- Town of Middlebury River Task Force
- Town of Middlebury Public Works Committee
- Town of Middlebury Police Department
- Town of Middlebury Planning Commission
- Town of Middlebury Select Board

#### Planning Step 2 – Involve the Public

The initial membership of the hazard mitigation planning team was created appointed by the Town of Middlebury Select Board and following that appointment, the team publicly noticed/advertised to grow membership and participation. Upon the team's appointment, The Select Board discussed options for public involvement and agreed to include regular reports at Select Board meetings that were broadcast on public television, Middlebury Community Television (MCTV). Following development of the team, the Town utilized a number of forums and methods for public outreach and education including the following:

- Town of Middlebury Public Meetings
- Press Releases
- Newspaper Advertisements
- Town of Middlebury Website Postings
- Front Porch Forum – Local Online Forum for Information Exchange
- Poster Distribution throughout Community
- Facebook
- Town of Middlebury Listserv emailing

- Town of Middlebury Planning Commission Meetings
- Town of Middlebury Select Board Meetings

#### Planning Step 3 – Coordinate with Other Departments and Agencies

Early in the planning process, the hazard mitigation planning team determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the county, and/or their interest as a neighboring jurisdiction, representatives from the following agencies were invited to participate:

- Addison County Regional Planning Commission
- State of Vermont Division of Emergency Management
- State of Vermont Department of Environmental Conservation
- State of Vermont Agency of Commerce and Community Development
- Middlebury College
- U.S. Army Corps of Engineers
- U.S. Federal Emergency Management Agency

In addition to those listed above, the planning team used technical data, reports, and studies from the following agencies and groups. The team obtained this information either from the internet or directly from the organization.

- State of Vermont Agency of Natural Resources
- State of Vermont Geological Survey
- National Oceanic and Atmospheric Administration
- National Drought Mitigation Center

#### Planning Step 4 – Identify the Hazards

The hazard mitigation planning team led the comprehensive research effort to identify and document all the natural hazards that have, or could, impact the Town. During research efforts to identify hazards, the planning team studied past events that triggered federal, state, and/or local disaster declarations within the planning area. Where data permitted, geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities.

#### Planning Step 5 – Assess the Risks

The team completed a hazard risk and vulnerability assessment matrix to establish a team baseline knowledge of the Town's risk of natural hazards. By collecting information from previous hazard events, assessing existing threats and the potential for future occurrences, the Town was able to better establish goals and objectives for future natural hazards.

Jurisdiction	High Risk	Moderate Risk
Town of Middlebury	Flooding and Fluvial Erosion; Severe Thunderstorm/Lightning; Severe Winter Storms; Earthquakes; Wildfire; Tornado/Wind	Drought; Ice Jams; Dam Failure; Landslides

#### Planning Step 6 – Set Goals

Based upon the risk assessment review and goal setting process, the planning team developed the following goals with several objectives and associated mitigation measures. These goals and objectives provide the direction for reducing future hazard-related losses within the Town of Middlebury.

- Goal 1: Increase Community Awareness of Middlebury's Vulnerability to Natural Hazards
- Goal 2: Reduce Vulnerability of People, Property, and the Environment to Natural Hazards
- Goal 3: Increase Interagency Capabilities and Coordination to Reduce the Impacts of Natural Hazards

#### Planning Step 7 – Review Possible Activities

Once the planning team determined which hazards warranted the development of specific mitigation measures, the planning team analyzed a set of viable mitigation alternatives that would support identified goals and objectives. A facilitated discussion then took place to examine and analyze the alternatives. With an understanding of the alternatives, a brainstorming session was conducted to generate a list of preferred mitigation actions.

#### Planning Step 8 – Draft a Mitigation Plan

The planning team collected input regarding the draft risk assessment and goals and activities identified in Planning Steps 6 and 7, and produced a com-

plete draft mitigation plan. This draft was posted for review and comment at the Town of Middlebury website and made available at the Town Office building. . Other agencies and bordering towns were invited to comment on this draft as well.

Public comments and other agency and group comments were integrated into the subsequent working draft, which was advertised and distributed to further collect public input and comments. The planning team then integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the review and approval by the Middlebury Select Board. The plan was then sent to FEMA for review and subsequent editing.

#### Planning Step 9 – Adopt the Plan

Following Approval Pending Adoption from FEMA and in order to secure support and officially implement the plan, the plan required approval and later adoption by the Middlebury Select Board (See adoption resolution) Once the adoption was complete, final approval by FEMA occurred on \_\_/\_\_/\_\_\_\_.

#### Planning Step 10 – Implement, Evaluate and Revise the Plan

#### Planning Step 10 – Implement, Evaluate and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the planning process, all of the planning team's efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. Finally, there are numerous organizations within the Town whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and mitigation in the Town of Middlebury.

#### Risk Assessment

Requirement §201.6(c)(2): [The risk assessment shall provide the] factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the juris-



## Identifying Hazards

diction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Based on historical, state and regional data, the planning team identified the top 10 natural hazards that threaten the planning area. The State of Vermont's Hazard Mitigation Plan also includes extreme temperatures and Nor'easters in its list of vulnerabilities. The planning team chose to not include these hazards because the risks associated with them were not considered significant

### Hazards Identified

1. Flooding and Fluvial Erosion
2. Severe Thunderstorm and Lightning
3. Wildfire
4. Severe Winter Storm
5. Earthquake
6. Drought
7. Tornado and High Wind
8. Landslide
9. Ice Jam
10. Dam Failure

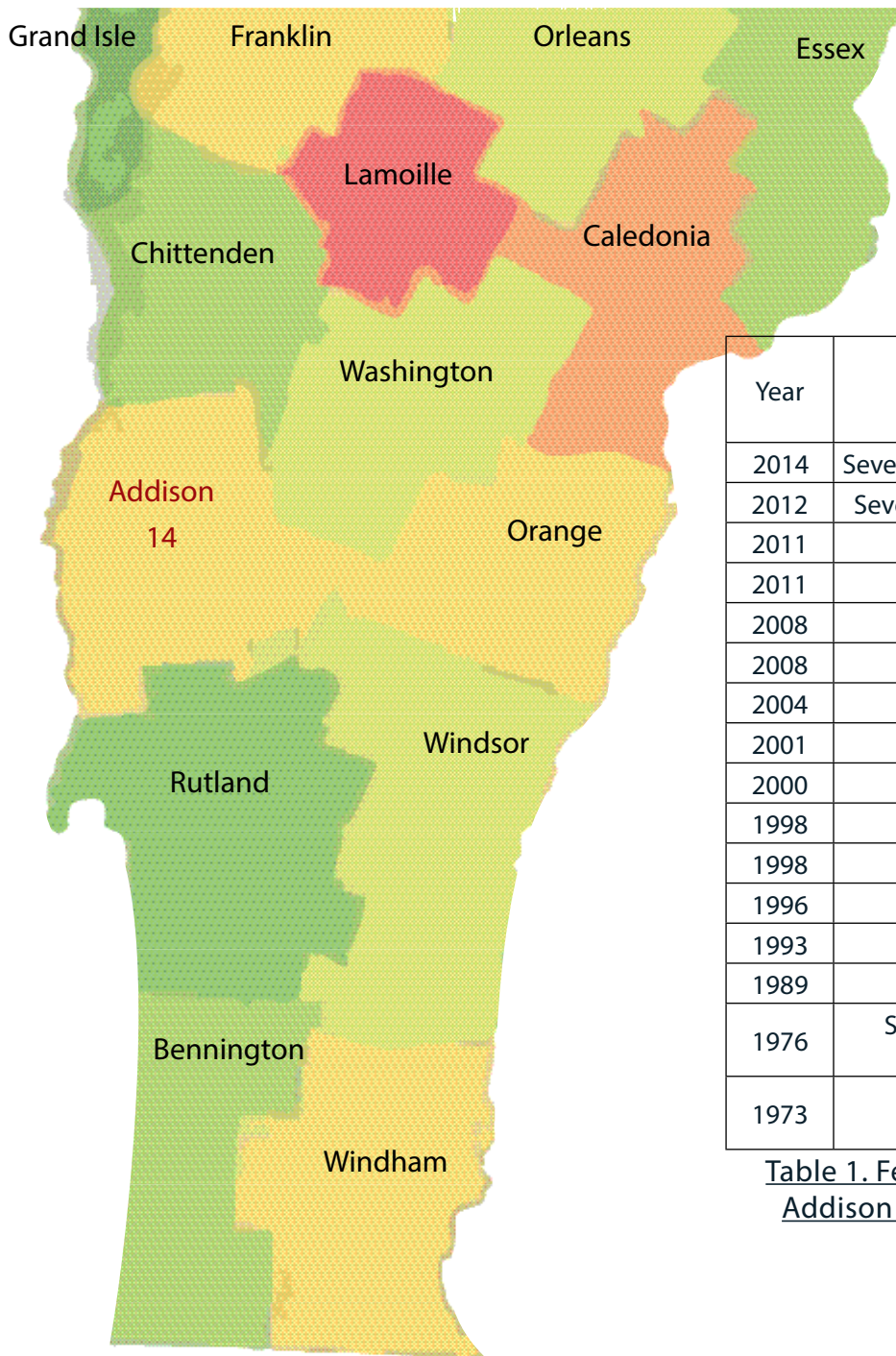
by the committee. In the planning area, Nor'easters are extremely unlikely as the Green Mountains block storms coming up the northeastern coast of the US. Similarly, the risk for extreme temperatures in the area is also small due to the moderating effects of nearby Lake Champlain and the Champlain Valley. would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment followed the methodology described in the FEMA publication, *Understanding Your Risks—Identifying Hazards and Estimating Losses*

(FEMA 386-2, 2002), which breaks the assessment down to a four-step process:

- 1) Identify Hazards
- 2) Profile Hazard Events
- 3) Inventory Assets



Year	Hazard Event	Federal Declaration Number
2014	Severe Winter Storm	4207
2012	Severe Storm, Flooding, Tornado	4066
2011	Tropical Storm Irene	4022
2011	Severe Storms, Flooding	1995
2008	Severe Storms, Flooding	1790
2008	Severe Storms, Flooding	1778
2004	Severe Storms, Flooding	1559
2001	Snowstorm	3167
2000	Severe Storms, Flooding	1336
1998	Severe Storms	1228
1998	Ice Storms	1201
1996	Major Storms, Flooding	1101
1993	Flooding	990
1989	Severe Storms, Flooding	840
1976	Severe Storms, High Winds, Flooding	518
1973	Severe Storms, Flooding, Landslides	397

Table 1. Federal Disaster Declarations in Addison County, Vermont since 1973.

Figure 1. Federal Disaster Declarations in Addison County, Vermont from 1973 - 2014

#### 4) Estimate Losses

Data collected through this process has been incorporated into the following sections of this chapter:

[Identifying Hazards](#) identifies the hazards and provides historical context to past natural disaster events in the Addison County area.

[Profiling Hazards and Assessing Vulnerability](#) discusses the threat to the planning area and describes previous occurrences of hazard events and the likelihood of future occurrences and assesses the Town's total exposure to natural hazards, considering assets at risk, critical facilities, and future development trends.

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.

Based on historical, state and regional data, the planning team identified the top 10 natural hazards that threaten the planning area. The State of Vermont's Hazard Mitigation Plan also includes extreme temperatures and Nor'easters in its list of vulnerabilities. The planning team chose to not include these hazards because the risks associated with them were not considered significant by the committee. In the planning area, Nor'easters are extremely unlikely as the Green Mountains block storms coming up the northeastern coast of the US. Similarly, the risk for extreme temperatures in the area is also small due to the moderating effects of nearby Lake Champlain and the Champlain Valley.

#### Methodology

Using existing natural hazards data and input gained through planning meetings, the planning team agreed upon a list of natural hazards that posed threats to the Town of Middlebury. Hazards data from the Vermont Division of Emergency Management, the Vermont Agency of Natural Resources, the National Oceanic and Atmospheric Administration, and many other sources were examined to assess the significance of these hazards to the planning area. Significance was measured in general terms and focused on key criteria such as frequency and resulting damage, which includes deaths and injuries and property and economic damage. The natural hazards evaluated as part of this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future. During research efforts to identify hazards, the planning team studied past events that triggered federal,

state, and/or local disaster declarations within the planning area. Federal and state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Addison County received numerous major disaster declarations between 1973 and 2014 and 3 emergency declarations. Addison County's disaster declaration history is summarized in following map and table. Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

For each hazard, a description of the hazard and associated problems is provided along with details specific to the Town of Middlebury. Information on past occurrences and the extent or location of the hazard within or near the town and impacts, where known, are also discussed here. To assess the history of natural hazard events in Middlebury, the planning team evaluated the hazards history for both the town and county. Much of the existing data and statistics are maintained on a countywide basis; therefore, the planning team relied on Addison County data. The planning team and other local resources, such as newspaper articles, were used to refine the county data to more accurately indicate how hazards affected the town in the past. In general, information provided by planning team members is integrated into this section with information from other data sources, such as National Weather Service databases.

The following sections provide profiles of the natural hazards that the planning team identified in the Identifying Hazards section and assesses the Town's vulnerability to those hazards.

### Flooding and Fluvial Erosion

Flooding is the most common recurring hazard event in the State of Vermont. In recent years, flood intensity and severity appear to be increasing. It is highly likely that flooding will continue in both the short-term and long-term. There are three main types of flooding that occur in Vermont: flooding from rain or snowmelt, flash flooding, and urban flooding. Flooding has also been known

to occur as a result of ice jams in rivers adjoining developed towns and cities. Flood damages are associated with inundation and fluvial erosion hazards (FEH). Data indicate that greater than 75 percent of flood damages in Vermont, measured in dollars, are associated with fluvial erosion. These events may result in widespread damage in major rivers' floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private dams, and beaver dams. Within Middlebury, the two most significant bodies of water that are subject to flooding are the Middlebury River and Otter Creek. Due to historic patterns of development, erosion issues are generally limited to erosive actions of high water on riverbanks. The historic settlement of East Middlebury on the Middlebury River and some locations along Otter Creek are most at risk for erosion associated with river channel movements.

The most significant erosion events in recent memory occurred in 2008 and 2011. Two successive events in June and August of 2008 required the complete replacement of the "Lower Plains Bridge" in East Middlebury due to failure of abutments due to fluvial erosion. In addition, the retaining wall near the abutments of the "Grist Mill Bridge" was also undermined. In 2011, the erosive actions of flooding down the

Flood Date	Property Damage
1927	\$14,400
1938	unknown
1947	\$3,100
1976	\$48,000
1989	\$50,000
1998	\$113,300
2008	\$1,217,000
2011	\$70,000

Table 2. Significant Flood Events in Middlebury.

Hazard	Location	Extent	Probability	Estimated Loss	Vulnerability
Flooding and Fluvial Erosion	Areas adjacent to the Middlebury River and Otter Creek	2,817 acres	Occasionally	Moderate	Yes

Table 3. Flooding and Fluvial Erosion Vulnerability Assessment

Creek from Tropical Storm Irene caused the Middlebury River to erode sections of its bank and change its route to flow down through the village itself. This event also caused additional undermining of the “Grist Mill Bridge” retaining wall. Creek Road continues to lose ground to an ever changing river but these bank failures are not attributable to any particular events. No records of number of acres lost to fluvial erosion have been found. Historically, industrial structures were built close to the banks of the river to take advantage of water power. The Marbleworks area in the center of town was, at one point, almost entirely powered by water through direct mechanical means and later through electric generating stations located up and down the Creek.

The village of East Middlebury was built in its current location on an alluvial fan of the Middlebury River due to the readily available access to water power. At one point there were 4 impoundments serving small scale industry in this area. High flow events had great impact to these local industries as flood waters eroded river-banks and damaged footings for buildings located too close to the bank. Portions of these areas were severely damaged due to flooding events in 1830, 1913, 1927, 1938 and 2011. Photographs showing the extent of damages following the 1927, 1938 and 2011 flooding and erosion events indicate the wholesale relocation of the Middlebury River onto State Route 125. These events resulted in major flooding throughout the Village of East Middlebury as well as destruction of most of the transportation infrastructure.

Phase 2 & 3 Stream Geomorphic Assessments on the Middlebury River show evidence of extensive channelization, bank armoring and gravel extraction that have been historically used to attempt to control the rivers. Current wisdom indicates that these attempts to control the river are temporary at best and tend to provide a false sense of security to those who would develop in these “protected” areas. In the worst case, these same measures tend to destabilize the river so that its energy is then diverted to other unprotected locations further downstream causing an increased risk there. Much of the erosion susceptible property along Otter Creek and its floodplain is currently in agricultural use and is not currently at risk. Future development along the Creek is severely limited due to a town-wide no-build protection provided by adopted floodplain zoning. Properties at risk include a few homes developed prior to current zoning on Creek Road along Otter Creek where the river bank has been extensively armored in an attempt to stabilize an unstable reach of the river.

There are currently 31 policies insured under the National Flood Insurance Program and total coverage is \$6,656,100 with no repetitive loss structures. Since 1978 there have been 5 total claims for a total payment of \$6,125.

Based on the results of overlaying the Fluvial Erosion Hazard Zone with the location of the E911 points, there is one multi-family residential, eight single-family residential, one commercial, one fire hydrant and one 'other' unit in the town that are mapped as vulnerable to potential erosion hazards. The estimated loss for damage to these properties (buildings only) is up to \$1,307,300. This represents 0.13% of the grand list.

#### Severe Thunderstorm and Lightning

Severe thunderstorms are capable of producing high winds (including down-drafts), large hail, lightning, flooding, rains, and tornadoes. Thunderstorm winds are generally short in duration, involving straight-line winds and/or gusts in excess of 50 mph. Thunderstorm winds tend to affect areas of Vermont with significant tree stands as well as areas with exposed property and infrastructure and aboveground utilities. Thunderstorm winds can cause power outages,

Thunderstorm Date	Property Damage
6/6/2005	\$98,200
7/24/2003	\$61,900

Table 4. Thunderstorms Causing More than \$20,000 in Damage since 2003.

