

# *Town of Cavendish, Vermont: All Hazard Mitigation Plan*

Adopted \_\_\_\_\_

*Prepared by the Town of Cavendish and Southern  
Windsor County Regional Planning Commission*

**2015-2020**

DRAFT

Town of Cavendish 2015-2020 All Hazard Mitigation Plan  
\_\_\_\_\_ 2015

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**CERTIFICATE OF ADOPTION**

Town of Cavendish, VT  
Selectboard

**A Resolution Adopting the  
Town of Cavendish 2015-2020 All Hazard Mitigation Plan**

WHEREAS, the Town of Cavendish has worked with the Southern Windsor County Regional Planning Commission to prepare an updated hazard mitigation plan for the town, to identify natural hazards, analyze past and potential future damages due to natural and man-made caused disasters, and identify strategies for mitigating future damages; and

WHEREAS, duly-noticed public meetings were held by the Cavendish Selectboard on \_\_\_\_\_ to present and receive public comment on the draft Plan; and

WHEREAS, the updated 2015-2020 Cavendish All Hazard Mitigation Plan was submitted to the Division of Emergency Management and Homeland Security and the Federal Emergency Management Agency for review on \_\_\_\_\_; and

NOW, THEREFORE BE IT RESOLVED that the Town of Cavendish Selectboard hereby adopts the 2015-2020 Cavendish All Hazard Mitigation Plan for municipal use and implementation.

Duly adopted this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

Cavendish Selectboard:

\_\_\_\_\_  
Chair, Cavendish Selectboard

\_\_\_\_\_  
Member

\_\_\_\_\_  
Member

\_\_\_\_\_  
Member

\_\_\_\_\_  
Member

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## **1. INTRODUCTION**

The goal of this stand-alone Hazard Mitigation Plan is to help the community identify risks and provide local mitigation strategies it can take to make Cavendish more disaster resilient.

### *What is Hazard Mitigation?*

Hazard mitigation is an action taken to reduce or eliminate the long-term risk to human life and property from both natural and man-made hazards. The work done to minimize the impact of hazard events to life and property is called Hazard Mitigation Planning.

## **2. PURPOSE**

The Federal Emergency Management Agency (FEMA), the Vermont Division of Emergency Management and Homeland Security (DEMHS), and local towns have come to recognize that it is less expensive to prevent disasters than to repeatedly repair damage after a disaster has struck. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where the hazards are most severe, what is most likely to occur and identify what local actions can be taken to reduce the severity of the hazard and reduce their impacts on the community.

Hazard mitigation planning and strategies include the following benefits:

- structural or land improvements
- increased public education and awareness of hazards
- altering the hazard area to remove the hazard occurrence
- reducing the hazard frequency through structure or land treatment
- increased community support for specific actions to reduce future losses
- reduction in financial and physical losses caused by hazard events
- eligibility for hazard mitigation grants and aid
- strengthened partnerships

The Town of Cavendish All Hazard Mitigation Plan is a stand-alone plan to assist the town in identifying hazards within the town and identify strategies to reduce or eliminate these hazard risks.

Previously, the Town of Cavendish All Hazard Mitigation Plan was an annex to the Southern Windsor County Regional Planning Commission Multi-Jurisdictional All Hazard Mitigation Plan. The updated plan is intended to serve as a 'stand-alone' plan for the Town of Cavendish and will focus on the hazards and mitigation programs best suited for the town.

A partial list of revisions that have been made include:

- Reorganization/restructuring of the plan
- Reevaluation of hazards using new methodology
- Update of data, tables and charts
- Review and update status of mitigation strategies
- Incorporation of new state initiatives on river corridor and fluvial erosion mitigation
- Identification of current mitigation strategies
- Maps

### **3. TOWN PROFILE**

The Town of Cavendish is located within Windsor County in southeastern Vermont, bordered by the towns of Weathersfield, Reading, Plymouth, Ludlow, Chester and Baltimore. Regional highways, including VT Routes 131 and 103, connect with large population areas outside Cavendish. VT Route 103 and VT Route 131 are part of the National Highway System and are utilized by many heavy trucks traveling through the town. A short segment of VT Route 106 runs through the northeastern corner of Cavendish. Evacuation routes are detailed in the Cavendish Basic Emergency Operations Plan.

The Green Mountain Railroad runs through Cavendish on the route that extends from Bellows Falls to Rutland. Currently the tracks are used mainly for freight traffic, although an excursion train, the Green Mountain Flyer, runs from Bellows Falls to Ludlow during the fall foliage season.

Current land use in the Town of Cavendish follows patterns of traditional Vermont villages. The villages of Cavendish and Proctorsville have a mixture of commercial, industrial, residential uses, and services such as post offices, health care, the elementary school and municipal offices. The village centers are served by municipal water and sewer service, while outlying areas are served by private wells and on-site septic systems. Residential areas outside the village centers are primarily rural in nature, and of low- or moderate-density.

The majority of the land area in the town is forested, much of which is owned by the State. Steep slopes, undeveloped ridgelines and large wetland areas not only add to the scenic beauty of the landscape, but are also important habitat areas for deer, moose and bear. Although only one dairy farm is still in operation in the town, many open fields and agricultural lands are also important assets to the town and add to its rural character.

Of Cavendish's 25,140 acres, 1,766 acres are pasture land, 971 are crop land and 18,826 are forested. The remaining 3,577 acres have been developed for residential, commercial, industrial or other planned uses. Of the forested lands, roughly 4,040 acres are state-owned lands – 2,420 acres by the Department of Fish and Wildlife and 1,620 by the Department of Forests, Parks and Recreation.

The climate is generally temperate with moderately cool summers and cold winters; as in the rest of Vermont. Average annual precipitation is around 40 inches, and snowfall generally ranges from a minimum of 70 inches to as much as 200 inches in the Green Mountains. The weather is unpredictable, and large variations in temperature, precipitation, and other conditions may occur both within and between seasons.

Elevations in town rise to a high point of 2,092 feet at the summit of Hawks Mountain near the Baltimore town line. The Black River runs easterly along Route 131 through the Village Centers of Cavendish and Proctorsville, to the confluence with Twenty Mile Stream, a major tributary which drains from the north.

The U.S Census Bureau indicates a 2010 population of 1,367, resulting in a -7% percent growth rate since the 2000 census. This is significantly lower than the -1.3% percent growth rate for Windsor County and significantly lower than the 2.8% growth rate for the state during the same period. The negative growth rate coupled with adopted regulatory tools prevent future development in identified hazard areas. Although a decrease in development has occurred, mitigation priorities remain unchanged.

The ongoing growth and expansion of Okemo Mountain Resort and other ski areas may put some development pressure on the town of Cavendish. In light of this development pressure, the residents of

Cavendish have expressed a desire to maintain traditional patterns of development in the town; although there are no zoning bylaws or subdivision regulations in effect in Cavendish at this time.

#### **4. PLANNING PROCESS**

The local planning process used to develop this hazard mitigation plan follows guidance by the Federal Emergency Management Agency (FEMA) and the Vermont Division of Emergency Management and Homeland Security (DEMHS). Beginning in the spring of 2014, Southern Windsor County Regional Planning Commission (SWCRPC) staff reviewed the 2013 Cavendish All Hazard Mitigation Plan, which at the time was an annex to the 2012 Southern Windsor County Regional Planning Commission Multi-Jurisdictional All Hazard Mitigation Plan to identify key areas for updates. The State of Vermont also recently adopted an updated Hazard Mitigation Plan in November of 2013 (Vermont HMP 2013), which was consulted during this update.

##### **4.1 Public Process**

The Town of Cavendish in partnership with the Southern Windsor County Regional Planning Commission established a plan of completion for the Cavendish All Hazard Mitigation Plan which included public meetings to discuss and complete the following:

- Complete hazard analysis and hazard extent
- Review hazard history and identify additional data to be included
- Review plan and identify mitigation strategies to address each high hazard
- Review past completed or on-going mitigation projects and actions
- Identify new mitigation projects and actions

##### **4.2 Plan Update Process**

On October 1<sup>st</sup> 2014, SWCRPC staff met with the Cavendish Planning Commission to begin the town process for this plan.<sup>1</sup> Participants discussed the purpose and timeline for updating the plan and groups/individuals that should be invited to meetings and made aware of the plan update. Most were familiar with the process, as the previous plan had been adopted only two years prior. Changes discussed with the Town included new grouping of some hazards, new identified hazards, and new methodology for assessing and scoring each hazard which is described below in Section 5.1- Hazard Identification and Analysis. Attendees of the meeting collaborated in creating the hazard analysis seen in **Table 2: Hazard Identification and Analysis**. Hazards scoring a 6 are identified but not covered in this plan.

In the winter of 2014-2015, SWCRPC staff reviewed and edited the previous version of the Hazard Mitigation Plan to continue the rewriting process. Revisions in this plan include updates to the town profile section; all data charts, tables and maps; incorporation of hazard events that occurred since the last plan revision, and integration of new relevant reports and documents including the Black River Phase 1 and Phase 2 Stream Geomorphic Assessments, Black River Corridor Management Plan, and the proposed draft update of the Town of Cavendish-Flood Hazard Area Regulations.

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<sup>1</sup> See Sign-in sheet 10.1, Agenda 10.1, Minutes 10.1

Following the draft edits completed by SWCRPC, a publicly noticed meeting was held at Cavendish Town Hall on March 25, 2015<sup>2</sup>. SWCRPC opened the meeting with a review of the prior plan and major changes in the update. Those present, including members of the Town Hazard Mitigation Committee, discussed the current status of each of the Hazard Mitigation and Preparedness Project and Actions identified in the previous plan, updated the list of Resources for Hazard Mitigation, and discussed recovery projects from Tropical Storm Irene, other current mitigation efforts and foremost hazard concerns. The group reviewed mitigation ideas from the FEMA Mitigation Ideas guidebook, the Black River Corridor Management Plan and earlier planning discussions. New potential future strategies were identified, discussed and selected based on their feasibility and effectiveness in reducing hazard impact.