Hazard	Location	Area Impacted	Probability	Estimated Loss	Vulnerability
Severe Thunderstorm and Lightning	Approximately 1 Structure Per Year	isolated Locations	Highly Likely	Minor	No

Table 5. Severe Thunderstorm and Lightning Vulnerability Assessment



transportation and economic disruptions, and significant property damage, and pose a high risk of injuries and loss of life. Microbursts and macrobursts are downdrafts that move outward from the base of a thunderstorm and can reach speeds in excess of 80 mph. Microbursts (the smaller of the two in terms of area affected) pose an extreme threat to aircraft. The downward wind can exceed the lift component of an aircraft, making it impossible to maintain altitude, which for low flying aircraft (especially during takeoff and landing) is extremely dangerous.

Thunderstorms range in size and type. An ordinary cell thunderstorm consists of one cell with an updraft and downdraft and produce strong winds, rain, lightning, and even hailstones. Multicell cluster thunderstorms consist of several ordinary cell thunderstorms in the vicinity of each other. Multicell cluster thunderstorms are extremely prone to causing flash flooding. Squall line thunderstorms move in a line or front that can exceed 100 miles in length, with the strongest rains and winds at the front of the storm. Supercell thunderstorms are the largest, longest lasting, and most devastating thunderstorms. Nearly all tornadoes are formed from supercell thunderstorms. Supercell thunderstorms can also form hailstones larger than golf balls. These supercell storms have clockwise rotating winds that exacerbate the storm. Lightning, hail, flash flooding, and tornadoes are all associated with this type of thunderstorm.

The following table represents extreme thunderstorms in Addison County since 2003. Severe storms which include lightning along with wind and rain events are a common occurrence in Addison County during summer months. Lightning strikes routinely cause fires to trees along ridge tops and less commonly start fires in structures. Fires associated with lightning strikes to inhabited buildings occur fewer than once every five years on average. More common is loss of power and damage to electronic equipment in homes where there has been a

Hazard	Location	# impacted	Probability	Estimated Loss	Vulnerability
Wildfire	Areas Where Houses Are Built in the Forest	932	Likely	Minor	No

Table 6. Wildfire Vulnerability Assessment



proximity strike. Anecdotally, there are multiple reports each year of electronic equipment unprotected by surge suppressors which are damaged by lightning strikes. Generally, these homeowners file insurance claims for damages and total annual damages in the entire community likely do not exceed \$10,000. The NCDC reports 16 thunderstorms and one lightning storm of note occurring in Middlebury since 1993.

Power outages that result from these types of storm events are not uncommon in Middlebury. Their occurrence is inconvenient to residents but typically short-lived. Mitigation activities over the years by power companies have re-routed many remote power lines onto town highway ROW for improved performance. Increased pruning activities along ROW have also reduced impacts from major storm events. Generally the extent of damages due to these hazards are limited to wind damage to structures and/or power lines and electrical spikes which fry delicate electronics. The worst-case damages would include isolated structural damage (roof damage) coupled with extended power outages and lightning damage to the electronic controls for the towns utilities.

### Wildfire

A wildfire is the uncontrolled burning of woodlands, brush, or grasslands. According to FEMA, there are four categories of wildfires that can occur throughout the United States:

Wildfires: Fueled by natural vegetation; typically occur in national forests and parks, where federal agencies are responsible for fire management and suppression

Interface or Intermix Fires: Urban wildfires in which vegetation and the built environment provide fuel

Firestorms: Events of such an extreme intensity that effective suppression is virtually impossible; occur during extreme weather and generally burn until conditions change or the available fuel is exhausted

Prescribed Fires and Prescribed Natural Fires: Fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes

Wildfires can be a result of naturally occurring influences such as lightning, extreme drought and heat, and human influences such as a discarded cigarette butt, improperly extinguished campfire, or a stray spark from nearby railroad tracks. The potential for threat of wildfires is dependent upon topography and

slope, surface fuel characteristics, recent climate conditions, current meteorological conditions, and fire behavior. Once a wildfire threatens a community, it is often too late to protect nearby structures, and populations have to be evacuated for their own safety. These fires have damaged structures and utilities as well as hundreds of acres of woodlands.

In spite of an active agricultural base, much of the Town of Middlebury is forested. Consequently, many structures in the town would fall within an urban/wildfire interface. This increased risk for forest fire due to proximity is moderated by the so-called "Teflon Forest" conditions of the Northeastern US. While moisture levels generally tend to be higher than in the fire-plagued western forests, scattered periods of drought can increase fire danger levels to "Extreme" particularly during spring and fall seasons when dry leaves cover much of the forest floor.

In addition, springtime burning of open fields has been a longstanding historic practice thought to improve field fertility. Every year, a few of these fires get out of control and threaten houses and outbuildings. Records of wildfire sizes are rarely kept by the local fire department. Statewide, the worst fires have been: 1000 acres in Groton in 1883, 1900 acres in Duxbury in 1903, and also in 1903 a fire consumed 1200 acres. Locally, the worst fire in recent memory occurred in nearby Cornwall which had a controlled burn get out of control in March of 2012. This fire consumed approximately 150 acres but no property damage was recorded.

Within the past 50 years, forests have been closed to recreation state-wide 3 times due to extreme fire conditions. While these incidents have not resulted in large-scale damage in the Town of Middlebury, the conditions existed for widespread forest fires. In addition, an unusually dry spring will often result in a no-burn proclamation most recently seen in 2009.

Increased development within the urban/wildfire interface continues throughout the state and Middlebury has not escaped that trend. Middlebury currently hosts 932 residences located within the urban/wildfire interface. The extent of an uncontrolled fire which covered the forested areas of Middlebury would be the loss of several homes and outbuildings. Similarly, out-of-control grass fires

could threaten farm outbuildings and homes, especially where former farmland has been subdivided into multiple larger lots, with each housing a residence. It is becoming increasingly important that residences and essential facilities be constructed with an eye toward wildfire resistance by establishing a no-burn zone around structures and by providing suitable water supplies for fire fighting to more remote residences.

### Severe Winter Storm

Severe winter storms bring the threat of heavy accumulations of snow, cold/wind chills, strong winds, and power outages that result in high rates of damage and even higher rates of expenditures.

A heavy accumulation of snow, especially when accompanied by high winds, causes drifting snow and very low visibility. Sidewalks, streets, and highways can become extremely hazardous to pedestrians and motorists. Severe winter storms develop through the combination of multiple meteorological factors. In Vermont and the northeastern United States, these factors include the moisture content of the air, direction of airflow, collision of warm air masses coming up from the Gulf Coast, and cold air moving southward from the Arctic.

Severe winter storm alerts are communicated using terminology listed in the table below.

Winter Storm Watch	Snowstorm conditions are possible in the specified area, usually within 36 hours.
Winter Storm Warning	Snowstorm conditions are expected in the specified area, usually within 24 hours.
Blizzard Warning	Sustained winds or gusts of 35 mph occurring in combination with considerable falling/blowing snow for a period of at least three hours are expected.
Heavy Snow Warning	Snow accumulations are expected to approach or exceed 6 inches in 12 hours.

Table 7. Winter Storm and Blizzard Alert Terminology.

Terminology related to snowfall and other frozen precipitation is provided in the subsequent table below.

Term	Definition
Snowstorm	A storm with heavy snow
Blizzard	A severe snowstorm with cold temperatures, winds at or above 35 mph, and low visibility (less than ¼ mile)
Heavy Snow	Seven inches or more of snow falling within a 24-hour period
Winter Storm	Heavy snow with sleet and/or freezing rain
Blowing Snow	Wind driven snow that reduces visibility to six miles or less causing significant drifting

Table continued on next page

Drifting Snow	Uneven distribution of snowfall caused by strong surface winds
Flurries	Light snow falling for short durations
Freeze	Occurs when the surface air temperatures is expected to be 32 F or below over a widespread area for a significant period of time
Snow Showers	Snow falling at varying intensities for brief periods of time

Table 8. Snowfall and Other Frozen Precipitation Terminology

The National Weather Service uses the Northeast Snowfall Impact Scale (NE-SIS) to categorize the severity of a snowstorm based on the amount of snowfall and the population at risk. The NESIS provides a numerical measurement of the snowstorm's potential socioeconomic impact compared with past storms and assigns each large storm into one of the five categories.

Category	NESIS Value	Description
1	1-2.499	Notable
2	2.5-3.99	Significant
3	4-5.99	Major
4	6-9.99	Crippling
5	10+	Extreme

Table 9. NESIS Definition of Snowstorms

With the almost annual occurrence of a significant snow or ice storm, the Town of Middlebury feels the impact of a winter storm most on the infrastructure of the community.

The Town is able to keep the roads open and treated for most storms and rarely has lost the ability to keep up with a winter storm due to the Town's high preparedness level and ongoing mitigation actions. Fortunately, the regular occurrence of winter storms also causes most residents to maintain a high level of preparedness for winter storm

In 1998 the worst ice storm on record hit much of northern Vermont and the Town of Middlebury was not spared. Three quarters of an inch of ice toppled trees onto power lines and the resultant power outages continued for several days as remote power lines were accessed by off-road vehicles.

The worst snowfalls on record accumulated 24" of snow in a single storm. These occurred March 11-14 of 1888 and February 14th 2007. This last storm, known as the Valentine's Day Blizzard. This "Valentines' Day Blizzard" stressed the resources of most local communities, including the Town of Middlebury, to capacity.

In March of 2001, the so-called “Town Meeting Day” snow event caused reduced ability for residents to travel to the voting booth due to hazardous conditions. Some of the additional costs of keeping roads open on voting day were reimbursed through State and Federal assistance.

As population growth and housing expands along remote road corridors, increasing dependency on local roads by the new homeowners requires changes in winter maintenance. The town has, thus far, been able to keep up with those increased demands on its services through additional hires and equipment purchases.

The following table illustrates significant winter events in Addison County and the costs associated with those events.

Winter Storm Date	Property Damage
1/4/2003	\$49,500
12/6/2003	\$49,500
12/15/2003	\$61,900
1/2/2005	\$32,300
2/10/2005	\$46,200
10/25/2005	\$115,500
2/25/2006	\$28,200
2/14/2007	\$237,100
12/11/2008	\$45,000
2/23/2010	\$130,000

Table 10. Significant Winter Storm Events in Addison County 2003-2010.

Hazard	Location	Extent	Probability	Estimated Loss	Vulnerability
Severe Winter Storm	Whole Town	25,403 acres	Highly Likely	2,956 structures	No

Table 11. Severe Winter Storm Vulnerability Assessment

## Earthquake

According to the USGS, an earthquake occurs when two blocks of the Earth suddenly slip past one another. The surface where they slip is called the fault or fault plane. The location below the Earth’s surface where the earthquake starts is called the hypocenter, and the location directly above it on the surface of the Earth is called the epicenter.

The magnitude of an earthquake is represented by a rating on the 'Richter scale'. The Richter scale was introduced in 1935, by Charles F. Richter as a base-10 logarithmic scale, which determines magnitude as the logarithm of the amplitude of the seismic waves on a seismograph. It ranges from -1 to 10 with 8 and above considered “Great”. A 4.1 is considered “Minor”.

Earthquakes in the northeastern United States generally have deep foci ( $> 10$  km) and are considered to be intraplate. The deep faults along which these earthquakes occur are not expressed on the ground surface. Although there are numerous faults exposed at the ground surface in the northeastern United States, there is no evidence for significant motion along these faults (e.g., Jacob, 1991; Ebel and Kafka, 1991).

Vermont is classified as an area with low to moderate seismic activity. Sixty-three known or possible earthquakes have been centered in Vermont since 1843 (Ebel, et. al. 1995). The two strongest recorded earthquakes measured in Vermont were of a magnitude 4.1 on the Richter scale. One was centered in Swanton and occurred on July 6, 1943, and the second occurred in 1962 in Middlebury. The 1962 earthquake was felt throughout New England and resulted in broken windows and cracked plaster, while the Swanton earthquake caused little damage.

Earthquakes centered outside the state have also occasionally been felt in Vermont. Twin quakes of 5.5 occurred in New Hampshire in 1940. In 1988, an earthquake with a magnitude 6.2 on the Richter scale took place in Saguenay, Quebec and caused shaking in the northern two thirds of Vermont (Ebel, et al 1995).

In May 2001 and again in the summer of 2010, earthquakes in the 5.0-5.5 range have been felt in New Haven, VT with epicenters in New York and Quebec respectively.

Based on information provided by the Vermont Geological Survey, Department of Environmental Conservation, Agency of Natural Resources, HAZUS outputs for the region are summarized as follows: The Middlebury Once-in-500 year earthquake (5.7 magnitude) could cause significant damage in Addison County. The Goodnow, NY Once-in-500 year earthquake (6.6 magnitude) could cause shaking just above the lower limit for building damage. The Montreal, Quebec (6.8 magnitude) and the Tamworth, NH (6.2 magnitude) Once-in-500 year earthquakes probably would not cause damage in Addison County. Only the loss data from the Middlebury and Goodnow events are shown below:

#### Middlebury Scenario:

Building damage – HAZUS estimates that over 1600 buildings will receive at least moderate damage. This is a little more than 13% of the total number of buildings in the county. HAZUS also estimates that all essential facilities (hospital, schools, police stations and fire stations will receive at least moderate damage.

Transportation & utility systems – HAZUS estimates minimal disruption of the transportation and utility systems. However, over 9000 households in the region are expected to be without electrical power for up to three days.

Casualties – Minimal casualties are also expected with less than twenty-five requiring medical attention and less than three needing hospitalization in the region.

Economic loss – Direct building losses were estimated at > \$83 million and business interruption losses are expected to be as much as \$105 million in 2005 dollars. HAZUS estimates that although there was minimal damage to the transportation system the loss would still be close to \$15 million. Approximately \$4.4 million would be needed to repair damaged communications systems.

Goodnow Scenario:

Building damage – HAZUS estimates that over 600 buildings will receive at least moderate damage. This is a little more than 5% of the total number of buildings in the county. HAZUS also estimate that all essential facilities (hospital, schools, police stations and fire stations will receive at least moderate damage. Transportation & utility systems – HAZUS estimates minimal disruption of the transportation and utility systems. However, over 4000 households are expected to be without electrical power for up to three days in the region.

Casualties – Minimal casualties are also expected with less than six requiring medical attention and only one needing hospitalization.

Economic loss – Direct building losses are estimated at > \$17 million and business interruption losses are expected to be as much as \$24 million. HAZUS estimates that although there was minimal damage to the transportation system the loss would still be close to \$3.6 million. Approximately \$0.9 million would be needed to repair damaged communications systems.

Hazard	Location	Extent	Probability	Estimated Loss	Vulnerability
Earthquake	Whole Town	25,403 acres	Occasionally	2,956 structures	No

Table 12. Earthquake Vulnerability Assessment

## Drought

Drought is defined as a water shortage with reference to a specified need for water in a conceptual supply and demand relationship. It is a complex phenomenon that is difficult to monitor and assess because it develops slowly and covers extensive areas, as opposed to other disasters that have rapid onsets and obvious destruction. Also unlike most disasters, the effects of drought can linger long after the drought has ended. It is an inherent, cyclical component of natural climatic variability and can occur at any place at any time. It is difficult to determine the onset, duration, intensity, and severity of a drought, all of which affect the consequences and mitigation techniques. High winds, low humidity, and extreme temperatures can all amplify the severity of the drought.

There are four types of drought: meteorological, agricultural, hydrological, and socioeconomic.

Meteorological drought is defined as a reduction in rainfall from a normal precipitation pattern in regard to the amount, intensity, or timing of the event as well changes in the temperature, humidity, and wind patterns. The strict threshold differs for every nation; the United States defines meteorological drought as receiving less than 2.5 mm of rainfall in 48 hours. Meteorological drought is the first drought stage detected.

Agricultural drought is defined by deficient moisture conditions that cause a lasting effect on crops and non-natural vegetation. It is dependent on rainfall, temperature, topography, evapotranspiration, permeability, and porosity of soils, precipitation effectiveness, and vegetative demand. Agricultural drought begins when the available soil moisture supports the actual evapotranspiration rate at only a fraction of the potential evapotranspiration rate.

Hydrological drought is related to the effects of decreased precipitation on surface or subsurface water supply. It is the last stage of drought and is lagged behind meteorological and agricultural drought because water infiltrates down to the groundwater during the latter portion of the hydrological cycle. Subsurface water supply is the last drought component to return to normal when meteorological conditions and aquifer recharge return.

Socioeconomic drought is what happens when the consequences of the drought start to affect the socioeconomic sector. It occurs when the demand for an economic good is greater than the available supply due to weather-related drought. Examples of such goods include water, hydroelectric power, food grains, meat, dairy, and much more. Socioeconomic drought affects the associated population both individually and collectively.



Drought Severity	Return Period (years)	Description of Possible Impacts	Standardized Precipitation Index (SPI)	NDMC Drought Category	Palmer Drought Index
Minor Drought	3 to 4	Going into drought; short-term dryness slowing growth of crops or pastures; fire risk above average, Coming out of drought; some lingering water deficits; pastures or crops not fully recovered	-0.5 to -0.7	D0	-1.0 to -1.9
Moderate Drought	5 to 9	Some damage to crops or pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing, voluntary water use restrictions	-0.8 to -1.2	D1	-2.0 to -2.9
Severe Drought	10 to 17	Crop or pasture losses likely; fire risk very high; water shortages; water restrictions imposed	-1.3 to -1.5	D2	-3.0 to -3.9
Extreme Drought	18 to 43	Major crop and pasture losses; extreme fire danger; widespread water shortages or restrictions	-1.6 to -1.9	D3	-4.0 to -4.9
Exceptional Drought	44+	Exceptional and widespread crop and pasture losses; exceptional fire risk; shortages of water in reservoirs, streams and wells creating water emergencies	less than -2	D4	-5.0 or less

Table 13. Drought Measurement Matrix

The severity of a drought depends on the duration, intensity, and geographic extent of the water shortage as well as the demands on the area's water supply. The USDA rates droughts from D0–D4, depending on the severity of the drought, the amount of time it will take for vegetation to return to normal levels, and the possible effects of the drought on vegetation and water supply. Local knowledge indicates there are occasional dry spells that are considered severe once every 10 years on the average. Generally, risks associated with these droughts include drying up of shallow wells and reduced productivity or failure of agricultural crops.