SWCRPC incorporated input from this meeting into a revised draft plan which was submitted to the Planning Commission for review and comment prior to their meeting on April 1, 2015.<sup>3</sup> Planning Commission member comments were discussed and incorporated into the draft. This revised draft plan was distributed to the Cavendish Selectboard for review on April 3, 2015, prior to their meeting on April 13, 2015. Simultaneously, the revised draft plan was put out for public comment and review by adjacent towns. This was done by posting an electronic copy on the town and SWCRPC websites and having a hard copy of the plan advertised and made available at the town office. The draft was distributed to adjacent towns for comment via email. **Yes/No** comments were received from the public.

Input was solicited by SWCRPC staff through meetings, email and digital postings in order to reach as many members of the community as possible including members of the Cavendish Planning Commission, Selectboard, Town Manager, Emergency Management, Fire Department Chief, town personnel, school principal, and members of the Cavendish public and surrounding towns. The meeting agendas included a section by section review of the previous plan with an emphasis on identifying the highest hazards facing the town and mitigation actions specific to the town. The previous version of the Cavendish Hazard Mitigation Plan, Cavendish Town Plan and the recently updated SWCRPC Regional Plan, were provided as examples to facilitate the discussion.

Participants were given an opportunity to voice their concerns and discuss areas of town most likely to be affected by these hazards, and comment on future goals and mitigation strategies that may be undertaken to reduce the risk of future harm and cost to the town. Changes in priorities, development, and local mitigation efforts were also considered throughout the revision process. The implementation schedule at the end of this document in **Table 8**, reflects the **2015-2020 Mitigation and Preparedness Actions and Projects** as determined during this process. Following the meetings, SWCRPC staff made the revisions and drafted a new, updated plan which is available for review at the Cavendish Town Office and posted on the SWCRPC website ([www.swcrpc.org](http://www.swcrpc.org)). The final adopted Cavendish Local Hazard Mitigation Plan will also be posted on the SWCRPC website and available at the Cavendish Town Offices.

**Table 1** below lists the mitigation and preparedness projects and actions from the previous 2013 Multi-Jurisdictional All Hazard Mitigation Plan for Cavendish. Mitigation actions, listed in order of priority set at that time, are shown here with an additional column to indicate the status of each as identified by the Town. Some not-completed actions have been reevaluated and incorporated into the 2015-2020 Projects and Actions at the end of this document.

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<sup>2</sup> See Sign-in sheet 3.25, Agenda 3.25

<sup>3</sup> See Sign-in sheet 4.1, Agenda 4.1

**Table 1: Status on Past Plan Mitigation and Preparedness Projects and Actions**

MITIGATION ACTION	TYPE OF ACTION	HAZARD ADDRESSED	RESPONSIBLE PARTY	TIME FRAME	FUNDING SOURCE	STATUS
Upsize and replace culverts known undersized culverts	Mitigation	Flooding, Transportation Disruption	Road Foreman, Town Manager	Annually	Town Budget	On-going
Develop a hazardous materials response plan	Preparedness	Hazardous Material Incident, Earthquake	Fire Departments, SWCRPC	2013-2015	SWCRPC EMPG funds	Completed, Updates are ongoing
Provide back-up power supply for town EOC/Shelter	Preparedness	High Wind, Severe Winter Weather	Emergency Management, Town Manager, Selectboard Chair	2012-2015	HMGP, VEM Generator Grant	Needs Funding
Identify high hazard trees and remove to reduce power outages	Mitigation / Preparedness	High Wind, Severe Winter Weather	Town Manager, GMP, Tree Warden	2014-2018	Utilizing Existing Town Resources	On-going/Needs structured scheduling
Purchase land along Winery Road for flood storage	Mitigation	Flooding	Town Manager	2012-2016	HGMP, PDM-C	Reconsidered/ Not Needed
Revise flood hazard regulations to include data from River Corridor Studies	Mitigation	Flash Flooding	Town Manager, Planning Commission, SWCRPC	2012-2014	Utilizing Existing Town Resources, SWCRPC	Completed/ New FHR, to be adopted 2015, includes river corridor overlay and flood resiliency measures
Retrofit critical facilities for greater protection from earthquake, high winds, and snow load capacity	Mitigation	Earthquake, High Winds, Winter Weather	Town Manager, Selectboard Chair	2014-2019	HMGP, Town Capitol Budget	Not Done Reconsidered, Low priority Hazards
Provide outreach materials on safe home heating during winter	Mitigation	Structure fire	Selectboard, SWCRPC	2013-2015	Utilizing Existing Town Resources	Completed, procedures in place, Ongoing

Review SWCRPC Commodity Flow Study for incorporation into response planning	Mitigation	Hazardous Materials, Transportation Disruption	Fire Departments, Town Manager, Road Foreman, SWCRPC	2013	Utilizing Existing Town Resources	Not yet done
Participation by the town in Firewise programs is recommended	Mitigation	Wildfire, Structure Fire, Severe Winter Weather	Selectboard, Fire Departments	2013	Utilizing Existing Town Resources	Completed for Schools, Ongoing
Provide Firewise 'Be Firewise Around Your Home' brochure to property owners	Mitigation	Structure fire, Wildfire	Fire Departments	Ongoing	Utilizing Existing Town Resources	Completed for schools, Ongoing
Install additional dry hydrants as needed	Mitigation	Structure fire, Wildfire	Emergency Management Director, Fire Departments, Selectboard	2014-2015	Town budget, dry hydrant grant program	# Dry Hydrants Installed/ Ongoing
Tie down all non-anchored structures	Mitigation	Earthquake, High Wind, Flood	Homeowners, Planning Commission	2013-2015	Utilizing Existing Town Resources	Addressed in Revised FHR to be adopted 2015
Develop a policy to ensure all non-secure propane tanks are tied down	Mitigation	Earthquake, Flooding	Selectboard, Planning Commission	2012-2014	Utilizing Existing Town Resources	Addressed in Revised FHR to be adopted 2015

#### **4.3 Plan Maintenance Process**

The future method for monitoring and evaluating the Cavendish All Hazard Mitigation Plan includes annual meetings of the identified Hazard Mitigation Review Committee in partnership with the SWCRPC. The purpose of these meetings will be to continue to identify hazards which may threaten structures and property within the town and to review the mitigation strategies included within this plan. The mitigation strategies will be reviewed annually to ensure that appropriate actions are being followed and budgeted for as necessary. These efforts will be coordinated by the Emergency Management Director and Town Manager. An effort will be made to involve representatives from the Town Selectboard, Planning Commission, Cavendish and Proctorsville Volunteer Fire Department, along with local volunteer boards and interested members of the public, including local business owners. In addition, neighboring communities will be pointed to where draft versions can be found for review and comment.

Additional outreach will continue to garner input from community members and businesses which have not been included in previous hazard mitigation planning efforts. The Town of Cavendish and SWCRPC recognize the importance of public participation in hazard mitigation planning and will continue to provide opportunities for public comment and review during future plan revisions and updates.

The Hazard Mitigation Committee will be responsible for monitoring this plan to ensure that specific mitigation actions are implemented as resources or opportunities become available. This includes the identification and application for additional funding opportunities. The Hazard Mitigation Committee will also be responsible for reviewing the plan to ensure proposed mitigation actions remain in line with current town goals, strategies, and policies.

Four years into the five year plan revision process, the SWCRPC and Local Emergency Planning Committee 3 (LEPC3) will assist the Cavendish Hazard Mitigation Committee in revising and updating this plan to incorporate issues which have been identified during the ongoing mitigation meetings. The Cavendish All Hazard Mitigation Plan update process will begin in July 2019 assuming a July 2015 plan adoption, with the first public meeting of the Hazard Mitigation Committee. All public meetings will be warned following town protocols.

Following the meeting, a draft plan will be made available for public comment. The plan will be available on the SWCRPC website [www.swcrpc.org](http://www.swcrpc.org), Cavendish town website <http://www.cavendishvt.com/>, and paper copies will be available at the town office. A second publicly warned meeting will be held no later than November 2019 in which any substantial revisions gathered during the public input period will be discussed. The SWCRPC will make all necessary edits to the plan and provide the Hazard Mitigation Committee with a revised version for final review. Subsequently, the plan will be sent to the Vermont State Hazard Mitigation Officer for referral to FEMA for Approval Pending Adoption (APA). Following APA, the town may then adopt the Cavendish All Hazard Mitigation Plan and forward a copy of the adoption resolution for FEMA to complete the plan approval and adoption process.

## **5. RISK AND VULNERABILITY ASSESSMENT**

The following assessment addresses the Town of Cavendish's vulnerability to all of the hazards identified by the Hazard Mitigation Committee during the hazard analysis. The likelihood of occurrence and impact to the town were used to assess the town's vulnerability to each hazard.

### **5.1 Hazard Identification and Analysis**

A hazard vulnerability assessment for the town began with an inventory of all possible hazards, both natural and man-made. The assessment considers the frequency of occurrence, the anticipated amount of warning time and potential impact to the community of each hazard to determine the relative risk each poses. The ranking methodology used for the analysis ranked the frequency of occurrence, warning time, and potential impact on a scale from 1 to 4, as detailed below the table. The overall hazard score provided is a sum of these scores. For this plan, the hazards which ranked a seven or greater were considered for inclusion and additional information. Some hazards discussed in the previous plan were identified as low vulnerability and rare occurrence to the town. These hazards, which scored below seven, are not covered in the plan but may still occur. The results of this analysis is shown in **Table 2: Cavendish Hazard Identification and Analysis** on the next page.