An extended drought period in the 1960s saw the development of several community-owned water systems in communities along Lake Champlain. Most recently a dry period in 2000 saw a few Addison County residents without water for several weeks which was finally relieved by fall rains.

Hazard	Location	Extent	Probability	Estimated Loss	Vulnerability
Drought	Residences Served by Private Wells and Farms	Outside Village Centers	Occasionally	400 Private Wells	No

Table 14. Drought Vulnerability Assessment

Fortunately, the Town of Middlebury and the East Middlebury Fire District #1 supply the majority of residents with potable water through deep wells supplied by a large aquifer along the Green Mountains generally east of Route 116 on the east side of Town. These supplies were not affected during the 1960 or 2000 droughts. A major drought, however could eventually impact these aquifers and challenge the water supply systems for the entire community. A drought of this extent would limit local agricultural production as well as impact residential household use. Water use restrictions and over-drilling of existing wells would also be needed to weather a drought of this magnitude.

Water for the Town of Middlebury distribution system is provided by 3 wells, a principal supply at Palmer Springs on Route 116 (Well #2), and two auxiliary wells (#3 and #4) on a separate site located to the north off Route 116. The East Middlebury Fire District #1 distribution system is supplied by a primary well located off Ossie Rd and supplemented by springs on Sand Hill and a well on Route 125 / Route 116. Both systems have a reservoir that provide a 1-2 day supply.

In the entire Town of Middlebury jurisdiction, an estimated 400 homes, farms and businesses are served by individual private wells or springs, not through the Middlebury or East Middlebury public water systems. Direct costs of drought conditions borne by individuals are difficult to track accurately. No direct costs to the Town have been recorded in the past 25 years.

Tornado and High Winds

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of 1 mile wide and 50 miles long. Tornado season in Vermont runs ordinarily from March through August; however, tornadoes can strike at any time of the year if the essential conditions are present.

High winds come in many forms in Addison County and are included in damages associated with Hurricane/Tropical Storm, Tornado and Hail Storms. In addition to these specific events, high winds are often associated with collisions of major weather fronts when high pressure and low pressure systems create extreme gradients between them. Locally developing thunderstorms due to convective forces in the at-

Hazard	Location	Extent	Area of high-est risk	Estimated Loss	Vulnerability
Tornado and High Wind	Base of Green Mtns. and Route 116	1,674 acres	Likely	221 Private Homes / Structures	No

Table 15. Tornado and High Winds Vulnerability Assessment

mosphere can also generate high winds, such as those experienced in parts of eastern Vermont on July 6, 1999, downing hundreds of large trees in 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. In fact, 34 tornadoes were recorded in the State between 1950 and 1999, injuring 10 people and causing over \$8.4 million dollars in estimated property damage. Since 1950, no tornadoes have been recorded in Middlebury though unconfirmed sightings have been reported in nearby Bridport and Cornwall.

Both straight-line and tornadic high wind events are possible in Middlebury. Fortunately, Vermont has never experienced a hurricane in its recorded history. However, remnants known as tropical storms have blown through the Champlain Valley causing greater damage due to flooding than high winds (see flooding). In both 2011 and 2012, winds as high as 60-80mph accompanied by hail up to 1" were felt in the region causing scattered damages in the form of dents on cars, damaged roofs and downed trees which, in turn caused scattered power outages. No records of greater damages than that were found in a review of high wind articles in the local paper. Nearly all of the recorded high wind events have occurred from May through August and most of these occurred in the afternoon.

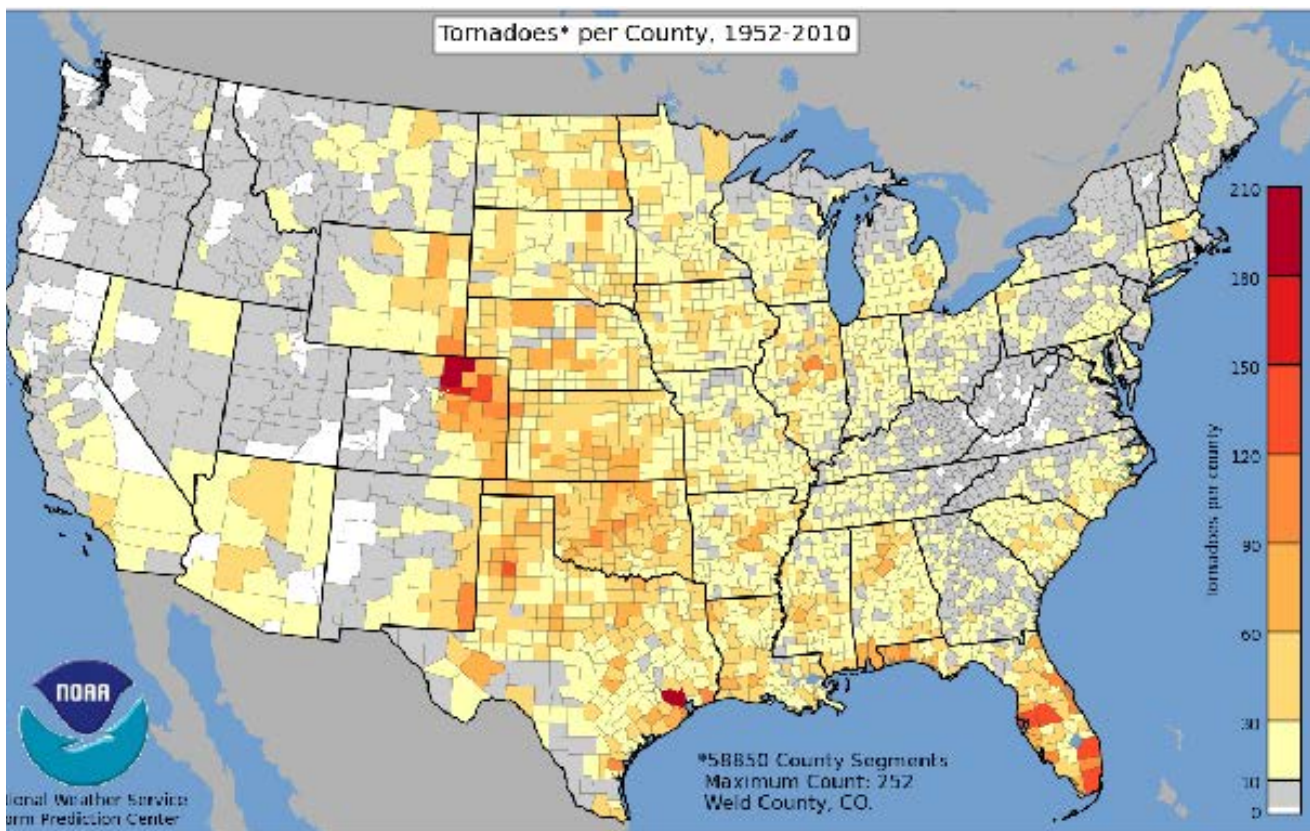


Figure 2. Tornado Distribution Across the United States by County, 1952-2010.

Hazard	Location	Extent	Probability	Estimated Loss	Vulnerability
Landslides	Select Areas Base of Green Mtns.	Isolated Locations	Occasionally	Negligible	No

Table 16. Landslides Vulnerability Assessment

### Landslide

The term "landslide" describes a wide variety of processes that result in the downward and outward movement of slope-forming materials including rock, soil, artificial fill, or a combination of these. The materials may move by falling, toppling, sliding, spreading, or flowing.

Vermont actually has a relatively high incidence of landslides, though this type of disaster rarely occurs. Landslides usually result from human-caused or natural changes to groundwater flow that cause pore pressure changes in bank materials or removal of vegetation and human-caused or natural undercutting of steep banks. Landslides can be triggered by one or a combination of factors, including fluvial erosion, soil saturation, natural geologic weathering processes such as the freezing and thawing of soils, human modification of the bank, increases in loading on top of the slope, surface or near surface drainage patterns, and loss of vegetation. Fluvial erosion, causing bed and bank erosion or associated with water flowing along the toe of the slope, removes bank material to over-steepen and potentially under-cut the slope.

The general make up of soils, bedrock and topography in the Town of Middlebury are generally not suited to extensive landslide risk with the exception of previously identified fluvial erosion hazards. No major landslides in the Town of Middlebury were found within the past 25 years. Review of historical records as far back as 1900 also show no recorded landslides, therefore, the extent of the landslide hazard in Middlebury can only be conjecture.

The general exception to this rule is in the transition area where the base of the Green Mountains meets the lake bed of the former Champlain Sea. At this transition there are deposits of gravel made by passing glaciers thousands of years ago. These gravel deposits have been extensively mined for construction materials either as aggregate fill in concrete products or as base for constructing roads. Fortunately, State statute now requires pits to be reclaimed prior to closure which includes the stabilization of all remaining cut banks through re-grading and vegetative plantings. In Middlebury, only one such residence was identified with these characteristics off Route 116. The residence sits far enough back from the cut edge of the gravel pit so it is not at risk of landslide/gravel bank collapse. The extent of possible damages in Middlebury due to landslide are generally limited to the loss of transportation infrastructure in the transition area due to roadbed collapse or more likely, blockage due to debris in the road.

### Ice Jams

The Northeast States Emergency Consortium states that ice jams occur when warm temperatures and heavy

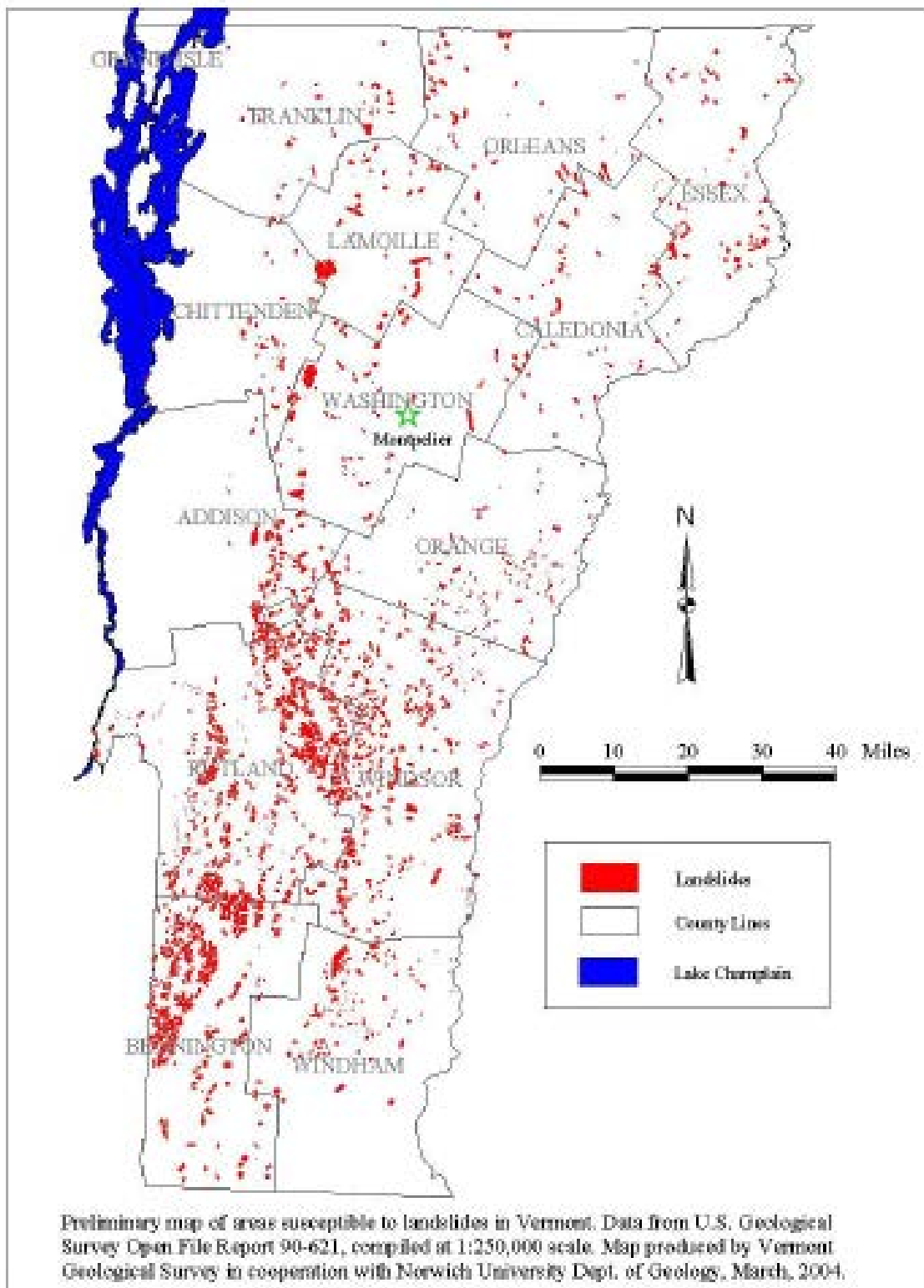


Figure 3. Areas Susceptible to Landslides in Vermont,  
Vermont Geological Survey, 2004.

rain cause snow to melt rapidly. Snowmelt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of the river. The ice layer often breaks into large chunks, which float downstream and often pile up near narrow passages or other obstructions, such as bridges and dams.

Ice jams include those that form in the early winter as ice formation begins (freeze-up jams); those that form as a result of the breakup of ice covers (breakup jams); and those that contain elements of both (combination jams). Ice events can include ice jams, ice jams that are not formally identified as such, the formation of an ice cover that raises water levels upstream or decreases water levels downstream, or any other result of ice formation, ice cover formation and progression, or ice cover breakup.

Ice jams are a generally common occurrence along Vermont’s rivers due to rapid thawing and/or rain runoff entering into frozen rivers. These frozen rivers rise and break up 12-18 inch deep plates of ice which, in their journey downstream, are prone to hanging up on shallow bars and causing a temporary and sudden damming effect. In Middlebury, the effects of Ice jams along the Otter Creek generally cause little or no damage to public and/or private properties. Ice jams along Otter Creek generally cause flooding into the extensive floodplain on either side of the creek.

Since these floodplains have never been developed due to almost annual flooding, large ice chunks floating in the flood waters end up being deposited on farm fields in the floodplain and melt away harmlessly. The exceptions to this natural mitigation in Middlebury are where Town roads and railroads have been built near the river banks in these floodplains. Creek Road is occasionally inundated during ice jams and subsequently needs to have chunks of ice removed after flood waters recede. Fortunately, the slow moving waters combined with frozen ground conditions result in a very low structural impact to the town highway. Damages are generally limited to the inconvenience of having to drive around the flooded areas and having limited access to the 2-3 homes located on high ground but accessed by floodplain driveways.

The Village of East Middlebury, on the other hand, is much more susceptible to damages when ice

Hazard	Location	Extent	Probability	Estimated Loss	Vulnerability
Dam Failure	Downstream Pulp Mill Bridge	failure could initiate collapse of downriver dams	Unlikely	Negligible	No

Table 18. Dam Failure Vulnerability Assessment



clogs the river channel. While the river occasionally gets blocked due to ice jams, these have generally occurred just east of route 7 and flooding has been limited to open floodplains south of Ossie Road. In mid January of 2014, a jam in the river caused minor flooding in this area but triggered a 24 hour watch by Middlebury Police and warning to area residents of the possibility of evacuation should the incident get any worse. Fortunately, as in most instances, the jam broke itself up before there was any flooding to homes or infrastructure in village areas. Dam Failure

A dam failure may occur for multiple reasons, such as an overtopping caused by floods that exceed the capacity of the dam, deliberate acts of sabotage, structural failure, movement of the foundation supporting

Hazard	Location	Extent	Probability	Estimated Loss	Vulnerability
Ice Jams	East Middlebury and Otter Creek Floodplain	Possible flooded residences and temporary closure of roads.	Unlikely	Minor	No

Table 17. Ice Jams Vulnerability Assessment

the dam, soil erosion in embankment dams, and inadequate maintenance and upkeep. Middlebury hosts a single run-of-the-river power dam located just downstream of the Pulp Mill Bridge. The 6-8 foot dam creates a head of water that is used to generate electric power during peak use times. Areas along Otter Creek below this dam have not been developed, primarily due to steep banks which formed a gorge-like valley prior to the construction of the Belden's Dam ½ mile downstream. The Pulp Mill Bridge Dam is not considered hazardous due to the extremely low impact which would be experienced downstream were this dam to fail.

Historical water power sources in East Middlebury powered local industry throughout the 18th and 19th centuries. The associated check dams failed years ago and were not rebuilt when electric power became the prevalent power source. Anecdotal tales of dams failing in the East Middlebury area were not documented for this plan but remnants of sluices and failed water control structures dot the landscape near the edge of the Middlebury River in this area and contribute somewhat to the course that water takes once flooding has started

No records have been found to document the extent of damage due to failure of historic check dams and there have been no other dam failures recorded in recent years. The primary damages from these failures would have been to the dam itself and loss of income at the associated mill. As was earlier indicated, if the one remaining dam in town were to fail, no structures would be put at risk and the elevated water levels would be easily absorbed by the Beldens Falls dam in nearby New Haven.

An estimate of the vulnerability of the Town to each identified hazard, in addition to the estimate of hazard risk, is provided in the following tables, Hazard Risk Assessment and Vulnerability Assessment. Risk Assess-

## Risk Assessment Table

Hazard	Probability	Warning Time	Geographic Extent	Potential Impact	Risk Score
Flooding and Fluvial Erosion	2	4	3	3	12
Severe Thunderstorm and Lightning	4	4	1	2	11
Wildfire	3	4	1	2	10
Severe Winter Storm	4	1	3	1	9
Earthquake	2	4	3	1	10
Drought	2	1	2	2	7
Tornado and High Wind	3	4	1	2	10
Landslide	2	4	1	1	8
Ice Jam	2	4	1	2	9
Dam Failure	1	2	1	1	5

Table 19. Risk Assessment Table.



ment is measured in general terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Together, this information portrays the impact, or vulnerability, of the hazards identified.

## Risk Assessment Table Guide

### Probability

1	Unlikely	< 1% in a given year
2	Occasionally	1-10% in a given year
3	Likely	> 10% but < 100% in a given year
4	Highly Likely	100% in a given year

### Warning Time

1	More than 12 hours
2	6 - 12 hours
3	3 - 6 hours
4	< 3 hours

### Geographic Extent

1	Isolated Locations	< 20% of population impacted
2	Community Wide	> 75% of population impacted
3	Region Wide	Complete community and surrounding communities impacted

### Potential Impact

1	Negligible	Isolated minor property damage, minor disruption to infrastructure
2	Minor	Isolated moderate to severe property damage, brief disruption to infrastructure
3	Moderate	Severe damages at neighborhood level, temporary closure of infrastructure
4	Major	Severe damages town-wide, temporary to long term closure of infrastructure

## Vulnerability Assessment Table Guide

### Vulnerability

Yes	Does the hazard present the threat of disaster?
No	Does the hazard present the threat of a routine emergency?

### Extent

1	Isolated Locations	< 20% of population impacted
2	Community Wide	> 75% of population impacted
3	Region Wide	Complete community and surrounding communities impacted

### Estimated Loss

1	Negligible	Isolated minor property damage, minor disruption to infrastructure
2	Minor	Isolated moderate to severe property damage, brief disruption to infrastructure
3	Moderate	Severe damages at neighborhood level, temporary closure of infrastructure
4	Major	Severe damages town-wide, temporary to long term closure of infrastructure

### Vulnerability Assessment Table

Hazard	Location	Area Impacted	Number/Type of Structures	Estimated Loss	Vulnerability
Flooding and Fluvial Erosion	Areas Adjacent to Middlebury River and Otter Creek	2,817 acres, Isolated Locations	47 Private Homes / Structures	Moderate	Yes
Severe Thunderstorm and Lightning		Isolated Locations		Minor	No
Wildfire	Areas Where Houses are Built in the Forest	932 acres, Isolated Locations	116 Private Homes / Structures	Minor	No
Severe Winter Storm	Whole Town	25,403 acres, Region Wide	2,956 Structures	Negligible	No
Earthquake	Whole Town	25,403 acres, Region Wide	2,956 Structures	Negligible	No
Drought	Residences Served by Private Wells and Farms	Outside Village Centers, Community Wide	Approximately 400 Private Wells	Minor	No
Tornado and High Wind	Base of Green Mtns. and Route 116	1,674 acres, Isolated Locations	221 Private Homes / Structures	Minor	No
Landslide	Select Areas Base of Green Mountains	Isolated Locations		Negligible	No
Ice Jam	East Middlebury and Otter Creek Floodplain	Isolated Locations		Minor	No
Dam Failure	Downstream Pulp Mill Bridge	Isolated Locations	Six dams, four considered active	Negligible	No

Table 20. Vulnerability Assessment Table

## Mitigation Strategy

### Introduction

Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and actions for the Town of Middlebury Hazard Mitigation Plan. In consideration of the previous chapters that included research and planning for hazard risk assessment, profiling and vulnerability, the planning team developed the following mitigation strategy:

- Communicate the hazard information collected and analyzed through this planning process as well as planning team success stories so that the community better understands what can happen where and what they themselves can do to be better prepared.
- Implement the action recommendations of this plan.
- Use existing rules, regulations, policies, and procedures already in existence.
- Monitor multi-objective management opportunities so that funding opportunities may be shared and broader constituent support may be garnered.

### Goals and Objectives

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Up to this point the planning team has organized resources, assessed natural hazards and risks, and documented the planning process. A profile of Middlebury's vulnerability to natural hazards resulted from this effort, which is documented in the preceding chapter. The resulting goals, objectives, and mitigation actions were developed based on this profile.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard for implementation, that is, implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that the goals are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Based upon the risk assessment review and goal setting process, the planning team developed the following goals with several objectives and associated mitigation measures. These goals and objectives provide the direction for reducing future natural hazard-related losses within the Town of Middlebury.

#### Goal 1: Increase Community Awareness of Middlebury's Vulnerability to Natural Hazards

Objective: Inform and educate the community about the types of hazards the Town of Middlebury is exposed to, where they occur, and recommended responses

#### Goal 2: Reduce Vulnerability of People, Property, and the Environment to Natural Hazards

Objective: Provide mechanisms to enhance life safety

Objective: Reduce impacts to critical facilities and services

Objective: Reduce impacts to existing buildings and infrastructure to the extent possible

Objective: Reduce impacts to future development and infrastructure to the extent possible

Objective: Reduce impacts to the town's natural and historic resources

Objective: Reduce impacts to public health

### Goal 3: Increase Interagency Capabilities and Coordination to Reduce the Impacts of Natural Hazards

Objective: Continue to collaborate and coordinate with other agencies on planning, projects, hazard response, and funding opportunities.

#### Prioritization Process

Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In order to identify and select mitigation measures to support the mitigation goals, each hazard identified in the Identifying Hazards section was evaluated. Once it was determined which hazards warranted the development of specific mitigation measures, the planning team analyzed a set of viable mitigation alternatives that would support identified goals and objectives. A facilitated discussion then took place to examine and analyze the alternatives. With an understanding of the alternatives, a brainstorming session was conducted to generate a list of preferred mitigation actions. Once the mitigation actions were identified, the planning team was provided with several decision-making tools, including FEMA's recommended prioritization criteria, STAPLEE sustainable disaster recovery criteria, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another.

STAPLEE stands for the following:

Social: Does the measure treat people fairly? (e.g., different groups, different generations)

Technical: Is the action technically feasible? Does it solve the problem?

Administrative: Are there adequate staffing, funding, and other capabilities to implement the project?

Political: Who are the stakeholders? Will there be adequate political and public support for the project?

Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal?

Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?

Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority. Other criteria used to assist in evaluating the benefit-cost of a mitigation action includes:

Does the action address hazards or areas with the highest risk?

Does the action protect lives?

Does the action protect infrastructure, community assets or critical facilities?

Does the action meet multiple objectives (Multiple Objective Management)?

What will the action cost?

What is the timing of available funding?

With these criteria in mind, team members were asked to prioritize projects. This process offered an opportunity to review ongoing mitigation actions and provided both consensus and priority for future mitigation actions. During the process, emphasis was placed on the importance of a benefit-cost review in determining project priority; however, this was not a quantitative analysis. The following sections identify [Ongoing Actions](#) and [Future Actions](#).

## Ongoing Actions/ Ability to Expand

### Flooding and Fluvial Erosion

Flooding and erosion are the highest risk in town with the highest vulnerability. Over the years extensive mitigation activities have been deployed to protect the town's residents and infrastructure from the risks associated with flooding and erosion.

Ongoing and/or Past Practices:

- Where Creek Road travels parallel to Otter Creek, the river banks have been

heavily armored and also across the channel where the railroad passes.

- Structures along Otter Creek in the downtown area have been built to create a solid concrete chute which, in former times, directed river water into various industrial turbines and wheels.
- The benefit of building alongside a natural waterfall has also served the downtown well as flood waters do not tend to back up into residential areas but instead, drop over the falls into areas of gradient sufficient to carry them away from the built environment.
- The Village of East Middlebury, which was built on an unstable alluvial fan, has historically required considerable effort to keep flood waters from damaging developed infrastructure. Check dams were replaced regularly due to washouts until water power was no longer used. Efforts to stabilize an inherently unstable river in this area has resulted in a collective mixture of riverbank armoring, concrete floodwalls and earthen berms to try to keep the river within a narrow channel as it passes through the village. These manmade structures require ongoing maintenance to continue to protect the built environment of the village.
- In less developed areas susceptible to flooding and erosion, efforts have been made by local conservation organizations to purchase easements in floodplains and to conduct soil stabilizing plantings along river banks.
- The Town has also been proactive in flood mitigation through its membership in the NFIP including the adoption of regulations that prohibit much development in identified floodplains.
- Adoption of Fluvial Erosion Hazard Zoning by the town in 2008 brought these identified erosion hazard areas under much of the same development restrictions as had previously protected only identified floodplains. These FEH zones extend to stream banks and riverbanks throughout town.
- The Town created a conservation fund which is funded via town taxation and is available to be used for conservation purposes which can include purchase of development rights in flood and erosion-prone areas.
- In 2013, as part of a mitigation grant, the Town contracted the firm of Malone and MacBroom to research and make recommendations for long term flood protection in the East Middlebury village area. The intent was to come up with a long term solution which would take into account both the protection



of the built environment and the need for the unstable river to continue its ongoing lateral movement and occasional flooding.

- Adoption of recommended codes and standards for maintenance of town highways including prescriptions for ditching, culvert sizing, construction of new facilities, and surface maintenance to make town roads more resistant to flooding and the erosive actions of high level water runoff. Ability to expand:
- Fine tuning of Fluvial Erosion zoning by the planning commission can allow lower future risk as new structures are not added to vulnerable sites and vulnerable structures are removed.
- Continued financial support for the conservation fund by the voters can continue to allow protection of beneficial floodplain through additional purchases of development rights in sensitive areas.
- Implementation of mitigation plans as identified in the Malone & McBroom in East Middlebury with HMGP funding should reduce flooding in this area.
- Fine tuning of flood zoning bylaws and exploration of CRS by the planning commission can lead to greater insurance benefits for residents as well as potentially lowering risk in flood-prone areas.

Ability to expand:

- Fine tuning of Fluvial Erosion zoning by the planning commission can allow lower future risk as new structures are not added to vulnerable sites and vulnerable structures are removed.
- Continued financial support for the conservation fund by the voters can continue to allow protection of beneficial floodplain through additional purchases of development rights in sensitive areas.
- Implementation of mitigation plans as identified in the Malone & McBroom in East Middlebury with HMGP funding should reduce flooding in this area.
- Fine tuning of flood zoning bylaws and exploration of CRS by the planning commission can lead to greater insurance benefits for residents as well as potentially lowering risk in flood-prone areas.

### Severe Thunderstorm and Lightning

As described in the previous chapters associated with hazard risk and profiling, severe thunderstorms are known to produce strong winds and lightning which can result in power failure. The likelihood of a widespread power failure has been partially mitigated in recent years due to the following actions by ISO New

England and Green Mountain Power and by other local measures.

Ongoing Practices:

- In 2007, the Northwest Reliability Project was completed by VELCO, the state's transmission utility. This added a 345kw line to existing major grid lines coming out of Rutland County. Though some found it unnecessary, the overall redundancy of the grid in Addison County was likely improved by this action.
- In the late 2000's, Green Mountain Power purchased a series of hydroelectric dams along Otter Creek from OMYA, a private corporation. This locally produced power allows for emergency generation of locally produced power.
- In 2013, Green Mountain Power purchased the assets of CVPS to create a single supplier to the Addison Region, consolidating ownerships and making available the linking of the two power company's delivery systems.
- Since the ice storm of 1998, Green Mountain Power and CVPS have regularly cut dead and dying trees along their distribution system as well as stepped up overall vegetation management activities under their lines. In addition, many older lines have been re-routed along town roads to support a more immediate response in the event of damaged power lines.
- Also since the 1998 ice storm, many local residents purchased and installed back-up generators in their homes. The Town of Middlebury at that time, received grant funds to install a generator large enough to power the town offices and gym which serves as a regional shelter.
- Protecting valuable town electronics through use of surge suppressors
- Equipping and training the Middlebury Fire Department to be able to respond effectively to lightning strike-caused fires.
- Some town buildings are appropriately outfitted with Lightning Rods otherwise known as Air Terminals.
- Adoption of recommended codes and standards for maintenance of town highways including prescriptions for ditching, culvert sizing, construction of new facilities, and surface maintenance to make town roads more resistant to flooding and the erosive actions of high level water runoff.
- An active tree warden and proactive removal of at-risk street trees will support the above on-going power reliability efforts.

#### Ability to Expand:

Financial support for ongoing road and bridge improvement projects will allow lessening of future risk to the transportation infrastructure.

#### Wildfire

The Town of Middlebury currently mitigates the effects of wildfire through the following:

##### Ongoing Practices:

- Equipping and training the Middlebury Fire Department to be able to effectively respond to wildfire incidents.
- Supporting the efforts of the local Forest Fire Warden in requiring outdoor burn permits and in enforcing no-burn recommendations by the State Dept of Forests and Parks.
- Requiring adherence to Section 575 of the subdivision regulations for all new subdivisions as they relate to fire protection facilities (water storage, hydrants, emergency vehicle access).
- Supporting reduction of tree/powerline interface as identified under power outage mitigation.

#### Ability to Expand:

- The Planning Commission could fine tune zoning to require minimal fire protection zones for all housing located within forested and/or open fields.

#### Severe Winter Storm

The Town of Middlebury currently mitigates the effects of severe winter storms through the following actions:

##### Ongoing practices:

- Purchase of all new highway equipment with winter storm activities in mind.
- Subcontracting snow removal for critical facilities such as Police Department and Sewage Treatment Plant for implementation when town crews need to be available for highway plowing duties.
- Supporting power outage mitigation by Green Mountain Power through vegetation maintenance where trees and power lines can come in contact under heavy ice load.
- The town pre-purchases sand and salt in anticipation of use during the winter months.
- Requiring that all driveway access to town roads are built with snow clear-

ing and line-of-sight considerations in mind.

- Carbon monoxide warnings are sent out to the public when snow depth accumulations approach normal vent heights.
- Providing space for use as warming shelters for residents without power or heat due to storms.

Ability to Expand:

- The Town could adopt snow load standards in its zoning for all new construction.

### Earthquake

Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard. Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard.

Ability to expand:

- The addition of building codes which require earthquake proofing for all new construction is an example of an ability to expand on current practices which is neither cost effective nor a recommended action for this hazard.
- The town could support earthquake awareness through its website and/or newsletters.

### Drought

Most homeowners with shallow wells have learned to live with the inconvenience of dry spells by purchasing bottled water and using public toilets and laundries for the short periods they would be without a dependable water supply. When the inconvenience has become too much, many of these homeowners have mitigated the problem by drilling deep wells. Increasingly, home mortgages are requiring a dependable deep well water supply as a condition of a loan.

Agricultural activities highly dependent on water such as fruit and vegetable crops can be severely impacted by lack of rain. Most of these businesses have mitigated the effects of periodic droughts by providing irrigation systems. Other farms, dependent on crops to feed livestock rather than humans, are highly impacted by low water supplies and may be dependent on a USDA disaster

declaration to find relief.

Ability to expand:

- Water service could be expanded to all areas of town however there is not currently the financial support for such an expansion.

#### Tornado and High Wind

Based on factors of probability and minor impact, the Town has not focused its resources towards mitigation of this hazard.

Newly constructed buildings may have tie downs between roof and side walls but no building codes exist within the community that require residential construction to any particular standard.

Where high wind hazards have been recognized, it is usually a function of damage that might be caused if a tree were to be blown over and its effect on a residents' home. For this reason, some trees are removed from the landscape to reduce their vulnerability to high wind events.

The Town of Middlebury supports removal of dead and hazardous trees in the town right-of-ways to mitigate the hazards associated with their falling either on town highways or on power lines. The Town also supports the efforts of individual residents in making their properties more wind resistant but does not require specific construction standards.

Ability to expand:

- Educational materials can be provided via the town website and/or newsletter.

#### Future Actions

##### Landslide

Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard.

Adoption of Fluvial Erosion Hazard Zoning by the town in 2008 brought identified erosion hazard areas under much of the same development restrictions as had previously protected only identified floodplains. These FEH zones extend

to streambanks and riverbanks throughout town.

Ability to expand:

- Slope-based development limitations can be added to existing zoning bylaws by the planning commission.

#### Ice Jam

Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard.

#### Dam Failure

Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard.

#### Flooding and Fluvial Erosion

The planning team identified the following long-term projects to mitigate flooding and fluvial erosion in Middlebury:

- Complete all three phases recommended in the Malone and MacBroom report of May 25, 2013.
  - Phase I - Increase floodplain access upstream of the Grist Mill Bridge and hard armor the right bank of the flood chute opened up after Irene.
  - Phase II - Replace and extend the 1927 floodwall at the Grist Mill Bridge.
  - Phase III - Increase floodplain access downstream of the Grist Mill Bridge and extend the Ossie Road berm east to connect with the Grist Mill Bridge floodwall.
- Follow codes and standards as adopted by the Select Board on **date**
- Continue to enforce development standards and no new development in floodplains and erosion hazard zones as indicated in the Town's zoning regulations.
- Consider applying for a higher rating in the NFIP through the Community Rating System
- Development of a conservation plan that addresses the following:
  - Reduction of impervious surface
  - Introduction of low impact development applications for stormwater control
  - Increase urban forest canopy throughout Middlebury's built environment

### Severe Thunderstorm and Lightning

The planning team identified the following actions as ways to mitigate the effects of a widespread power outage due to thunderstorms and lightning:

- Continue town budget support for the ongoing maintenance of town-owned generators, especially those which serve the identified emergency shelters in town.
- The town supports the ongoing efforts of Green Mountain Power to keep its distribution system well maintained and free of possible tree/powerline issues. The town supports the efforts by sanctioning power company service within the town rights of way and the re-locating of off-road distribution lines onto these same rights of way.
- The Town supports the removal and overall maintenance of hazardous trees within the community through an urban forestry program and its support of a Town Forester and Town Tree Warden.
- On private lands and for private homes the town believes it is the responsibility of local landowners to mitigate their own losses through purchase and installation of privately owned generators in the most power loss prone areas.
- Evaluating the need for additional Air Terminals on town owned buildings
- Periodically inspect electrical connections of computers and other valuable electrical appliances to ensure appropriate protection via surge suppressors.