A discussion of each of these hazards is given in the proceeding subsections including regional and local data records with a narrative description and its historical impact on Cavendish.

**Table 2: Cavendish Hazard Identification and Analysis**

[C11]

\*Note: We have defined 'Severe Weather' to include two or more of the above hazards.

Hazard	Frequency of Occurrence	Warning Time	Potential Impact	Hazard Score	Section
Flash Flood/Inundation Flood/Fluvial Erosion	3	4	3	<b>10</b>	5.2b
Severe Weather (Thunderstorm, Lightning, High Wind, Hail, and Flooding)*	3	2	2	<b>7</b>	5.2e
Hurricane/Tropical Storm	3	1	4	<b>8</b>	5.2c
Wildfire	2	4	2	<b>8</b>	5.2a
Bushfire	3	4	3	<b>10</b>	5.2a
Structural Fire	4	4	4	<b>12</b>	5.2a
Dam Failure	3	3	3	<b>9</b>	5.2f
Ice Jams	3	3	2	<b>8</b>	5.2d
Extreme Cold/Snow/Ice Storm	4	1	2	<b>7</b>	5.2i
Microburst/Tornado	2	4	3	<b>9</b>	5.2c,5.2e
Hazardous Material Spill	3	4	2	<b>9</b>	5.2g
Transportation Incidents	Considered a Low Hazard / scored <7				
Landslides/Mudslides/Rockslides	Considered a Low Hazard / scored <7				
Drought	Considered a Low Hazard / scored <7				
Water Supply Contamination	Considered a Low Hazard / scored <7				
Earthquake	Considered a Low Hazard / scored <7				

## Methodology Used For Hazard Analysis

- Frequency of Occurrence
  - 1 = Unlikely
    - <1% probability of occurrence in the next 100 years (less than 1 occurrence in 100 years)
  - 2 = Occasionally
    - 1-10% probability of occurrence per year, or at least 1 chance in the next 100 years (1 to 10 occurrences in 100 years)
  - 3 = Likely
    - >10% but <100% probability per year (at least 1 chance in the next 10 years)
  - 4 = Highly Likely
    - 100% probable in a year (annual occurrence)
- Warning Time
  - 1 = More than 12 hours
  - 2 = 6 – 12 hours
  - 3 = 3 – 6 hours
  - 4 = None / Minimal
- Potential Impact
  - 1 = Negligible
    - Isolated occurrences of minor property damage, minor disruption of critical facilities and infrastructure, and potential for minor injuries
  - 2 = Minor
    - Isolated occurrences of moderate to severe property damage, brief disruption of critical facilities and infrastructure, and potential for injuries
  - 3 = Moderate
    - Severe property damage on a neighborhood scale, temporary shutdown of critical facilities, and/or injuries or fatalities
  - 4 = Severe
    - Severe property damage on a town-wide or regional scale, shutdown of critical facilities, and/or multiple injuries or fatalities

## 5.2 Detailed Hazard Analysis

While the town may be affected by many hazards, the detailed hazard analysis and potential loss estimates listed in this plan have been identified as having a ‘high’ likelihood of occurrence within Cavendish. The types of hazards having the greatest impact can be gleaned from **Table 3**, a listing of **FEMA Disaster Declarations for Windsor County** since 1990.

Less significant hazards did not have occurrence frequencies or levels of impact that would necessitate a more detailed level of analysis. Human losses are also not calculated in this plan, but may be expected to occur depending on the type and severity of the hazard.

The following hazards have been identified as having a relatively ‘high’ total impact score based on the methodology above:

<u>SCORE</u>	<u>HAZARD</u>
12	Structural Fire
10	Flash Flood / Inundation Flood / Fluvial Erosion
10	Brush Fire
9	Microburst/Tornado
9	Hazardous Material Spill
9	Dam Failure
8	Wildfire
8	Hurricane/Tropical Storm
8	Ice Jams

When possible, previous occurrence data specific to Cavendish has been provided, however, for all high hazards this was not possible and the best available information has been provided. Throughout the life span of this Cavendish All Hazard Mitigation Plan, both the town and the SWCRPC will strive to continually gather local hazard information.

**Table 3: Federal Disaster Declarations for Windsor County VT**

Federal Disaster Declarations: Windsor County 1990 – 2015 (2/13)		
FEMA Disaster Number	Date of Declaration	Description
4207	February 3, 2015	Severe Winter Storm
4140	August 2, 2013	Severe Storms and Flooding
4120	June 13, 2013	Severe Storms and Flooding
4066	June 22, 2012	Severe Storm, Tornado, and Flooding
4043	November 8, 2011	Severe Storms And Flooding
4022	September 1, 2011	Tropical Storm Irene
4001	July 8, 2011	Severe Storms And Flooding
1995	June 15, 2011	Severe Storms And Flooding
1951	December 22, 2010	Severe Storm
1790	September 12, 2008	Severe Storms and Flooding

1784	August 15, 2008	Severe Storms, Tornado, and Flooding
1778	July 15, 2008	Severe Storms and Flooding
1715	August 3, 2007	Severe Storms and Flooding
1698	May 4, 2007	Severe Storms and Flooding
1559	September 23, 2004	Severe Storms and Flooding
1488	September 12, 2003	Severe Storms and Flooding
1428	July 12, 2002	Severe Storms and Flooding
1358	January 18, 2001	Severe Winter Storm
1336	July 27, 2000	Severe Storms And Flooding
1307	November 10, 1999	Tropical Storm Floyd
1228	June 30, 1998	Severe Storms and Flooding
1184	July 25, 1997	Excessive Rainfall, High Winds, Flooding
1124	June 27, 1996	Flooding
1101	February 13, 1996	Storms and Flooding
1063	August 16, 1995	Heavy Rain, Flooding
990	May 12, 1993	Flooding, Heavy Rain, Snowmelt
938	March 18, 1992	Flooding, Heavy Rain, Ice Jams
875	July 25, 1990	Flooding, Severe Storm

#### ***a) Structural Fire and Wildfire/Brush Fire***

Fires, including structure fires, wildfires and brushfires, were identified during the hazard analysis and vulnerability assessment as relatively high hazards to the Town of Cavendish with scores of 12, 10 and 8, respectively.

**Structural fires** were specifically identified as having the highest possible risk to the town, with a Score of 12, due to their high probability of occurrence, short warning time and potential for catastrophic loss. Structure fires are common throughout Vermont during the winter months as residents heat their homes with wood or wood pellet burning stoves. With little or no warning, these fires can affect a single residential structure or spread to other homes, businesses or apartment complexes and can result in loss of property and life.

In Vermont, during 2013, there were 45,689 emergency incidents to which fire departments responded. National Fire Protection Association (NFPA) estimates show, while residential structure fires account for only 25 percent of fires nationwide, they account for a disproportionate share of losses: 83 percent of fire deaths, 77 percent of fire injuries, and 64 percent of direct dollar losses.

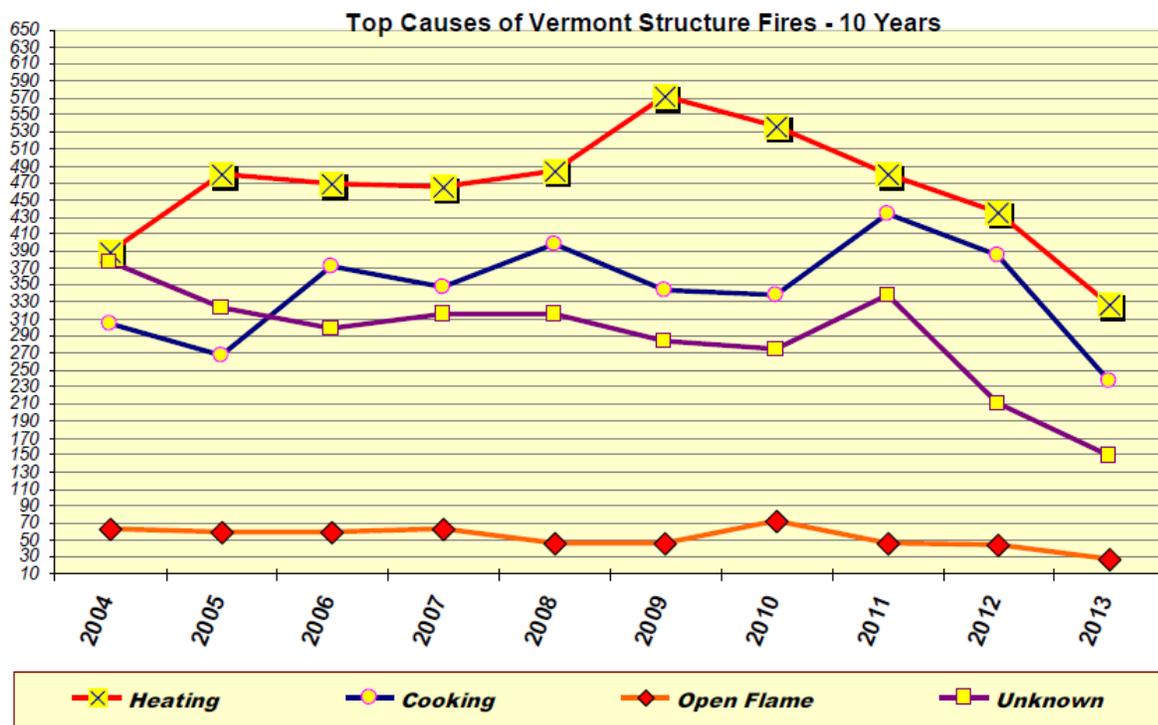
According to the 2013 Vermont Annual Fire Marshal Report, although the fire death rate in Vermont has improved significantly over the past few years, historically, it has been disproportionately high based on population. This is due, in part, to the large percentage of residents that live in small rural communities where emergency response time is delayed. Other characteristics of Vermont that lend toward greater loss from fire compared to other states are-

- 2<sup>nd</sup> highest percent of housing built before 1940
- 7<sup>th</sup> coldest state
- 2<sup>nd</sup> oldest median age where elderly are at higher risk

- 1<sup>st</sup> for per capita use of wood for heating

In 2013, Vermont reported a total of 2,739 incidences relating to structure and wildland (forest and brush) fires, 77% of which were structural fires. The leading cause of structure fires in Vermont are the result of heating incidents (39%) followed closely by cooking incidents (28%). Windsor County reported a total of 315 related fires, 73% of which were structure fires. Fires can be caused by improperly disposing of ashes with live coals from wood stoves or by faulty electrical wiring. The most significant common factor in fire fatalities in Vermont continues to be the absence of a functioning smoke detector in the sleeping area of residential structures.