### Wildfire

The Town of Middlebury supports the following actions to help mitigate the risks associated with wildfire in the community.

- Explore the need for a wildfire plan for the more rural areas of town.
- If identified in such a plan, provide “firewise” information for members of the Development Review Board and Planning Commission so they can effectively evaluate the need for additional wildfire mitigation provisions in future subdivisions.

### Severe Winter Storm

The Town of Middlebury supports the following actions to help mitigate the risks associated with severe winter storms in the community:

- Adoption of a winter storm snow removal plan indicating priority roads and potential parking bans.
- Encourage roof construction that takes into account potential snow load weights.
- Identify and provide back-up power for additional warming shelters throughout town.

Table 21. Future Action Priority Table

<b>Hazard</b>	<b>Action</b>	<b>Leadership Responsibility</b>	<b>Priority</b>	<b>Timeframe</b>	<b>Link to Goals</b>	<b>Funding Sources? (see Appendix B)</b>
Flooding and Fluvial Erosion	Milone and MacBroom Middlebury River Phase 1	Town Manager, Public Works, Planning	High	Q3, 2015 – Q3, 2016	1,2,3	HMGP, Town Budget
Flooding and Fluvial Erosion	Milone and MacBroom Middlebury River Phase 2	Town Manager, Public Works, Planning	High	Q3, 2016 – Q3 2017	1,2,3	HMGP, Town Budget
Flooding and Fluvial Erosion	Milone and MacBroom Middlebury River Phase 3	Town Manager, Public Works, Planning	High	Q3, 2017 – Q3 2018	1,2,3	HMGP, Town Budget
Flooding and Fluvial Erosion	Standards for floodplain and EH2 protection	Town Manager, Public Works, Planning	Medium	Q3, 2015-Q4, 2017	1,2,3	Town Budget MPG
Flooding and Fluvial Erosion	NFIP Rating Change	Planning Department, Planning Commission	Low	Q3, 2016 - Q3, 2017	3	Town Budget
Flooding and Fluvial Erosion	Create Conservation Plan	Planning Department, Planning Commission	Medium	Q3, 2015 - Q4, 2017	1,2,3	Town Budget
Severe Thunderstorm and Lightning	Evaluate Need for Additional Air Terminals on Town Buildings	Public Works, Fire Department	Low	Q3, 2015 – Q3 2016	2,3	Town Budget
Wildfire	Explore the Need for a Wildfire Plan	Planning Department Planning	Low	Q3, 2015 – Q4, 2017	1,2,3	USFS grant
Severe Winter Storm	Identify Back-up Power and additional Warming Shelters	Town Manager, Public Works, Planning Dept, Emergency Manager	Medium	Q2, 2016 – Q4, 2017	1,2,3	ARC support, Town Budget

Goal 1: Increase Community Awareness of Middlebury's Vulnerability to Natural Hazards

Goal 2: Reduce Vulnerability of People, Property, and the Environment to Natural Hazards

Goal 3: Increase Interagency Capabilities and Coordination to Reduce the Impacts of Natural Hazards

Table 21. Future Action Priority Table



### Earthquake

The Town does not believe the risks associated with earthquake are large enough to require any town building retrofits at this time.

The Town believes it is the responsibility of private homeowners to be ready for earthquakes. The town generally believes that building construction standards are the responsibility of each private homeowner.

### Drought

The Town supports recent changes to state rules which require a potable water supply and septic plans prior to development and supports groundwater protection efforts around both public and private water supplies.

### Tornado and High Wind

The Town supports development of an urban forestry program that provides for tree maintenance and care to reduce conflicts from events associated with high winds.

### Landslide

Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard.

### Ice Jam

Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard.

### Dam Failure

Based on factors of probability and negligible impact, the Town has not focused its resources towards mitigation of this hazard. Monitored at the state level.

## Plan Adoption

Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan.

The purpose of formally adopting this plan is to secure buy-in from the Town of Middlebury, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan. The governing board for the Town of Middlebury, the Select Board, has adopted this hazard mitigation plan by passing a resolution. A copy of the resolution is included in Appendix: Adoption Resolution. The plan was adopted on 01/12/2016.

## Plan Implementation and Maintenance

### Plan Implementation and Maintenance

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement. To ensure that the plan remains current and relevant, it is important that it be updated periodically.

### 5 Year Plan Update Process:

The plan will be updated at a minimum every five years in accordance with the following procedure:

1. The Middlebury Select Board assembles a Review/Update Committee made up of town department representatives and interested citizens.
2. The Committee will discuss the process to determine if any modifications or additions are needed due to changing conditions since the last update occurred. Data needs will be reviewed, data sources identified and responsibility for collecting/updating information will be as

signed to members.

3. Other Town plans (Emergency Operations Plan, Town Plan, etc) will be reviewed to ensure a common mitigation thread still exists throughout.
4. A draft update will be prepared based on these evaluation criteria:
  - o Changes in community and government processes, which are hazard related and have occurred since the last review.
  - o Progress in implementation of plan initiatives and projects.
  - o Effectiveness of previously implemented initiatives and projects.
  - o Evaluation of unanticipated challenges or opportunities that may have occurred between the date of adoption and the date of the report.
  - o Evaluation of hazard-related public policies, initiatives and projects.
  - o Review and discussion of the effectiveness of public and private sector coordination and cooperation.
5. Select Board representation on the committee will provide the board an ongoing opportunity to review the draft updates. Consensus will be reached on any changes to the draft.
6. The Select Board will notify and schedule a public meeting to ensure adequate public input.
7. The Select Board will recommend incorporation of community comments into the draft update.

#### Annual Plan Evaluation and Review Process:

Although the plan will be reviewed in its entirety every five years as described above, the Town will also evaluate the plan against its other programs, initiatives and projects annually as the town budget is created. This review will ensure that, whenever possible, progress can be monitored and projects either added or removed from the Town's work plan based on changing local needs and priorities.

#### Post-Disaster Evaluation and Review Process:

Should a declared disaster occur, a special review will occur in accordance with the following procedures:

1. Within six months of a declared emergency event, the Town will initiate a post disaster review and assessment.

2. This post disaster review and assessment will document the facts of the event and assess whether existing Hazard Mitigation Plans effectively addressed the hazard.
3. A report of the review and assessment will be created by a Review/Update Committee composed of representatives of affected town departments and citizens.
4. The committee will make a determination whether the plan needs to be amended. If the committee determines that no modification of the plan is needed, then the report is distributed.
5. If the committee determines that modification of the plan is needed, then the committee drafts an amended plan based on its recommendations and forwards to the Select Board for public input.
6. The Select Board will hold a public meeting to gather comments on the draft amendments and recommend inclusion if appropriate.
7. Once any changes are made as identified in the public meeting, the Select Board adopts the amended plan.

## Appendix A. History of Flooding in East Middlebury

### Flooding History

(Adapted from August 2003 Fluvial Geomorphic Assessment of the Middlebury River Watershed, South Mountain Research & Consulting Services and from USGS stream gauge records on Otter Creek at Battell Block)

FLOOD DATE(S)	DESCRIPTION	DATA SOURCE
1913 March	Highest peak flow and highest crest on record for the Otter Creek At Middlebury USGS station; 17' above normal.  Flood Insurance Study for adjacent New Haven watershed to the north cites flood damage for 1913.	USGS  Middlebury Flood Insurance Study, 1984  Anderson-Nichols, 1986
1927 November	Most severe flood overall in the recorded history of the State. Estimated 5 to 10 inches rain over three days.  Middlebury: Otter Creek flood crest at Middlebury USGS station, November 4, 1927 at 13.3 feet above normal.  "East Middlebury main street sustained damage as the river jumped its banks and flowed through the middle of the village."  "Three families at East Middlebury had to abandon their homes when the waters rushed through that village and washed the Main Street away."	Middlebury Flood Insurance Study, 1984  USGS  Anderson-Nichols, 1986  Dufresne-Henry, 1984  Johnson, 1927
1936 March 11-21	Two flood events hit southern and northern Vermont primarily: rain and snowmelt caused the first flood (March 11); intense rains falling on saturated ground caused the 2nd event (March 16).  Middlebury: Flood crest at Otter Creek USGS station; 10' above normal was recorded on March 21.	USGS  USGS
1938 September 12-21	Large quantities of rainfall followed by a hurricane caused flooding in the central and southern portions of Vermont.  11th highest peak annual flow on record for Otter Creek at Middlebury was recorded on September 25. Middlebury: USGS station 7.55 feet above normal.  Breakwater in East Middlebury Village was overtopped and Middlebury River waters flowed down Main Street causing road washouts and property inundation.  "The East Middlebury River broke through its retaining wall in several places above and in the village and changed its course into the middle of the village street washing away great pieces of the heavy macadam paving and ripping away the shoulders for almost the entire length of the village." "Replacement of the breakwater and the bridge back of Week's store [Grist Mill Bridge]" were required.	USGS  USGS  Addison Independent, Oct. 7, 1938.

FLOOD DATE(S)	DESCRIPTION	DATA SOURCE
1947 June 3 & July 7	Two flash floods referenced in Middlebury town report.  Per USGS records the highest crest at the Otter Creek Stream gauge was 6.1 feet on June 8th 1947	Middlebury Town Report, 1947.  USGS
1958 April 25	Fifth highest peak flow on record for the Otter Creek at Middlebury USGS station: 8.17 feet  Flood Insurance Study for adjacent New Haven watershed to the north cites flood damage for 1958.	USGS  Anderson-Nichols, 1986
1969 April 7	Fourth highest peak flow on record for the Otter Creek at Middlebury USGS station: 8.62 feet  Flood Insurance Study for adjacent New Haven watershed to the north cites flood damage for 1969.	USGS  Anderson-Nichols, 1986
1976 August 9-10	Statewide flooding related to Hurricane Belle  Middlebury: Town report references receipt of \$162,850 from the Federal Financial Assistance to repair damage done by Hurricane Belle to be used for stream cleaning and highway damage.	USGS  Middlebury Town Report, 1976
1989 August 4-5	"Heavy rains in late August resulted in significant flooding in East Middlebury."  South of Goodno Lumber Company buildings were inundated.	Middlebury Town Report, 1989  Middlebury Zoning Office records
1996 June 10	In June, washout on the North Branch Rd.	Middlebury Town Report, 1996
1998 late June and early July	This summer storm event followed an exceptionally wet spring and caused extensive damage in central Vermont particularly in upland towns of Addison and Washington Counties. "The most heavily damaged areas received up to 6 inches of rain over approximately six hours."	VTDEC, 1999
2008 June & August	Extensive washouts along Dugway and North Branch Roads; Lower Plains Bridge washed out; Multiple washouts along Route 125 causing multi-day closures; retaining wall at Grist Mill Bridge undermined.	Amy Sheldon personal observations.
2011 August 28	Tropical Storm Irene: Middlebury River jumped its banks downstream of Lower Plains Road Bridge behind Welch's property and continued down East Main Street past Goodno's and onto Chale Road; large amounts of sediment deposited in the stream channel; retaining wall at Grist Mill Bridge undermined.  USGS gauge at Otter Creek Falls records the Irene flood crest 4 days later at the 8th highest recorded level 7.31 feet above normal.	Amy Sheldon personal observations.  USGS - Fred Dunnington

## Appendix B. General Practice Mitigation Measures

Mitigation measures for “all-hazards” have been adapted from a flood mitigation approach developed by French Wetmore, of Wetmore and Associates in Park Forest, Illinois, into six categories:

- Prevention – measures intended to keep a hazard risk problem from becoming worse. They ensure that future development does not increase hazard losses. Examples would include: Planning and Zoning, Open space preservation, Land Development regulations, Storm water management.

- Property Protection – measures used to modify buildings, or their surroundings, subject to hazard risk rather than prevent the hazard from occurring. Examples are: Acquisition of vulnerable properties, Relocation from hazard prone areas, Rebuild or modify structures to reduce damage by future hazard events, Flood-proofing of flood-prone buildings.

- Natural Resource Protection – measures intended to reduce the intensity of hazard effects as well as improve the quality of the environment and wildlife habitats. Erosion and sediment control and Wetlands protection are examples.

- Emergency Services – measures that protect people before and after a hazard event. That would include: Warning, Response, Critical facilities protection, Health and safety maintenance.

- Structural Projects – measures that involve construction of man-made structures to control hazards. Some examples would include: dams, reservoirs, debris basins, channel modifications, storm sewers, elevated roadways.

- Public Information – activities intended to inform and remind people about hazardous areas and the measures to avoid potential damage and injury. Examples are: Outreach projects, Real estate disclosure, Technical assistance, Community education programs.

The following suggested Mitigation Measures were taken from the website of the Northeast States Emergency Consortium (NSEC).

## All Hazards

- Map vulnerable areas and distribute information about the hazard mitigation strategy and projects.
- Provide information to contractors and homeowners on the risks of building in hazard-prone areas.
- Develop a list of techniques for homeowner self-inspection and implementation of mitigation activities.
- Organize and conduct professional training opportunities regarding natural hazards and hazard mitigation.
- Distribute NOAA weather radios.
- Develop sound land use planning based on known hazards.
- Enforce effective building codes and local ordinances.
- Increase public awareness of community hazards.
- Provide sites that are as free as possible from risk to natural hazards for commercial and industrial activities.
- Consider conservation of open space by acquisition of repetitive loss structures.
- Consider conservation of open space by acquisition of areas identified as "vulnerable or at risk"
- Ensure a balance between residential growth, conservation of environmental resources through a detailed analysis of the risks and vulnerability to natural hazards.
- Conduct joint planning and sharing of resources across regions, communities, and states.
- Establish a hazard mitigation council.
- For future proposed development design guidelines, incorporate hazard mitigation provisions, including improved maps.
- Consider adding a "safe room" requirement for all new buildings.
- Establish incentives to encourage business owners and homeowners to retrofit buildings with hazard resistant features.
- Teach disaster and hazard awareness in schools.

## Flood

### Flood Hazard Mitigation Measures for Communities

- Developing and enforcing all-hazards building codes,
- Adopting incentives to encourage mitigation



- Developing administrative structures to support the implementation of mitigation programs
- Mitigation should be incorporated into future land use plans through riparian corridor protection, limiting flood hazard area development, and other measures.
- Developing and conducting public information campaigns on hazard mitigation should be a priority.
- Participate in the National Flood Insurance Program (NFIP).
- Conduct watershed geomorphic assessments.
- Encourage riparian corridor protection.

### Flood Hazard Mitigation Measures for Individuals

#### How to Protect Your Property:

- Keep insurance policies, documents, and other valuables in a safe-deposit box. You may need quick, easy access to these documents. Keep them in a safe place less likely to be damaged during a flood.
- Avoid building in a floodplain. Some communities do not permit building in known floodplains. If there are no restrictions, and you are building in a floodplain, take precautions, making it less likely your home will be damaged during a flood.
- Raise your furnace, water heater, and electric panel to higher floors or the attic if they are in areas of your home that may be flooded. Raising this equipment will prevent damage. An undamaged water heater may be your best source of fresh water after a flood.
- Install check valves in building sewer traps to prevent flood water from backing up into the drains of your home. As a last resort, when floods threaten, use large corks or stoppers to plug showers, tubs, or basins.
- Seal walls in basements with waterproofing compounds to avoid seepage through cracks.
- Consult with a construction professional for further information if these and other damage reduction measures can be taken. Check local building codes and ordinances for safety requirements.
- Contact your local emergency management office for more information on mitigation options to further reduce potential flood damage. Your local emergency management office may be able to provide additional resources and information on ways to reduce potential damage.

## Severe Winter Storm

### Winter Storm Hazard Mitigation Measures for Communities

FEMA's National Mitigation Action Plan suggests that state and local mitigation plans include the following:

- Developing and enforcing all-hazards building codesAdopting incentives to encourage mitigation
- Developing administrative structures to support the implementation of mitigation programs
- Mitigation should be incorporated into land use management plans.
- Developing and conducting public information campaigns on hazard mitigation should be a priority.

In addition, FEMA recommends the following actions to further protect communities from the effects of Winter Storms:

- Building code development and enforcement of snow loads
- Develop a storm water management plan for snowmelt
- Assuring adequate supplies of sand and salt
- Maintaining snow removal equipment so that it is ready to be deployed
- Retrofitting public buildings to withstand snowloads and prevent roof collapse
- Clearing roofs of excessive snow accumulations
- Develop a winter storm plan or annex to the local emergency management plan
- Develop a capability to monitor weather forecasts, conditions and warnings issued by the National Weather Service
- Identify appropriate shelters for people who may need to evacuate due to loss of electricity, heat or coastal flooding due to storm surge
- Assure that critical facilities such as police and fire stations and schools are accessible and equipped
- Clearing streets and roads of snow to assure the passage of public safety vehicles and general traffic.