The chart below depicts the top causes of Vermont Structure Fires over a 10 year period, which clearly shows Vermont heating is the number one cause of structure fires followed by cooking.<sup>4</sup>



**Wildland Fires**, which include forest, brush, crop or grassland fires, are relatively uncommon events in the State of Vermont, particularly large wildfire events. A wildfire is defined as ‘An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.’<sup>5</sup>

The State Hazard Mitigation Plan’s analysis of wildfire threat states that “Wildfire conditions in Vermont are typically at their worst either in spring when dead grass and fallen leaves from the previous year are dry and new leaves and grass have not come out yet, or in late summer and early fall when that year’s growth is dry”.

In addition to precipitation, a particular town’s vulnerability to large wildfires is directly related to the proportion and continuity of acreage that is forested, pasture and cropland. In Cavendish, this represents

<sup>4</sup> 2013 Vermont Annual Report of the State Fire Marshal

<sup>5</sup> 2013 Vermont Annual Report of the State Fire Marshal

86% of total town land cover. It can be anticipated that small brush and wildfires will continue to occur throughout the Town of Cavendish at a similar rate in coming years, however, given the current land cover and correct seasonal conditions the threat of a large wildfire remains. Uncontrolled surface wildfires that endanger either the Village of Cavendish or Proctorsville would be the worst anticipated wildfire event within the Town of Cavendish. The Hawk Mountain Wildlife Management Area and the Proctor/Piper State Forest are within close proximity to both village areas and present a large, uninterrupted source of wildfire fuel.

Both structure fires and wildland fires are reported in the annual Vermont State Fire Marshal Report which provides yearly fire statistics from reporting departments and by county. Windsor County Fire Responses are shown in **Table 4**. The Town of Cavendish has two departments, Cavendish and Proctorsville. Fire responses for each are shown below in **Table 5**.

**TABLE 4: ‘Annual Report of the State Fire Marshal’ for Windsor County<sup>6</sup>**

YEAR	Windsor County		
	Structure Fire Responses	Wildland Fire Responses	Total
2009	177	68	245
2010	181	70	251
2011	181	70	251
2012	201	101	302
2013	229	86	315

**TABLE 5: ‘Annual Report of the State Fire Marshal’ for Cavendish Reporting Fire Departments<sup>7</sup>**

YEAR	STRUCTURE FIRE RESPONSES			WILDLAND FIRE RESPONSES			TOTAL FIRE RESPONSES
	Cavendish FD	Proctorsville FD	Total	Cavendish FD	Proctorsville FD	Total	
2007	2		2	2		2	4
2008	8		8	4		4	12
2009	2	8	10	1	0	1	11
2010	4	10	14	1	5	6	20
2011	5	12	17	9	11	20	37
2012	3	14	17	7	6	13	30
2013	1	8	9	3	3	6	15

Cavendish currently participates in *Firewise*, a community outreach program through the National Fire Protection Association provides guidance, resources, and training on protecting homes and property from wildfire hazards. The *Firewise* program “teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action now to prevent losses.” The *Firewise* website

<sup>6</sup> Vermont Annual Report of the State Fire Marshal

<sup>7</sup> Vermont Annual Report of the State Fire Marshal

([www.firewise.org](http://www.firewise.org)) is an excellent resource for literature and community mitigation actions to follow[C12]. Also, the Annual Fire Marshal Report offers informational resources for property owners.

### **b) Flash Flood/Flood/Fluvial Erosion**

Flash floods and Fluvial Erosion are significant natural hazard events in the Town of Cavendish, and Windsor County, including inundation flooding events, ice jams, and potential dam failures. The town is susceptible to both flash flooding, frequently caused by summer thunderstorms and spring snow runoff, and the fluvial erosion which often accompanies these events. Flash flooding is further aggravated by fluvial erosion from previous damaging flood events. The damage from spring flooding events can vary greatly depending upon the amounts of precipitation, snow cover, spring melt, soil saturation, existing erosion and topography.

**Flash flooding** typically occurs during summer when a large thunderstorm or a series of rain storms result in high volumes of rain over a short period of time. Higher-elevation drainage areas and streams are particularly susceptible to flash floods. The National Weather Service describes a flash flood as:

*“A flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through river beds, urban streets, or mountain canyons sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam<sup>8</sup>”.*

The 2012 SWCRPC Multi-Jurisdictional All Hazard Mitigation Plan provides a detailed history of past flooding. **Table 3** above shows FEMA Disaster Declarations for Windsor County from 1990-2015. The table shows that, of the 28 disaster declarations for Windsor County, 25 were related to flooding. Not all of these events had an impact on Cavendish and some less severely than on other towns.

The Federal Emergency Management Agency (FEMA) has designated floodplain areas along the Black River main stem, Twenty Mile stream, and other small streams and river tributaries. Vermont Agency of Natural Resources has recently mapped river corridors for these stream segments along with special flood hazard areas which can be found on-line.<sup>9</sup> The river corridor for the Black River has been recently mapped and is shown on **Map #5: Water Resources**. Areas within the 100-year flood zone lie mainly along the Black River and Twenty-Mile Stream. There are some small areas of a 500-year flood zone along the Black River as well.

Currently, Cavendish is a participatory, non-sanctioned member of the National Flood Insurance Program and regulates development in the floodplain through the enforcement of the Town of Cavendish Flood Hazard Area Regulations. Cavendish is currently in the final stages of updating these regulations to include the recently mapped Black River Corridor overlay and a stronger focus on flood resiliency. These new FHA regulations are expected to be adopted in 2015.

For the Town of Cavendish, damage from a 100-year flood is influenced by the following factors:

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<sup>8</sup> National Weather Service <http://www.srh.noaa.gov/mrx/hydro/flooddef.php>

<sup>9</sup> The ANR FLOOD READY link below shows river corridors overlays comparable to FEH zones [http://maps.vermont.gov/ANR/Html5Viewer/Index.html?configBase=http://maps.vermont.gov/Geocortex/Essentials/ANR/RES/T/sites/Focus\\_on\\_Floods/viewers/FocusOnFloodsHTML/virtualdirectory/Resources/Config/Default](http://maps.vermont.gov/ANR/Html5Viewer/Index.html?configBase=http://maps.vermont.gov/Geocortex/Essentials/ANR/RES/T/sites/Focus_on_Floods/viewers/FocusOnFloodsHTML/virtualdirectory/Resources/Config/Default)

- Estimated number of residential buildings in 100-year flood zone: 51 structures in town are within the 100-year floodplain as mapped by FEMA of which 12 are located within the floodway.
- Estimated number of commercial buildings in 100-year flood zone: 14 structures in town are within the 100-year floodplain as mapped by FEMA of which 2 are located within the floodway
- Estimated number of bridges and culverts within Cavendish from the Vermont Online Bridge and Culvert Inventory Tool are 13 Town Bridges, 10 State Bridges, and 733 Town Culverts.
- There are 8 dams, including 5 along the Black River main stem including the CVPS dam at Cavendish Gorge.
- A number of hazardous waste sites/facilities are close to or within the flood zone including the town power plant.
- Several of the high risk populations are located in close proximity to the flood zones with the town.
- Many of the primary evacuation routes are either completely or partially within the flood zones.

Infrastructure and structures along higher elevation streams and drainage areas are often the most vulnerable to damage from flash flooding. The Black River and Twenty Mile Stream are areas of town known to be susceptible to flash flooding. Although flash floods are not frequent events, hazards posed can be significant as seen with the state-wide flooding from Tropical Storm Irene in the summer of 2011. Tropical Storm Irene brought much devastation to the Town of Cavendish. Several roads were completely washed away, bridges were destroyed and culverts were washed downstream

The total damage sustained by the Town of Cavendish from Tropical Storm Irene is **estimated at <<< million**. Many of the Towns roads were impacted by the storm and required repairs. In addition, numerous culverts required either replacement or repair. Below is a listing of major, non-road projects in Cavendish directly affected by Tropical Storm Irene (See **Map 1: Road Network Damage from Tropical Storm Irene**). A narrative excerpt from the 2011 Cavendish Town Report highlighting damage from Tropical Storm Irene is given under Hurricanes/Tropical Storms in section 5.2c.

#### **Damaged Infrastructure**

- Whitesville water main
- Mill Street water main
- Vermont Route 131 water main
- Vermont Route 131 sewer main
- Cavendish Waste Water Treatment Facility
- Sewer lift station
- Whitesville Bridge replaced (2014)
- Brook Road Bridge replaced (2014)
- Winery Road Bridge repaired (2014)
- Davis Road Bridge/Culverts to be replaced (2015)

Prior to Tropical Storm Irene in 2011, residents of Cavendish experienced three major floods within the last 100 years, one in 1927 , one in 1973, and Tropical Storm Floyd in 1999. The 1927 flood destroyed much of lower Cavendish Village and many houses and barns, while the 1973 flood washed out mainly roads and bridges. Areas within the 100-year flood zone lie mainly along the Black River and Twenty-Mile Stream. There are some small areas of a 500-year flood zone along the Black River as well.

**Fluvial Erosion** is erosion caused by rivers and streams, and can range from gradual bank erosion to catastrophic changes in river channel location and dimension during high flow conditions. While some flood losses are caused by inundation (i.e. waters rise, fill, and damage low-lying structures), most flood losses in Vermont are caused by “fluvial erosion”. Reasons are Vermont’s geography, extreme climate, deep snows, destructive ice jams and intense rainstorms. Centers of commerce in villages and towns became concentrated along river banks, forests were cleared, and many rivers moved or channelized to accommodate this development rendering them unstable and prone to fluvial erosion.<sup>10</sup>

Fluvial erosion is often associated with flash flooding and can result in catastrophic damage to property and infrastructure when a rapid adjustment of a stream channel occurs. Severe damage from fluvial erosion caused by Tropical Storm Irene have widened river beds and stripped river banks bare of natural vegetation making them more susceptible to additional erosion and landslides.

Cavendish, like many other towns within Southern Windsor County, is at risk for fluvial erosion hazard flooding events. Stream geomorphic assessments for the Black River and its major tributaries have been completed and Fluvial Erosion Hazard (FEH) Zones have been mapped and are available online.<sup>11</sup> SWCRPC is in the process of providing information on fluvial erosion hazard and river corridor bylaws, to further limit development and minimize risks, to local zoning officials and municipalities.

Some options for mitigating fluvial erosion hazards include:

- Environmentally-friendly river restoration techniques
- Natural channel design
- Remove or relocate threatened structures
- Erosion and landslide hazard maps
- Limiting new investments in river corridors
- Meet with State Geologist to inspect landslide activity and receive structural appraisal of landslide damaged embankments
- Fluvial erosion/river corridor bylaws

### *Cavendish Watershed Background*

The Town of Cavendish is located within Basin 10, a sub-watershed of the Connecticut River Drainage Basin. Basin 10 is comprised of two watersheds drained by the Black and Ottauquechee Rivers. Black River Watershed Phase 1 and Phase 2 Stream Geomorphic Assessments were completed in 2007 and 2010, followed by the Black River Corridor Management Plan, compiled in 2011 by Southern Windsor County Regional Planning Commission, and a Basin 10 Water Quality Management Plan in 2012. These watershed assessments and management plans focus primarily on hazard mitigation, local water quality and resource conservation. It should be noted that the recommendations outlined to address these concerns are intertwined, as strategies for protecting or improving water quality also serve to minimize the impact of hazard events.

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<sup>10</sup> Municipal Guide to Fluvial Erosion Hazard Mitigation, Vermont Agency of Natural Resources

<sup>11</sup>

The ANR FLOOD READY link below shows river corridors overlays comparable to FEH zones

[http://maps.vermont.gov/ANR/Html5Viewer/Index.html?configBase=http://maps.vermont.gov/Geocortex/Essentials/ANR/RES T/sites/Focus\\_on\\_Floods/viewers/FocusOnFloodsHTML/virtualdirectory/Resources/Config/Default](http://maps.vermont.gov/ANR/Html5Viewer/Index.html?configBase=http://maps.vermont.gov/Geocortex/Essentials/ANR/RES T/sites/Focus_on_Floods/viewers/FocusOnFloodsHTML/virtualdirectory/Resources/Config/Default)

Although only 6.2% of the Basin 10 land area is developed, much of this development is typically found in valleys and along waterways which is the case for Cavendish. Areas of high population concentration and services, namely the Villages of Cavendish and Proctorsville, are nestled along both banks of the Black River with sections that lie either within floodways, Special Hazard Flood Zones, river corridors, Fluvial Erosion Hazard areas or are surrounded by floodplains (**See Map#5: Water Resources**). A significant flood event in this area would disrupt evacuation routes, and could impact many residences, special population areas, town services, and hazardous waste storage sites (**Map #4: High Hazard Vulnerable Sites**).

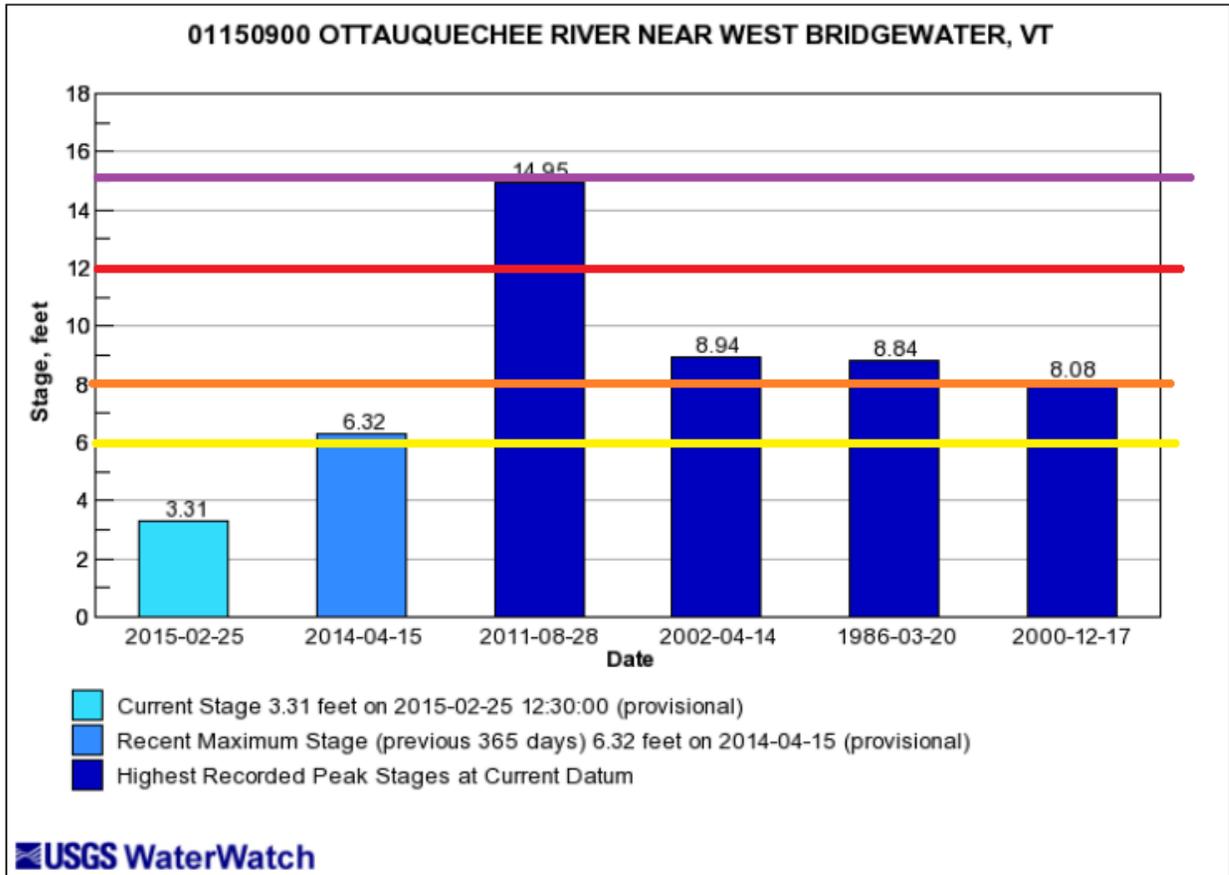
The Black River Corridor Management Plan outlines watershed, town and local level strategies for future river corridor management. The overarching strategy is to protect the river corridor by giving the stream/river the space needed to find its own natural equilibrium which will minimize, in the long run, hazards related to flooding, flash flooding, fluvial erosion and ice jams. Identified protection strategies relevant to hazard mitigation are listed below:

- Allow floodwaters to access their natural floodplains
- Preserve/restore channel-contiguous wetlands
- Stabilize stream banks and establish vegetative buffers
- Establish a local River Corridor overlay district & buffer
- Remove or replace Infrastructure including bridges, culverts and dams
- Incorporate hazard mitigation into local waterway regional planning regulations

The Phase 2: Stream Geomorphic Assessments and the Black River Corridor Plan have identified locations and site specific projects within Cavendish where protection opportunities exist to provide room for natural river channel movement and fluvial geomorphic stability. Designated River Corridor Protection Areas and Fluvial Erosion Hazards (FEH) within Cavendish have been mapped for the Black River main stem and the Twenty Mile Stream tributary.