### Winter Storm Hazard Mitigation Measures for Individuals

How to Protect Your Property:

- Make sure your home is properly insulated. If necessary, insulate walls and attic. This will help you to conserve electricity and reduce your home's power demands for heat. Caulk and weather-strip doors and windowsills to keep cold air out, allowing the inside temperature to stay warmer longer.
- Install storm windows or cover windows with plastic from the inside. This will provide an extra layer of insulation, keeping more cold air out.
- To keep pipes from freezing:
  - Wrap pipes in insulation or layers of old newspapers.
  - Cover the newspapers with plastic to keep out moisture.
  - Let faucets drip a little to avoid freezing.
  - Know how to shut off water valves.
- If the pipes freeze, remove any insulation or layers of newspapers and wrap pipes in rags. Completely open all faucets and pour hot water over the pipes, starting where they were most exposed to the cold (or where the cold was most likely to penetrate). A hand-held hair dryer, used with caution to prevent overheating, also works well.
- Consider storing sufficient heating fuel. Regular fuel sources may be cut off. Be cautious of fire hazards when storing any type of fuel.
- Before winter, be sure you install and check smoke alarms.
- Consider keeping safe emergency heating equipment:
  - Fireplace with ample supply of wood.
  - Small, well-vented wood, coal, or camp stove with fuel.
  - Portable space heater or kerosene heater. Check with your local fire department on the legality of using kerosene heaters in your community. Use only the correct fuel for your unit and follow the manufacturer's instructions. Refuel outdoors only, and only when cool. Keep your kerosene heater at least three feet away from furniture and other flammable objects.
- When using alternative heat from a fireplace, wood stove, space heater, etc., use fire safeguards and ventilate properly. Fire hazard is greatly increased in the winter because alternate heating sources are used without following proper safety precautions.
- Install snow fences in rural areas to reduce drifting in roads and paths, which could block access to homes, barns, and animals' feed and water.
- If you live in a flood-prone area, consider purchasing flood insurance to cover possible flood damage that may occur during the spring thaw. Homeowners' policies do not cover damage from floods. Ask your insurance agent about the National Flood Insurance Program if you are at risk.

## How to Plan for a Winter Storm:

- Service snow removal equipment before winter storm season. Equipment should be available for use if needed. Maintain it in good working order.
- Keep your car's gas tank full for emergency use and to keep the fuel line from freezing.
- Understand the hazards of wind chill, which combines the cooling effect of wind and cold temperatures on exposed skin. As the wind increases, heat is carried away from a person's body at an accelerated rate, driving down the body temperature. "Wind chill" is a calculation of how cold it feels when the effects of wind speed and temperature are combined. A strong wind combined with a temperature of just below freezing can have the same effect as a still air temperature about 35 degrees colder.
- Get training. Take an American Red Cross first aid course to learn how to treat exposure to the cold, frostbite, and hypothermia.
- Discuss with your family what to do if a winter storm WATCH or WARNING is issued. Designate one household member as the winter storm preparedness leader. Have him or her discuss what to do if a winter storm watch or warning is issued. Have another household member state what he or she would do if caught outside or in a vehicle during a winter storm. Everyone should know what to do in case all family members are not together. Discussing winter storms ahead of time helps reduce fear and lets everyone know how to respond during a winter storm.

## High Wind

### High Wind Hazard Mitigation Measures for Communities

FEMA's National Mitigation Action Plan suggests that state and local mitigation plans include the following:

- Developing and enforcing all-hazards building codes,
- Adopting incentives to encourage mitigation
- Developing administrative structures to support the implementation of mitigation programs
- Mitigation should be incorporated into land use management plans.
- Developing and conducting public information campaigns on hazard mitigation should be a priority.

FEMA also suggests that communities further reduce their vulnerability to hurricanes through the adoption and enforcement of wind- and flood-resistant building codes. Sound land-use planning can also ensure that structures are not built in the highest hazard areas.

#### High Wind Hazard Mitigation Measures for Individuals

- Make a list of items to bring inside in the event of a storm. A list will help you remember anything that can be broken or picked up by strong winds. High winds, often in excess of 40 miles per hour, can turn unanchored items into missiles, causing damage or injury when they hit.
- Keep trees and shrubbery trimmed. Make trees more wind resistant by removing diseased or damaged limbs, then strategically remove branches so that wind can blow through. High winds frequently break weak limbs and hurl them at great speed, causing damage when they hit property. Debris collection services may not be operating just before a storm, so it is best to do this well in advance of approaching storms.
- Remove any debris or loose items in your yard. High winds can pick up anything unsecured, creating damage to property when the debris hits.
- Install protection to the outside areas of sliding glass doors. Glass doors are as vulnerable as windows to breakage by wind-driven objects.
- If you live in a flood plain or are prone to flooding, also follow flood preparedness precautions. Nor'easters and severe thunderstorms can bring great amounts of rain and frequently cause floods.

#### Earthquake

##### Earthquake Hazard Mitigation Measures for Communities

FEMA's National Mitigation Action Plan suggests that state and local mitigation plans include the following:

- Developing and enforcing all-hazards building codes,
  - Adopting incentives to encourage mitigation
  - Developing administrative structures to support the implementation of mitigation programs
  - Mitigation should be incorporated into land use management plans.
- 
- Developing and conducting public information campaigns on hazard miti-

gation should be a priority.

FEMA's Earthquake Program has four basic goals directly related to the mitigation of hazards caused by earthquakes. They are to:

- Promote Understanding of Earthquakes and Their Effects.
- Work to Better Identify Earthquake Risk.
- Improve Earthquake-Resistant Design and Construction Techniques.
- Encourage the use of Earthquake-Safe Policies and Planning Practices.

### Earthquake Hazard Mitigation Measures for Individuals

How to Protect Your Property:

- Bolt bookcases, china cabinets, and other tall furniture to wall studs. Brace or anchor high or top-heavy objects. During an earthquake, these items can fall over, causing damage or injury.
- Secure items that might fall (televisions, books, computers, etc.). Falling items can cause damage or injury.
- Install strong latches or bolts on cabinets. The contents of cabinets can shift during the shaking of an earthquake. Latches will prevent cabinets from flying open and contents from falling out.
- Move large or heavy objects and fragile items (glass or china) to lower shelves. There will be less damage and less chance of injury if these items are on lower shelves.
- Store breakable items such as bottled foods, glass, and china in low, closed cabinets with latches. Latches will help keep contents of cabinets inside.
- Store weed killers, pesticides, and flammable products securely in closed cabinets with latches, on bottom shelves. Chemical products will be less likely to create hazardous situations from lower, confined locations.
- Hang heavy items, such as pictures and mirrors, away from beds, couches, and anywhere people sit. Earthquakes can knock things off walls, causing damage or injury.
- Brace overhead light fixtures. During earthquakes, overhead light fixtures are the most common items to fall, causing damage or injury.
- Strap the water heater to wall studs. The water heater may be your best source of drinkable water following an earthquake. Protect it from damage and leaks.

- Bolt down any gas appliances. After an earthquake, broken gas lines frequently create fire hazards.
- Repair any deep cracks in ceilings or foundations. Get expert advice if there are signs of structural defects. Earthquakes can turn cracks into ruptures and make smaller problems bigger.
- Check to see if your house is bolted to its foundation. Homes bolted to their foundations are less likely to be severely damaged during earthquakes. Homes that are not bolted have been known to slide off their foundations, and many have been destroyed because they are uninhabitable.
- Install flexible pipe fittings to avoid gas or water leaks. Flexible fittings will be less likely to break.
- Consider having your building evaluated by a professional structural design engineer. Ask about home repair and strengthening tips for exterior features, such as porches, front and back decks, sliding glass doors, canopies, carports, and garage doors. Learn about additional ways you can protect your home. A professional can give you advice on how to reduce potential damage.
- Follow local seismic building standards and safe land use codes that regulate land use along fault lines. Some municipalities, counties, and states have enacted codes and standards to protect property and occupants. Learn about your area's codes before construction.

#### How to Plan for an Earthquake:

- Pick "safe places" in each room of your home. A safe place could be under a sturdy table or desk or against an interior wall away from windows, bookcases, or tall furniture that could fall on you. The shorter the distance to move to safety, the less likely you will be injured. Injury statistics show that persons moving more than 10 feet during an earthquake's shaking are most likely to experience injury.
- Practice drop, cover, and hold-on in each safe place. Drop under a sturdy desk or table, hold on, and protect your eyes by pressing your face against your arm. Practicing will make these actions an automatic response. When an earthquake or other disaster occurs, many people hesitate, trying to remember what they are supposed to do. Responding quickly and automatically may help protect you from injury.

- Practice drop, cover, and hold-on at least twice a year. Frequent practice will help reinforce safe behavior.
- Talk with your insurance agent. Different areas have different requirements for earthquake protection. Study locations of active faults, and if you are at risk, consider purchasing earthquake insurance.
- Inform guests, babysitters, and caregivers of your plan. Everyone in your home should know what to do if an earthquake occurs. Assure yourself that others will respond properly even if you are not at home during the earthquake.
- Get training. Take a first aid class from your local Red Cross chapter. Get training on how to use a fire extinguisher from your local fire department. Keep your training current. Training will help you to keep calm and know what to do when an earthquake occurs.
- Discuss earthquakes with your family. Everyone should know what to do in case all family members are not together. Discussing earthquakes ahead of time helps reduce fear and anxiety and lets everyone know how to respond.

## **Appendix C.**Potential Mitigation Project Funding Sources

### Federal

#### FEMA

- Hazard Mitigation Grant Program. The Hazard Mitigation Grant Program (Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act) is activated during Presidential Disaster Declarations to assist in identifying mitigation projects, and funding these projects on a 75% Federal/25% non-Federal cost share basis. Mitigation program funding is based on 20% of the federal funds expended for the Infrastructure and Individual Assistance Programs. The HMGP supports other program activities, i.e. participation the NFIP is required for recipients of HMGP funds.
- National Flood Insurance Program (NFIP). The National Flood Insurance Program (NFIP) makes federally subsidized flood insurance available to property owners in locations agreeing to participate in the NFIP. If communities enter the NFIP, they are required to adopt floodplain ordinances meeting criteria established by FEMA. These criteria include: requiring permits for development within designated floodplains; review development plans and subdivision proposals to determine whether proposed



sites will be reasonably safe from flooding; require protection of water supply and sewage systems to minimize infiltration of floodwater; obtain, review, and utilize all base flood elevation data; and assure the maintenance of flood carrying capacities within all watercourses.

- The Community Rating System. An element of the NFIP, is designed to promote the availability of flood insurance, reduce future flood damages, and ensure the accurate rating of flood insurance policies. Participating communities may receive credit for proven mitigation measures, thus reducing the cost of flood insurance within their jurisdictions.
- The Individual Assistance Loss Prevention Program. Available to provide eligible owner- occupants, who sustained damage and received Disaster Housing Minimal Repair Funds, the opportunity to participate in a voluntary program where additional 100% federal funds are made available to break the damage-rebuild-damage cycle and help homeowners reduce or eliminate losses from future weather-related damage.
- The Individual and Family Grant (IFG) Minimization Program. Available to provide IFG-eligible owner- occupants the opportunity to participate in a voluntary program where additional state and federal funds are made available to break the damage-rebuild-damage cycle, and help reduce or eliminate losses from future weather-related damage. In addition, FEMA's 800 series provides funding for low cost mitigation measures.
- The Infrastructure Program (Section 406 of the Stafford Act). Authorizes funding for the repair, restoration, or replacement of damaged facilities belonging to public and private non-profit entities, and for other associated expenses, including emergency protective measures and debris removal. The Infrastructure Program also authorizes funding for appropriate cost-effective hazard mitigation related to damaged public facilities.
- The National Inventory of Dams (US Army Corps of Engineers project). Identifies high-hazard dams and encourages the development of warning systems and emergency plans for many of these facilities.

#### The National Weather Service

- The NWS provides meteorological and hydrologic services that includes weather and hydrologic warnings, forecasts, and related information. The primary mission of the NWS is to save lives and reduce property damage through timely issuances of tornado and flood warnings and river stage forecasts. To cope with dangerous weather, the NWS interacts with emergency services personnel throughout the state by: issuance of tornado and flash flood watches or warnings for those areas in which a threat is posed; issuance of flood watches and warnings for major streams and rivers within the state. Addison County is within the coverage area of the NWS office in Burlington but also may receive information from the Albany, NY office.

#### The U.S. Army Corps of Engineers

- The Corps undertake a broad range of civil works projects to develop, manage, and conserve the nation's water resources. No work may be undertaken without authorization and funding from Congress, either from specific legislation or continuing authorities. Projects are planned to serve as many purposes as are feasible and to protect or improve the environment as much as possible. The Corps is involved in developing and implementing plans for flood control, navigation, hydropower, recreation, and water supply. The Corps has authority for emergency operations, bank protection, permit administration, and technical assistance. Corps of Engineers assistance includes:
  - Studies and Projects
  - Discretionary Authority to implement certain types of water resources projects without specific Congressional approval. These projects are typically limited in cost and duration, and include:
    - Section 14 - Emergency Stream bank Protection of Public Facilities, limitation of \$500,000 per project.
    - Section 107 - Small Navigation Projects, usually for port facilities and navigation channels. Work on channels usually improves stream flow and aids flood control efforts.
    - Section 205 - Small Flood Control Projects, not to exceed \$5 million. Funds may be used for projects such as upgrading flood protection structures and channelization of streams.
    - Floodplain Technical Assistance, to include:

- Conducting floodplain mapping surveys to provide either first-time mapping of an area or to correct older floodplain maps;
- Conducting flood studies in cooperation with FEMA to determine actual flood levels for settlement of flood insurance claims;
- Providing technical advice regarding proposed floodplain ordinances and building codes.
- Emergency operations to respond to flood emergencies, to include flood fighting, constructing advance temporary measures in anticipation of imminent flood, and the repair of damaged flood control works after the flood event.
- Permit authority, the Corps has the authority to issue Permits to cover construction excavation and other related work in or over navigable waterways; and Permits covering the discharge of fill material in all waters of the United States and adjacent wetlands.

#### The Department of Housing and Urban Development

- Community Development Block Grant Program. Funds are provided as grants to units of local government. Local governments can use the funds to: construct flood and drainage facilities; finance rehabilitation projects that include flood proofing, elevation, purchase of flood insurance, etc.; finance acquisition and relocation of homes to remove them from the floodplains.
- Rental Rehabilitation Program. Funds to rehabilitate rental properties can be used for flood proofing and repair to flood damage.
- Section 312 Loan Program. Provides funds to rehabilitate both residential and non-residential properties, including flood repair and flood proofing.

#### The Department of Agriculture, Natural Resource Conservation Service

- NRCS can provide technical assistance in the conservation, development, and productive use of water resources. In addition, the NRCS monitors use of prime farmland.
- Watershed Protection and Flood Prevention. Technical and financial assistance to local entities to plan and install works of improvement for watershed protection, flood prevention, agricultural water management, and other approved purposes.
- Resource Conservation and Development. Technical and financial assistance to local entities to plan and install works of improvement for water-

shed protection, flood prevention, agricultural water management, and other approved purposes.

- Emergency Watershed Protection. Provides assistance to reduce hazards to life and property in watersheds damaged by severe natural events. NRCS can provide 100% of the cost of exigency situations, and 80% of the cost for non-exigency situations, if funds are available.
- Conservation Technical Assistance. Provided to land users to control erosion, sediment, and to reduce upstream flooding.
- River Basin Surveys and Investigations. Includes Conservation River Basin Studies to assist in solving existing problems or meeting existing or projected needs, and Floodplain Management Studies to provide information and assistance for reducing future flood damages. Financial assistance is provided by sponsors.

#### U.S. Geological Survey

- USGS provides certain hazard studies and recommendations. A portion of the mission of the USGS is to collect and analyze data on the quantity of surface water through a network of gauging stations. The data is used in preparing flood frequency reports to evaluate the severity of floods. This data is useful in flood hazard mitigation studies, establishing flood prone areas, and potential flood heights near hydraulic structures.

Economic Development Administration was established to generate new jobs, to help protect existing jobs, and to stimulate commercial and industrial growth in economically distressed areas of the United States.

Small Business Administration (SBA) Disaster Assistance Programs provide loans to businesses and individuals affected by presidential and SBA disaster declarations. The program provides direct loans to businesses to repair or replace uninsured disaster damage to property owned by the business, including real estate, machinery, and equipment, inventory and supplies. Businesses of any size are eligible. Non-profit organizations are also eligible. Assistance to individuals comes in the form of low-interest loans for repair or replacing damaged real and personal property. The SBA administers the Disaster Assistance Programs.

- Pre-Disaster Mitigation Loans. This new loan program began in January 2000 and is funded for five years. This program makes funds for mitigation available to businesses in Project Impact communities.

## State

### VTrans

- Town Highway Grants Program. State aid grants for highways are made annually to the governing body based on the number of Class 1,2 or 3 miles in the Municipality. The General Assembly appropriates a lump sum annually for this purpose (19 V.S.A. Section 306(a)). Distribution is made quarterly, with no application required. There is no requirement that State funds be matched with local funds, other than a requirement that municipalities expend no less than \$300 per mile of local tax revenues of their highways (19 V.S.A. Section 307).
- Town Highway Bridge Program. State assistance for major rehabilitation or reconstruction of bridges with a span of six feet or more on class 1, 2 or 3 town highways is made available by the Secretary of Transportation from annual appropriations for that purpose (19 V.S.A. Section 306(b)). State assistance amounts are not limited for any one project. The State assistance requires 10 percent participation or match of total project cost with town funds for replacement projects and 5% for rehabilitation projects. The local match is capped at the amount raised by a municipal tax rate of \$0.50 on the Grand List (19 V.S.A. Section 309(a)).
- Town Highway Structures Program. State grants for bridges, culverts and retaining walls that are part of the municipalities highway (Class 1, 2 or 3) infrastructure are made by the Secretary of Transportation from annual appropriations for the purpose. State grant amounts are limited to \$150,000 for any one project. State funds are required to be matched, as follows:
  - By at least 20% of the total project cost, or
  - By at least 10% of the total project cost providing that town has adopted Town Highway codes and standards and the town has conducted a highway infrastructure study (not less than three years old), which identifies all town culverts, bridges and identified road problems.
- Town Highway Class 2 Roadway Program. State grants to provide for the preservation of any Class 2 highways by providing grants for resurfacing or reconstruction are made by the Secretary of Transportation or his/her designee from annual appropriations for that purpose. State grants are limited to \$150,000 for any one project and there are match requirements for the town similar to the Town Highway Structures Program.
- Town Road & Bridge Standards, Infrastructure Study. As a result of legislative action relating to the Town Aid programs an incentive program was created providing additional funding to towns meeting two requirements:

- Adopted codes and standards.
- Conducted a network infrastructure study.