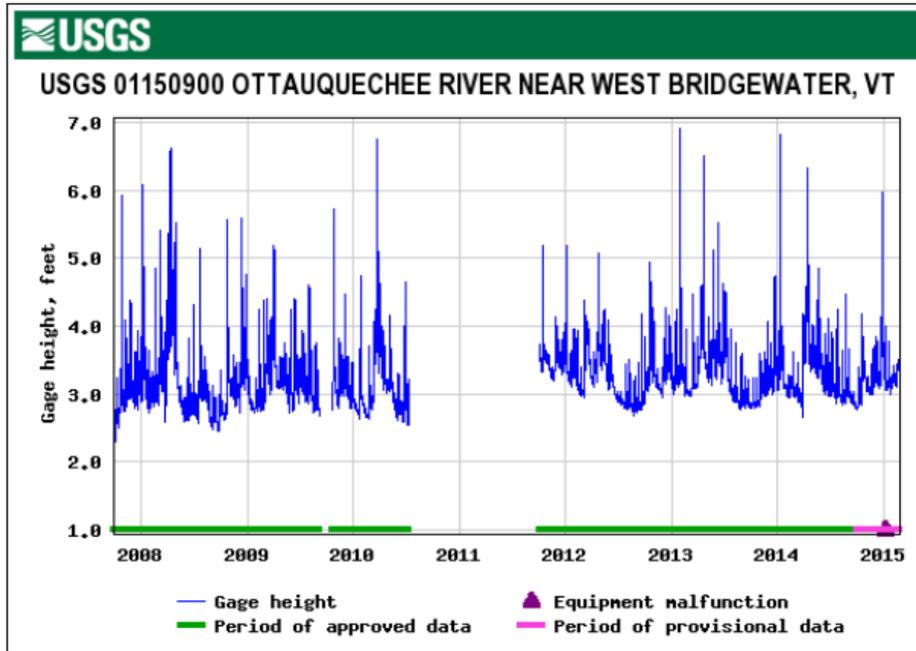
The USGS maintains a river gauge on the Ottauquechee River in West Bridgewater, site #01150900, located within Basin 10, northwest of the Town of Cavendish and is the closest daily monitored gauge location unimpeded by instream structures. The information obtained from the USGS for this gauge site is described below. While this data is not specific to the Town of Cavendish, the data may be used to estimate the worst case scenario flooding for Cavendish as these towns are located in close proximity and share similar topographical characteristics.

The bar chart below is a “Flood Tracking Chart’ for gauge site #01150900 from USGS WaterWatch (<http://waterwatch.usgs.gov>) which displays historic peak data for gauge height, or stage (height of the water in the stream above a reference point). National Weather Service Flood Levels are shown. Note the gauge height approached Major Flood Stage during Tropical Storm Irene.



Major Flood Stage:	15
Moderate Flood Stage:	12
Flood Stage:	8
Action Stage:	6

The graph below plots historical daily gauge height since 2008 obtained from the USGS National Water Information System (<http://waterdata.usgs.gov/nwis/si>). Although daily data was not available during 2011 it can be seen from this graph that levels during periods of spring melt regularly exceed Action Stage or 6 feet above reference height.



\* The site was discontinued during WY2011 due to a lack of funding, hence the missing data. USGS did survey and publish a peak stage and discharge for West Bridgewater. The peak for TS Irene was 14.95 ft and 9,070 cfs. The discharge was computed on basis of a contracted-opening and flow-over-road measurement of the peak flow. US Geological Survey, New Hampshire-Vermont Office

The table below was extracted from a 2014 USGS Scientific Investigations Report on flood analysis of the Ottawaquechee River (<http://pubs.usgs.gov/sir/2014/5214/>). Discharge or streamflow is the volume of water flowing past a given point in the stream in a given period of time. The table compares data during Tropical Storm Irene to AEP flood levels. According to this chart Irene flood levels were comparable to .2% AEP or a “500-yr flood”.

**Table 5.** Stages and water-surface elevations for the streamgage at USGS Ottawaquechee River near West Bridgewater, Vt. streamgage (sta. no. 01-150900), with corresponding discharge estimates at the USGS Ottawaquechee River at North Hartland, Vt. streamgage (sta. no. 01-151500).

[AEP, annual exceedance probability; %, percent; ft, feet; NAVD 88, North American Vertical Datum of 1988]

Location	10% AEP flood	2% AEP flood	1% AEP flood	0.2% AEP flood	Tropical storm Irene flood
Streamgage 01150900 at Ottawaquechee River near West Bridgewater, Vt.					
Stage, in feet above streamgage datum of 1,148.59 feet NAVD 88	10.96	12.65	13.28	14.73	14.95
Elevation, in feet above NAVD 88	1,159.55	1,161.24	1,161.87	1,163.32	1,163.54
Discharge, in cubic feet per second	2,140	3,910	4,960	8,390	9,070
Corresponding estimated unregulated discharge at streamgage 01151500 at Ottawaquechee River at North Harland, Vt.					
Discharge, in cubic feet per second	18,700	34,300	43,400	72,200	38,200

\*From USGS Scientific Investigations Report 2014-5214: ‘Analysis of Floods, Including the Tropical Storm Irene Inundation, of the Ottawaquechee River Vermont’ by Robert H. Flynn

The following definitions of “River Corridor” have been used by the State of Vermont:

*"River Corridor" means the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, ..., and for minimization of fluvial erosion hazards, as delineated by the Agency of Natural Resources in accordance with river corridor protection procedures. 10 V.S.A. Chapter 32 § 752. Definitions*

*The river corridor includes the channel; floodplains and the adjacent land; and the area identified in many communities as the Fluvial Erosion Hazard Area (FEH). The purpose of the zone is to identify the space a river needs to re-establish and maintain stable “equilibrium” conditions. In other words, if the river has access to floodplain and meander area within this corridor, the dangers of flood erosion can be reduced over time.<sup>12</sup>*

### c) **Hurricanes/Tropical Storms/Micro-Bursts**

Hurricanes and Tropical Storms are infrequent event in Windsor County and Vermont. More often, Vermont experiences localized Micro-Bursts and wind shears that tend to knock down trees and blow the roofs off barns and other structures. These hazards often cause serious flooding and widespread power outages from downed trees. This is a function of Vermont’s very rural nature with a large segment of its population living in remote locations dependent upon long extensions of the power grid. Prior to Tropical Storm Irene in August 2011, Vermont was impact by Tropical Storm Floyd in November, 1999.

Below is a narrative excerpt from the 2011 Cavendish Town Report highlighting damage from Tropical Storm Irene:

*“All over Cavendish: from Newton Road to Greven Road Extension; from Felchville Gulf Road to Cavendish Gulf Road; from Twenty Mile Stream Road to Greenbush Road and virtually all points in between there was severe flooding which wiped out roads, bridges, driveways, utility poles, yards, houses, commercial buildings and churches. The low lying parts of the villages of Proctorsville and Cavendish became inundated and wracked by devastating currents. We had known there was a storm coming, but we were still absolutely astounded by the height and the rapidity of the flood water’s rise. The anticipated high winds turned out to be less than was forecast – a blessing as the flood damage, in and of itself, was totally devastating.*

*Cavendish found itself alone – literally cut off from the rest of the world by State highways, town roads, culverts and bridges which were impassable in all directions! Power outages were widespread and many lost telephone service. What a mess! Both villages soon found themselves without water as there were three sections of municipal water main and a section of municipal sewer main which were literally blown apart. There simply was no water left in the system. The Town of Cavendish was indeed in dire straits! “*

Tropical Storm Irene brought much devastation to the Town of Cavendish which is described in detail under Flooding (Section 5.2a).

### d) **Ice Jams**

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<sup>12</sup> ([http://floodready.vermont.gov/flood\\_protection/river\\_corridors\\_floodplains/river\\_corridors#What\\_is\\_an\\_FEH\\_or\\_RCPA](http://floodready.vermont.gov/flood_protection/river_corridors_floodplains/river_corridors#What_is_an_FEH_or_RCPA))

Though not identified as a high hazard, ice jams may be a secondary event of flooding and threaten many of the same properties located within the FEMA Special Flood Hazard Area. When broken river ice begins to flow downstream, ice can build up against bridge abutments, undersized structures, and other obstructions to create a temporary dam impounding water which has the potential to flood surrounding areas. Ice jams threaten many of the same properties as inundation flooding and the damage can be expected to be similar.

Ice jams are common in New England and occur during winter and spring months when river ice begins to break up and flow downstream. Such ice flows can build up against bridge abutments or other obstructions and create a temporary dam impounding large volumes of water that have the potential to flood the surrounding areas and damage infrastructure, including the many bridges within the town. The loss of a bridge could disrupt transportation corridors and isolate residential areas. The most devastating winter floods have been associated with a combination of heavy rainfall, warm temperatures, rapid snowmelt and resulting ice jams. Winter weather with less than average snowfall can result in greater ice buildup on streams and rivers, potentially resulting in greater ice jam damage.

Ice jams are likely on the Black River and have occurred in town historically but are not typically recorded. Rain and warm weather either during a winter thaw or in the spring often create a number of ice jams on the Black River. In January 2014, a sudden warming created ice jams which in turn caused flooding for some of the homes in Proctorsville that are close to the river. This may become more of a hazard threat as climate conditions become more extreme. This hazard would be studied and addressed by the Agency of Natural Resources when rivers are flowing to determine whether there is something in the river that is causing the ice jams to form.

The following ice jam events have been recorded by the US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL):

▪	01/1990	Chester	Williams River
▪	03/1992	West Windsor	Mill Brook
▪	03/1992	Windsor	Mill Brook
▪	03/1992	Windsor	Connecticut River
▪	01/1996	Chester	Williams River
▪	01/1996	Cavendish	Black River
▪	01/1996	Springfield	Black River
▪	01/1999	Chester	Williams River
▪	12/2000	Windsor	Connecticut River
▪	12/2000	Chester	Williams River (2 ice jams)
▪	01/2001	Windsor	Connecticut River
▪	12/2003	Springfield	Connecticut River

#### e) ***Severe Weather***

For the purposes of the Windsor All Hazard Mitigation Plan, severe weather is defined as being two or more of the following hazards occurring together: thunderstorms, power failure, high wind, lightning, hail, and flooding. Flooding is described in greater detail above, this section of the hazard analysis will focus on non-flood events.

***Power failure*** is a common secondary hazard caused by severe weather and has an annual frequency within Windsor. Power outages can occur on a town wide scale and are typically the result of power lines

damaged by high winds or heavy snow / ice storms but may also result from disruptions in the New England or national power grid as indicated by the widespread outages in 2003. Dead or dying trees in proximity to power lines pose a particular threat for power failure as these trees are often brought down by triggering events such as winter storms.

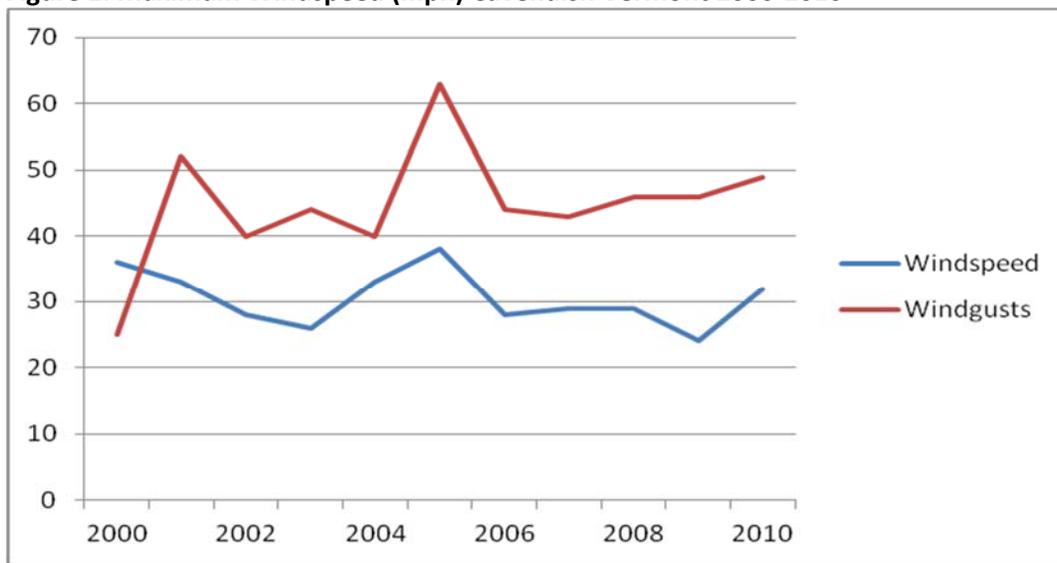
Potential loss estimates are difficult to predict for power failures as they are typically isolated in geographic area and short in duration. Therefore, power failures often have only minimal impact to people and property. Power failures usually result in minor inconveniences to residents however, longer duration events may result in the loss of perishable items and business losses. Power outages in winter months may result in the loss of home heating, ruptured water pipes and the resulting structural damage. The loss of home heating may be a contributing factor to the increase in structure fires during the winter months.

The Town of Cavendish would benefit greatly from back up generation of power particularly at the two emergency shelters, including the Emergency Operation Center (EOC) located at the town offices.

**High winds** can result from hurricanes, tropical storms, summer *thunderstorms*, and tornadoes. The 2013 Vermont Hazard Mitigation Plan does not delineate high winds as a separate hazard, the plan states '*high winds pose a threat to the safety of Vermont's citizens and property.*' The National Weather Service issues wind advisories when sustained winds of 31-39 miles per hour are reached for at least one hour or gust between 46-57 miles per hour. Damage from summer thunderstorms in Cavendish has been historically limited in both scope and cost. The Beaufort Wind Scale shown below can be used to predict damage based upon wind speeds.

The following graph displays a historical record of the maximum wind speeds recorded in Cavendish. Over the past decade, the highest recorded wind speed approached 40 miles per hours with gusts reaching over 60 miles per hours.

**Figure 1: Maximum Windspeed (mph) Cavendish Vermont 2000-2010<sup>13</sup>**



<sup>13</sup>Historical windspeed data from Wunderground: <http://www.wunderground.com/>

**Lightning** is a giant spark of electricity in the atmosphere between clouds, the air, or the ground<sup>14</sup>. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. As lightning can strike up to 50 miles away from a thunderstorm, can carry up to 100 million volts of electricity, and can reach temperatures upward of 50,000 degrees Fahrenheit it proves extremely hazardous to human life. Lightning can also damage infrastructure, plants, and property, and can start forest fires. Lightning is the most unpredictable weather-related event.

**Tornadoes** have the potential to cause more significant damage but occur rarely in our area and their effects, although severe, are very local in extent. The State of Vermont Hazard Mitigation Plan states that “Overall, Vermont has averaged less than one tornado per year since 1950. This ranks the state as 47th out of the 50 states for tornado frequency.” The largest tornado that has occurred within 50 miles of the Town of Cavendish occurred in 1998 and registered as an F3 tornado, with wind speeds over 158 miles per hour<sup>15</sup>. The vast majority of tornadoes that have occurred in our region had wind speeds of less than 113 mph. There are no reported deaths from tornadoes in our region. No high wind hazard areas have been identified or mapped in our region. Cost estimates for high wind events are difficult to predict due to the large range of impacts they can have upon an area.

Beaufort Wind Scale		
Classification Number	Wind Speed	Land Conditions
6	25 to 31 mph	Large branches in motion; whistling in telephone wires
7	32 to 38 mph	Whole trees in motion; inconvenience felt walking against wind
8 to 9	39 to 54 mph	Twigs break off trees; wind generally impedes progress
10 to 11	55 to 73 mph	Damage to chimneys and TV antennas; pushes over shallow rooted trees
12 to 13	74 to 112 mph	Peels surfaces off roofs; windows broken; mobile homes overturned; moving cars pushed off road
14 to 15	113 to 157 mph	Roofs torn off homes; cars lifted off ground

For the purposes of the Hazard Mitigation Plan, the scale is only shown above wind force 5; Data from NOAA

The largest tornado to have occurred within 50 miles of Cavendish occurred in 1998 and registered as an F3 tornado, with wind speeds over 158 miles per hour<sup>16</sup>. The majority of tornadoes that have historically occurred within the region have wind speeds of less than 113 miles per hours. There are no reported

<sup>14</sup> NOAA.gov

<sup>15</sup> <http://www.homefacts.com/tornadoes/Vermont/Windsor-County/Windsor.html>

<sup>16</sup> Homefacts: <http://www.homefacts.com/tornadoes/Vermont/Windsor-County/Windsor.html>

deaths from tornadoes nor have high wind areas been mapped within the region. Cost estimates are difficult to predict due to the large range of impacts that they can have upon an area.

Using the Cavendish wind data from **Figure 1**, the likely magnitude for future high wind events will fall between 40 and 50 miles per hour or Beaufort scale number 8-9 and will likely result in downed trees, power lines, and small damage. The possibility does remain for larger high wind events such as the 1998 F3 tornado on the Enhanced Fujita Scale.

**Hail** is a form of precipitation that falls as pellets of ice. The pellets can range in size from balls typically 5–50 mm in diameter on average, though can be much larger during severe occurrences. Hail can be especially damaging to crops, homes and cars, and large hailstones can be deadly to livestock and people caught outside during an event.

#### **f) Dam Failure**

Dams are manmade structures built to impound water for many purposes, including water storage for potable water supply, livestock water supply, irrigation, or fire suppression. Dams can also be built for recreation, flood control and hydroelectric power or can be multifunction, serving two or more of these purposes. Dam failure is when the structure is breached and potentially can cause inundation of downstream areas and property. Although dam failures can occur at any time in a dam's life, they are most common when water storage for the dam is at or near design capacity. At high water levels or during high flow events the water force on the dam is greater and several of the most common failure modes are more likely to occur. Correspondingly, for any dam, the probability of failure is much lower when water levels are substantially below the design capacity for the reservoir.

There are 8 dams in the Town of Cavendish identified on **Map 5: Water Resources**. There are five dams noted along the Black River main stem including the CVPS dam at Cavendish Gorge. These dams, carry a hazard category of low, meaning failure would likely result in no loss of life and physical/economic damage only to the dam owner. It is suspected that some of these mapped dams may be non-functional, spanning a dried channel, and should be reviewed and updated. Dam Failure was classified during the Hazard Analysis by the Hazard Mitigation Committee with a score of 9, a moderate to high threat to the town due to the potential severity of this type of hazard event. While there are no dams in the town that are of particular concern, there are several dams upstream from the town that pose a hazard if they were to be overtopped or fail outright. Specifically, there are five dams in Ludlow that are on the Vermont Agency of Natural Resources Dam Safety Program's list of high hazard dams<sup>17</sup>. The dams are inspected by a state representative on a rotating basis and are not considered to be "in significant danger of failure."

#### **g) Hazardous Materials Spill**

The Vermont Agency of Natural Resources Spills Database includes the most comprehensive listing of hazardous materials spills. Table 6 shows reported spills within the Town of Cavendish, including Proctorsville, since the year 2010.