#### Agency of Natural Resources

- Ecosystem Restoration Grant Program. As part of a governor's initiative to improve water quality in Lake Champlain, Funds have been allocated to assist in clean-up. Funds from this source have paid for a large portion of recent geomorphic studies in the Addison region as well as supporting the development of Fluvial Erosion Hazard Zones. Additionally, funds have been allocated to purchase development rights in hazardous locations.

#### The Department of Public Safety, Division of Emergency Management

- Hazard Mitigation Grant Program. Previously described under Federal Programs.
- Local Emergency Management Director Program. A continuing program of training for local emergency management directors to provide a consistent base of knowledge to understand their roles and responsibilities in Emergency Management.
- Generator Grant Program. VEM allocates funds from FEMA EMPG to allow towns to purchase back-up power sources for emergency shelters for continued use in the event of a power failure.

#### Regional

##### The Addison County Regional Planning Commission

- ACRPC provides assistance to local governments concerning planning for future land use, business, transportation, emergency management and population.
- In addition to the specific programs mentioned below, ACRPC has identified Municipal Development Plans and Capital Improvement Plans as appropriate local planning mechanisms suitable for incorporating many of the provisions of this plan. These plans, by statute, need to be updated on a 5 year rotation. In Addison County, each municipality adopts these new or updated plans according to their own timetable and therefore, each is at a different place in the planning and adoption process. At the time of each rewrite, ACRPC generally assists local planning commissioners and will encourage inclusion of appropriate provisions of this plan into any new document.
- One effective ongoing program is a local culvert survey and upgrade pro-

gram, which is sponsored by the ACRPC. This program provides funding to communities for survey and location of installed culverts to determine condition and effectiveness. Those identified as needing repair and replacement are eligible for hazard mitigation funding.

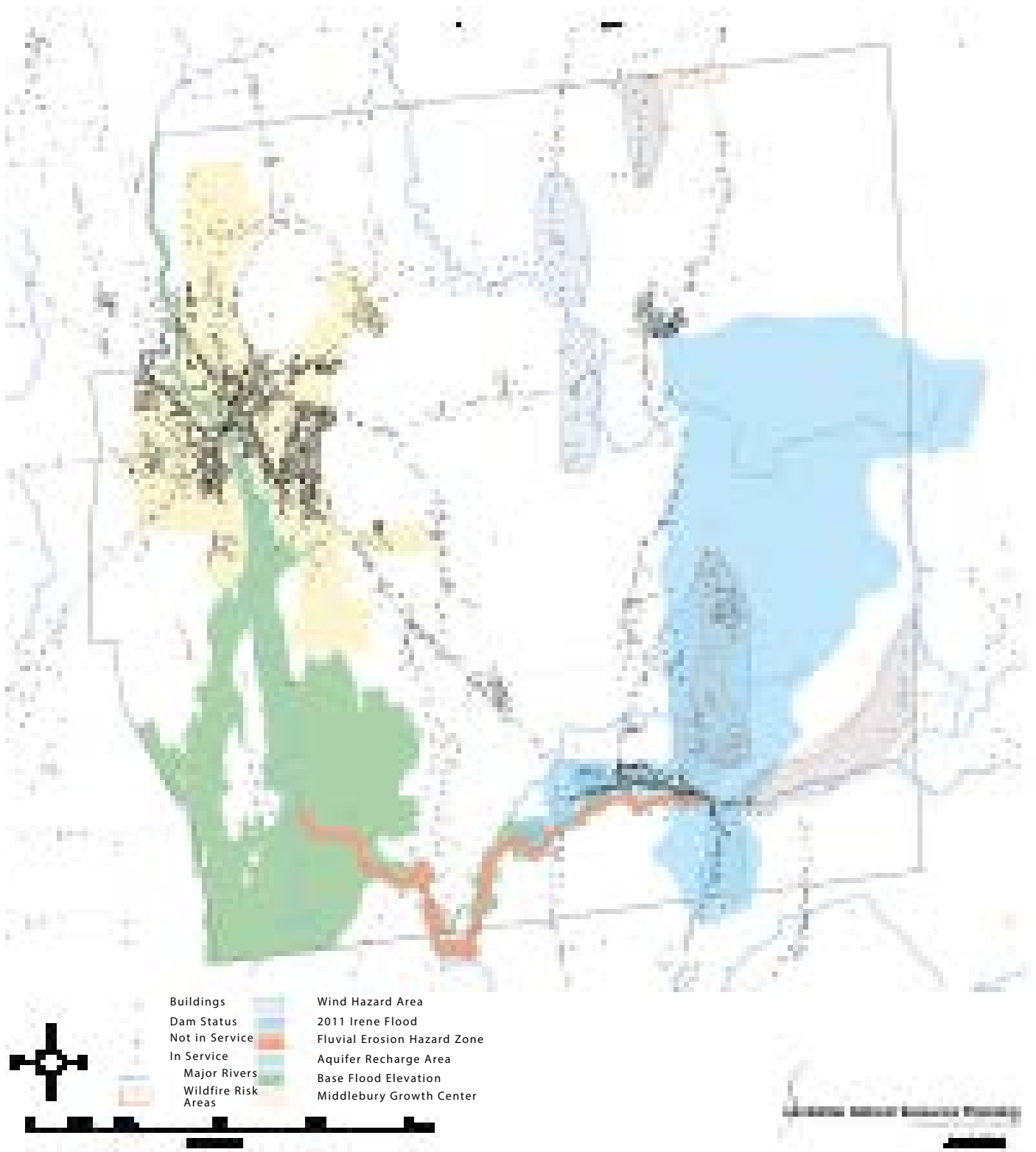
- Past regional mitigation projects and initiatives include:
  - Project Impact. FEMA and Vermont Emergency Management designated Addison County as a “Project Impact” community in 1999. The goal of “Project Impact” is to bring communities together to take actions that prepare for and protect themselves against disasters in a collaborative effort. “Project Impact” encourages communities to do these things:
    - Identify Hazards and Community Vulnerability
    - Prioritize Hazard Risk Reduction Efforts
    - Build Community Partnerships for Risk Reduction Projects and Activities
    - Communicate Successes and Establish Public EducationThe list of projects that have all or a portion of the project cost supported by Project Impact include:
    - Red Cross Schools Program
    - Culvert Replacement/Stone Lined Ditch in Goshen
    - Demonstration House in Cornwall
    - Middlebury River Assessment
    - Ripton Fire Station Move
    - Weather Radio Purchases
    - Shoreline Stabilization Handbooks for the Lakeside Towns
    - Flood Warning Rain Gauges – Mountain Towns
    - Monkton Evacuation Center
    - Back-up Power Project
  - The Lewis Creek Study. Vermont Department of Environmental Conservation (VTDEC) River Management Program, in collaboration with academic, agency and watershed association partners, completed a pilot project in the Lewis Creek watershed. The project was intended to help develop remote sensing and rapid stream geomorphic assessment methodologies that would help to problem solve at the watershed level, gain a broader constituency for river management and to have a consistent statewide protocol.
  - Pre-Disaster Mitigation (PDM-C) Planning Grants: Development and continued updating of this and other mitigation planning activities are supported through funding from FEMA’s PDM-C, Flood Mitigation Assistance (FMA), and Emergency Management Performance Grant (EMPG) grants.

- Geomorphic Assessments, State of Vermont Agency of Natural Resources and PDM-C funding supported ongoing geomorphic assessments on the major flash flood prone streams and rivers in the Addison Region including the Middlebury River, New Haven River, Neshobe River, Leicester River, Lemon Fair, and Otter Creek. These studies have benefited both mitigation of disasters and mitigation of ongoing surface water pollution.



## Appendix D. Local Maps

### All Hazards Base Map



## All Hazards Quadrant 1 Map



Dam Status

Not In Service

In Service

Parcel Boundary

Irene Flooding

Wildfire Risk Area

Wind Hazard Area

Fluvial Erosion Hazard Zone

Base Flood Elevation

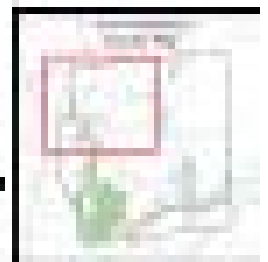
Source:

Wind and Wildfire risk areas based on past events  
documented by Dan Werner, Middlebury

Director of Operations

Base Flood Elevation is from FEMA 1984 FIRM Maps

Irene Flooding is from Amy Sheldon

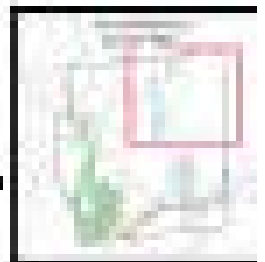


## All Hazards Quadrant 2 Map



### Source:

Wind and Wildfire risk areas based on past events  
documented by Dan Werner, Middlebury  
Director of Operations  
Base Flood Elevation is from FEMA 1984 FIRM Maps  
Irene Flooding is from Amy Sheldon



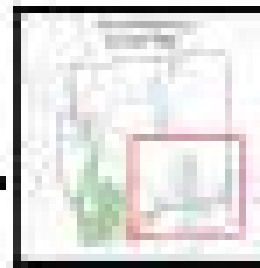
All Hazards Quadrant 3 Map



Dam Status  
Not In Service  
In Service  
Parcel Boundary

Irene Flooding  
Wildfire Risk Area  
Wind Hazard Area  
Fluvial Erosion Hazard Zone  
Base Flood Elevation

Source:  
Wind and Wildfire risk areas based on past events  
documented by Dan Werner, Middlebury  
Director of Operations  
Base Flood Elevation is from FEMA 1984 FIRM Maps  
Irene Flooding is from Amy Sheldon



All Hazards Quadrant 4 Map



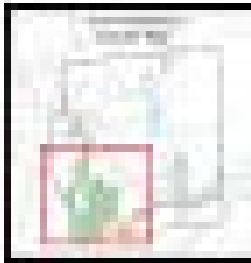
- Dam Status

Not In Service

In Service

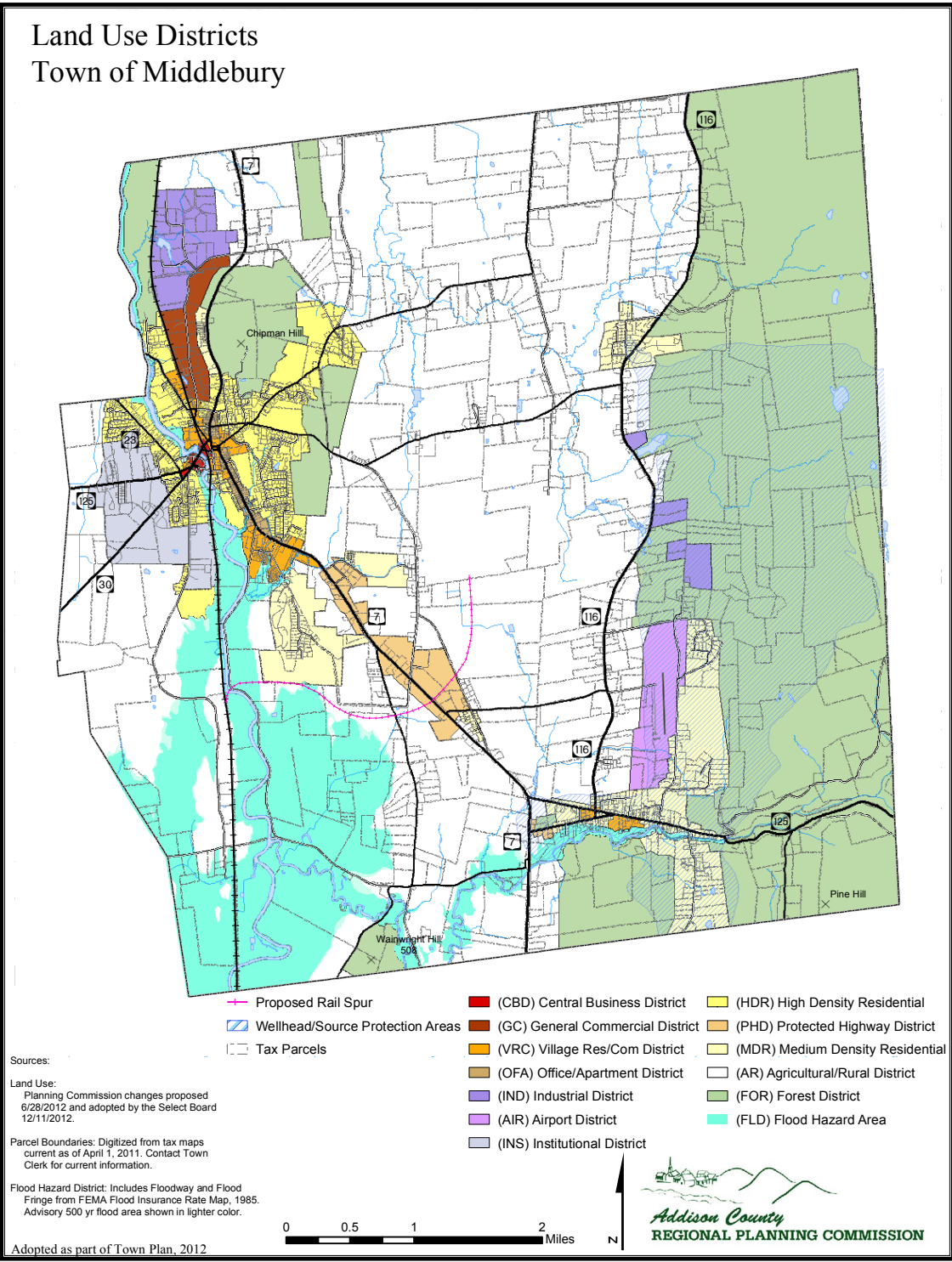
Parcel Boundary
- Irene Flooding
- Wildfire Risk Area
- Wind Hazard Area
- Fluvial Erosion Hazard Zone
- Base Flood Elevation

Source:  
Wind and Wildfire risk areas based on past events  
documented by Dan Werner, Middlebury  
Director of Operations  
Base Flood Elevation is from FEMA 1984 FIRM Maps  
Irene Flooding is from Amy Sheldon



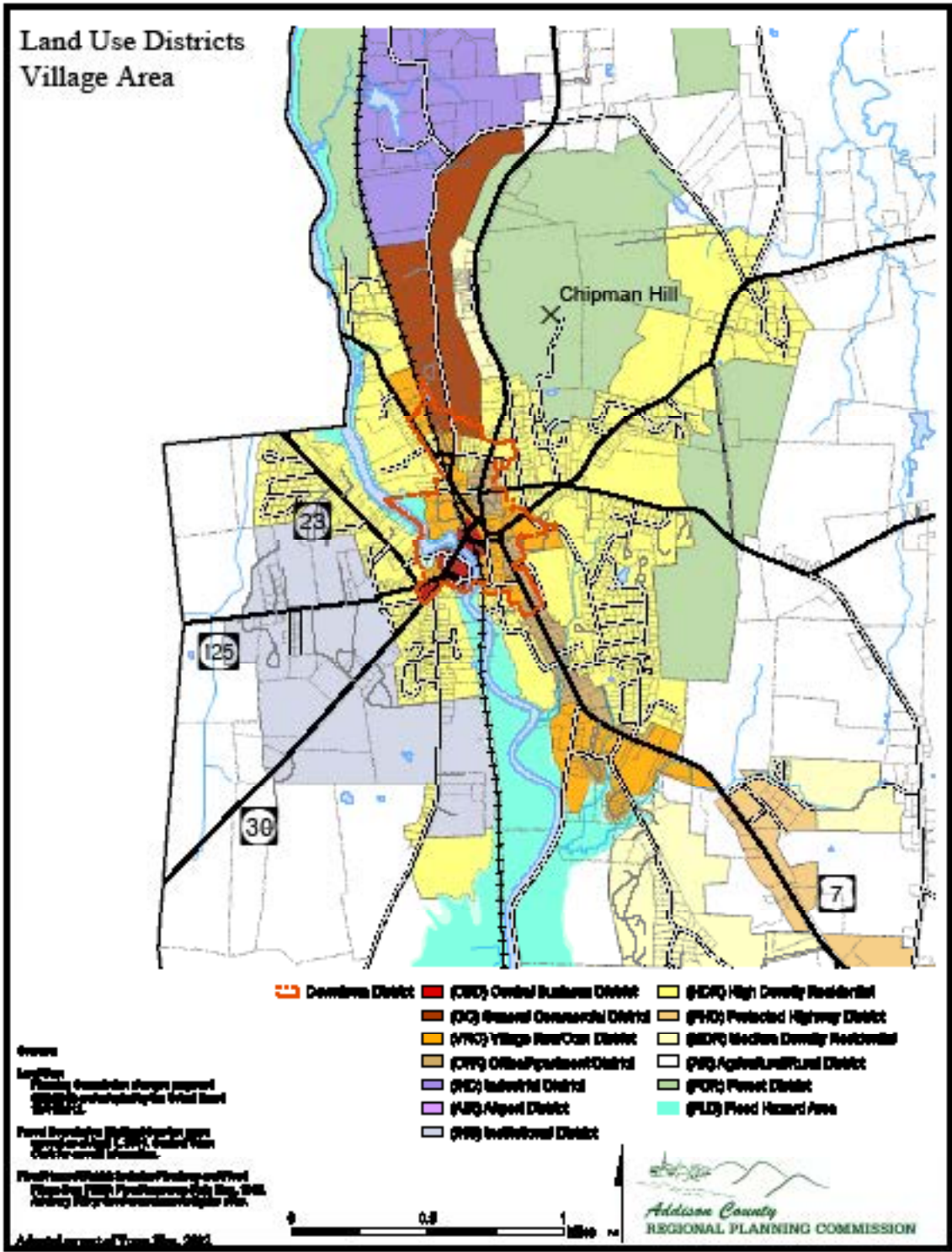
# Town of Middlebury Land Use Districts Map

Includes FLD - Flood Hazard Area



# Middlebury Village Area Land Use Districts Map

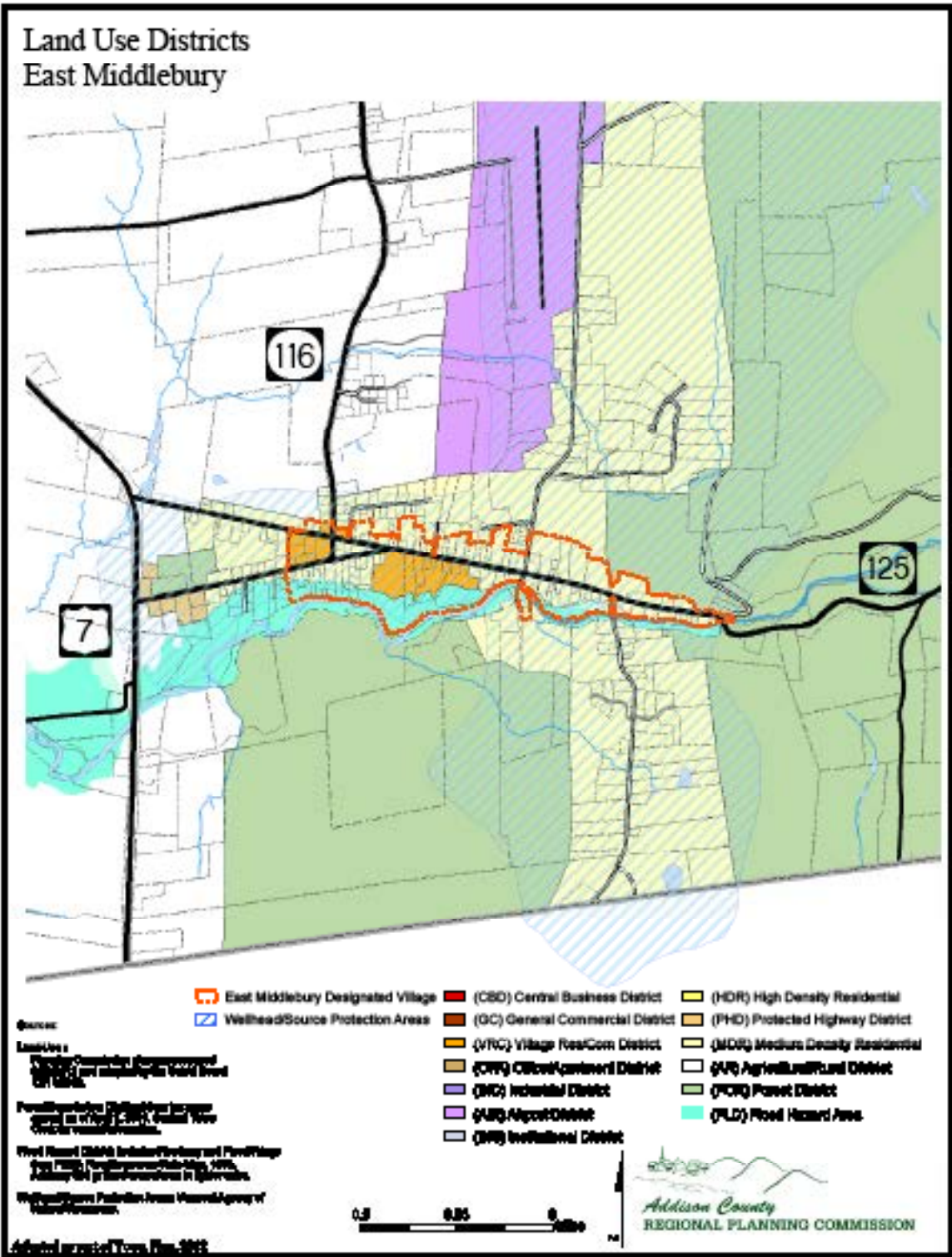
TABLE 1-1-1 FLD - Flood Hazard Area





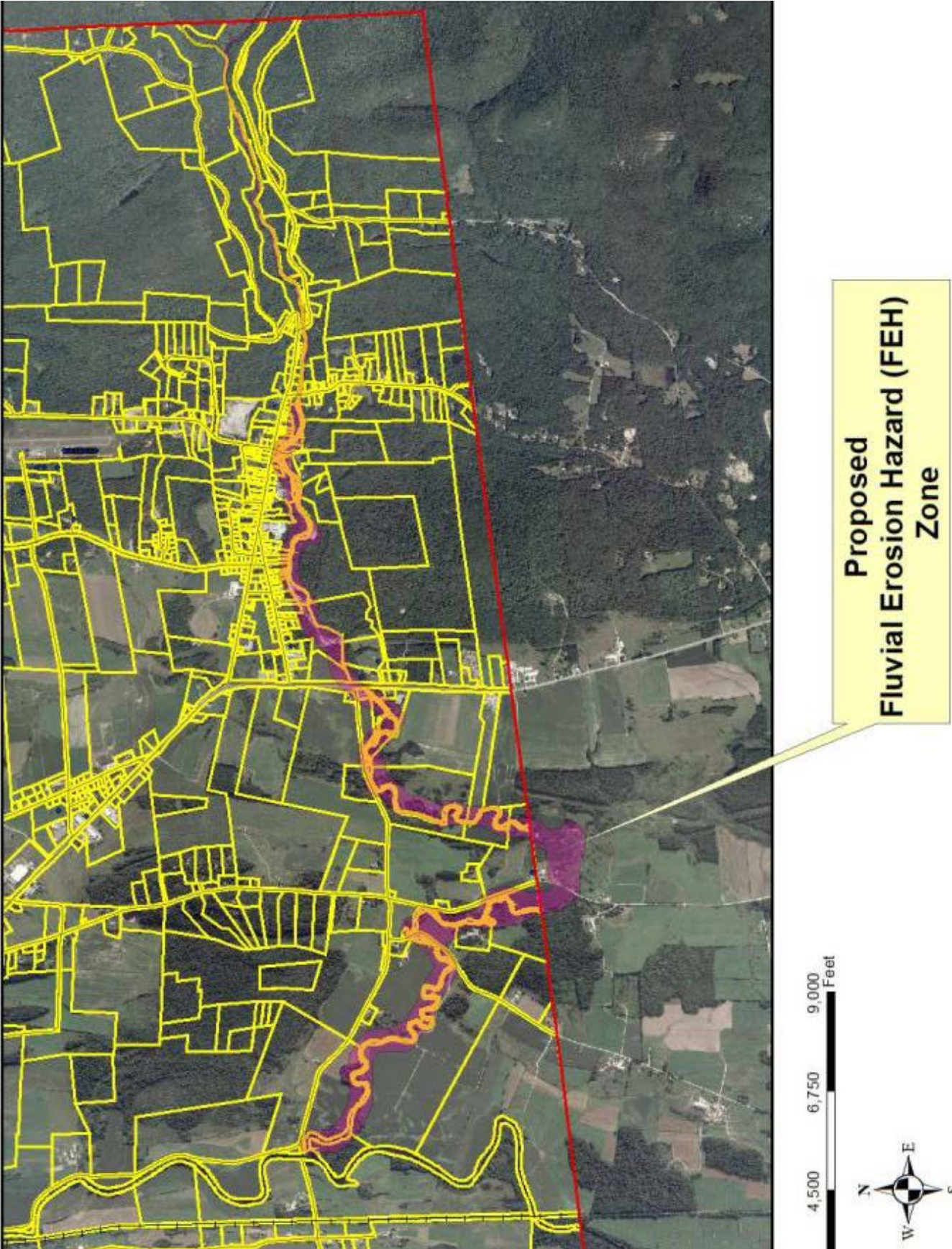
# East Middlebury Village Area Land Use Districts Map

TABLE 1-1-1 FLD - Flood Hazard Area

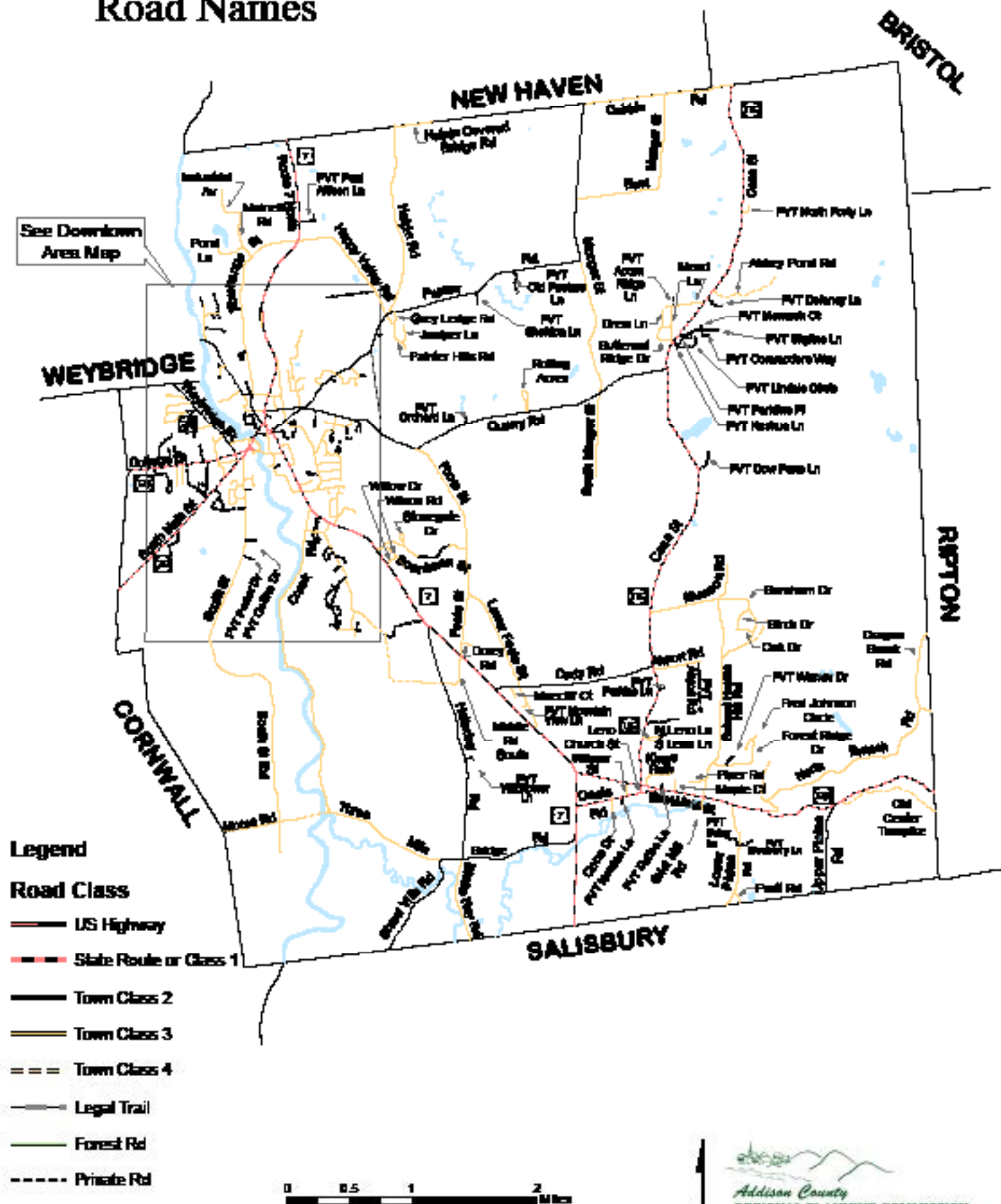




Fluvial Erosion Hazard Zone Map

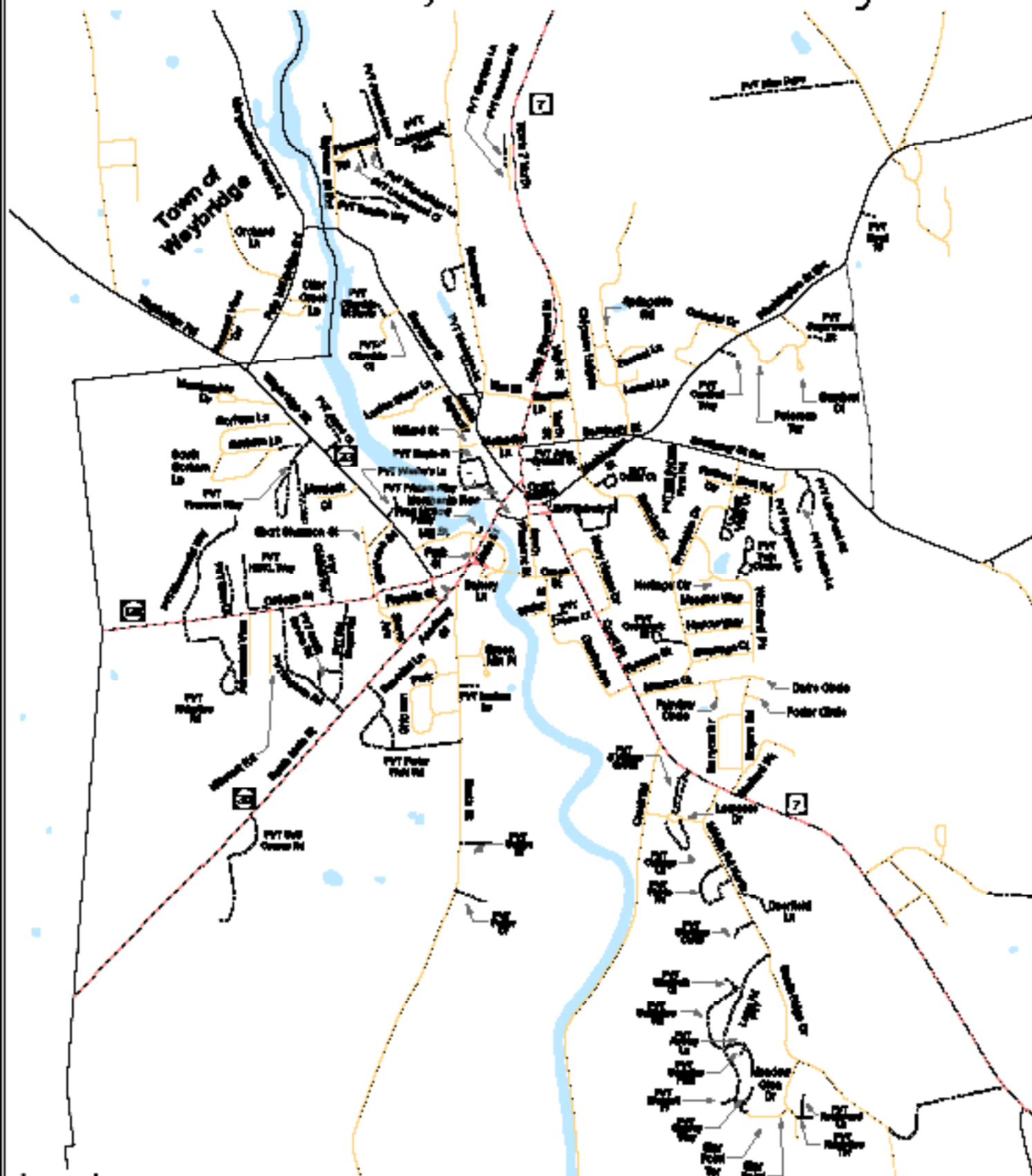


## Town of Middlebury Road Names





# Downtown Area, Town of Middlebury



## Legend

- |                          |                |
|--------------------------|----------------|
| — US Highway             | — Town Class 4 |
| — State Route or Class 1 | — Legal Trail  |
| — Town Class 2           | — Forest Rd    |
| — Town Class 3           | — Private Rd   |

0 0.125 0.25 0.5  
Miles

ACRPC 1/28/13

Addison County  
REGIONAL PLANNING COMMISSION

CERTIFICATE OF ADOPTION

<<DATE>>

**TOWN OF MIDDLEBURY, VERMONT**  
**A RESOLUTION ADOPTING THE TOWN OF MIDDLEBURY, VERMONT HAZARD MITIGATION PLAN**

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

WHEREAS, the Town of Middlebury has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its **Town of Middlebury, Vermont Hazard Mitigation Plan (Plan)** under the requirements of 44 CFR 201.6; and

WHEREAS, the **Plan** specifically addresses hazard mitigation strategies, and Plan maintenance procedures for the Town of Middlebury; and

WHEREAS, the **Plan** recommends several hazard mitigation actions (projects) that will provide mitigation for specific natural hazards that impact the Town of Middlebury with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this **Plan** will make the Town of Middlebury eligible for funding to alleviate the impacts of future hazards;

Now therefore, be it RESOLVED by the Selectboard of the Town of Middlebury, Vermont:

1. The **Town of Middlebury, Vermont Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of Middlebury, Vermont;
2. The respective officials identified in the action plan contained within this **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution.

ADOPTED this 12<sup>th</sup> day of January 2016 by the Town of Middlebury Selectboard.

  
\_\_\_\_\_  
Selectboard Chair

  
\_\_\_\_\_  
Selectboard Member

ATTEST:

  
\_\_\_\_\_  
Town Manager

## **Appendix F.** Public process documentation (minutes, reports)

[see attached](#)