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<sup>17</sup> State of Vermont Hazard Mitigation Plan

<b>Table 6: Vermont Agency of Natural Resources - Spills Database; Since 2010 in Cavendish</b>			
<b>Date</b>	<b>Address</b>	<b>Quantity</b>	<b>Material</b>
9/4/2011	Condos at 51 Depot St.	5 gallons	Fuel Oil
6/8/2012	Between 632 & 582 Main St.	1 drum	unknown
9/14/2011	Riprap project on Rt. 103	5-10 gallons	Diesel
9/23/2011	River bank-Black River Carlton Rd.	30 gallons	Transformer Oil
12/20/2011	Roadside on Rt103, Proctorsville	200 gallons	Diesel
7/11/2014	unknown	55 gallons	Fuel Oil

The Agency of Natural Resources lists 28 spills within the Town of Cavendish since 1974. These spills, and other historical spill data reveals that the vast majority of transportation related hazardous material incidents in Vermont are car and/or truck related accidents that typically result in a spill of less than 100 gallons of gasoline, oil, or other auto related fluids. Notable exceptions in the region over the past four decades include truck accidents resulting in the release of 2300 gallons of #2 fuel oil, 200 gallons of sodium hydroxide, and multiple truck accidents that each resulted in thousands of gallons of spilled milk. There are two state highways and railway that pass through Cavendish which make the town more vulnerable to a significant hazardous spill prompting the need for a response plan.

**Transportation Incidents** received a hazard score below 8 and are not addressed in this plan. However, a significant threat to the town posed by transportation incidents is the potential for releasing hazardous materials into the surrounding area, including rivers and streams which typically run alongside major roadways. Major disaster level incidents involving our highways, trains, and airways, although not frequent, could happen at any time, however, adverse weather conditions can be a catalyst for traffic accidents.

The Town of Cavendish currently has one road segment listed as a “high crash site” by the Vermont Department of Transportation. For Cavendish, total crash listings for the period of 1/09-12/13 include 19 crash listings on local roads, and 62 crash listings on State Highway Route 103, as reported by the Vermont Agency of Transportation General Yearly Summaries from 1/09-12/13. This is an annual average of 12 crashes on Route 103. A significant portion of Hazardous Material incidents are instigated by transportation incidents.

#### ***h) Extreme Cold/Snow/Ice Storms***

Winter storms and blizzards, with snow, ice, and freezing temperatures in varying combinations, are fairly commonplace in Cavendish and occur town wide. Heavy wet snows of early fall and late spring, as well as ice storms, can result in property damage and in loss of electric power, leaving people without adequate heating capability. Power loss is often the result of downed trees, which can also disrupt traffic and emergency response by making roads and driveways impassable.

A winter storm is considered severe when there is a possibility of:

- Six or more inches of snow fall at a given location within 48 hours,
- There is property damage, injuries or deaths, or
- An ice/glaze storm which causes property damage, injuries or death.

**A Nor’easter** is a large weather system traveling from South to North, passing along, or near the Atlantic seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas from a northeasterly

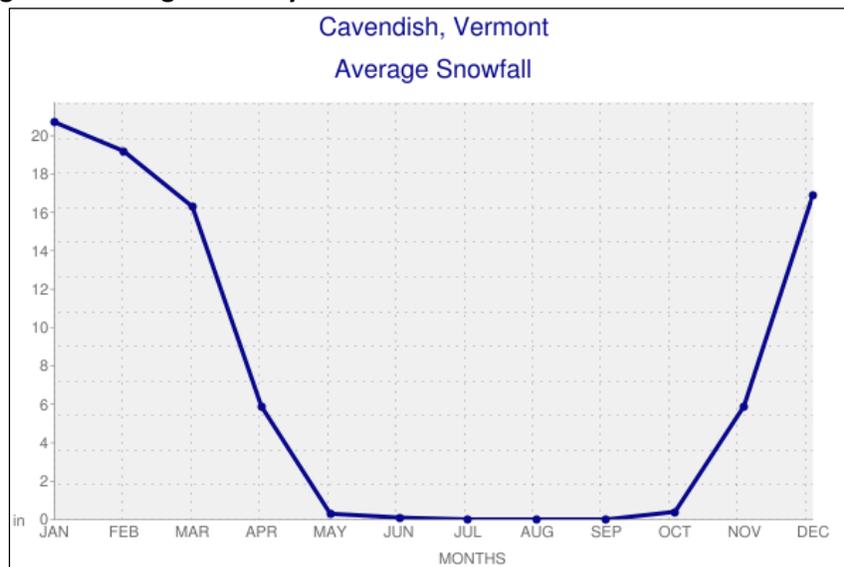
direction. The sustained winds may meet or exceed hurricane force. The Dolan-Davis Nor'easter Classification Scale is utilized to determine the severity of Nor'easters:

### The Dolan-Davis Nor'easter Classification Scale

CLASS	% OF STORMS	AVERAGE RETURN INTERVAL	AVERAGE PEAK WAVE IN FEET	AVERAGE DURATION IN HOURS
1 WEAK	49.7	3 DAYS	6.6	8
2 MODERATE	25.2	1 MONTH	8.2	18
3 SIGNIFICANT	22.1	9 MONTHS	10.8	34
4 SEVERE	2.4	11 YEARS	16.4	63
5 EXTREME	0.1	100 YEARS	23.0	96

**Blizzards** are defined by the National Weather Service as “sustained winds or frequent gusts of 35 mph or greater (and) considerable falling and/or blowing snow reducing visibility frequently to 1/4 mile or less for a period of three hours or more<sup>18</sup>.” Damage from blizzards snow and ice storms can vary depending upon wind speeds, snow or ice accumulation, storm duration, and structural conditions (such heavy snow and ice accumulation on large, flat roofed structures). The following **Figure 2** shows average monthly snowfall amounts for Cavendish. Cavendish residents can expect at least 60 pounds of weight per square foot on their infrastructure during winter months.

**Figure 2: Average Monthly Snowfall Cavendish Vermont**



**Ice Storms** are defined by the National Weather Service as “occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility

<sup>18</sup> National Weather Service Glossary

lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of ¼" or greater."<sup>19</sup>

Ice storms have a significant impact on Northern New England, with high elevation locations being the most severely impacted. Multiple sources state that a ¼ inch of ice accumulation from an ice storm can add 500 pounds of weight on the lines between two power lines.

## **6. MITIGATION PROGRAM**

### **6.1 Goals and Strategies**

The following sections detail the mitigation goals, strategies, and potential mitigation actions which the town has identified to aid in the reduction of threats posed by the hazards detailed in this plan. The implementation schedule that follows is a table of actions that the town has targeted for implementation during the five year cycle of this plan.

The 2012 Cavendish Town Plan, adopted August 28, 2012, identifies the following goals, policies and recommendations which directly support hazard mitigation or enhance local appreciation and awareness which indirectly support hazard mitigation.

- Development that creates negative impacts shall be prohibited in headwaters of watersheds or areas supplying recharge water to aquifers.
- Development shall be prohibited in areas where soil conditions and topography will cause pollution of ground or surface waters.
- Development shall be prohibited on steep slopes where erosion is likely to occur.
- The Black River is valued as both a scenic and recreational resource; in order to protect that resource, development is prohibited along the Black River corridor when such values will be negatively impacted.
- Naturally vegetated buffer strips of at least 50-100 feet should be left next to all rivers, lakes, and ponds, and at least 50 feet next to streams and wetlands, so as to filter pollution, prevent erosion, and protect fisheries and wildlife habitat.
- Development projects shall provide continued public access for recreational purposes to the Black River.
- Development shall not degrade the water quality of the Black River and its tributaries.
- The town shall advocate for the protection of existing swimming and fishing holes along the river.
- Sewage treatment plans shall maximize opportunities to treat waste effectively and minimize the length of the C zone (mixing zone) in the Town of Cavendish in order to maximize swimming and recreational opportunities.
- The legislative body and the Planning Commission of the Town of Cavendish will actively

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<sup>19</sup> National Weather Service Glossary

participate, as appropriate, in reviews of the Ludlow Sewage Treatment System to restore and improve the quality of water in the Black River in Cavendish to maximize opportunities for swimming, boating, fishing and other water activities.

- Develop regulations that include an overlay district for aquifer protection areas.
- Identify potential, new public access areas along the Black River and encourage design and construction of such areas.
- Town officials should continue working with local sportsman organizations and the State Fish and Wildlife Department to develop a plan for stream and river habitat management and to assure a continued program of game fish stocking.
- Development plans for lands subject to periodic flooding must comply with local, state and federal flood hazard regulations in order to protect the health, safety and welfare of the public.
- Update and readopt the Town's Flood Hazard Regulations.
- Developments and sub-divisions shall utilize cluster development to effectively preserve the productivity of prime agricultural and forest soils.
- Require maintenance and enhancement of forest resources and implementation of sustainable forest management practices that provide habitat for diverse natural species, avoid high grading of timberlands, and follow Acceptable Management Practices.
- Use Acceptable Management Practices (AMPs), farming methods that prevent water pollution, prevent soil erosion and degradation, and protect public health and safety.
- While earth and mineral resources are important commodities and provide materials necessary for construction and public infrastructure needs, their extraction can potentially be damaging to aesthetics and natural resources. Of particular concern include degradation of surface and groundwater quality through site erosion and discharges of contaminants into exposed surface areas.
- Earth extraction operations and associated vehicular traffic must not compromise pedestrian or driving safety by increased volume of traffic and large trucks traveling on minor or major roads. Earth extraction vehicular traffic must not be routed through village areas when other reasonable alternative routes can be used.
- Cavendish, as well as other bodies of water such as lakes, streams, and ponds and all require protection.
- It is the Town's intention to maintain the scenic values along Route 131 while maintaining high standards of safety. Scenic corridors, including the Black River Corridor and 20-Mile Stream Corridor shall be considered as a valuable town resource and shall be protected.
- Upgrade public water and sewer systems as needed to maintain efficiency, ensure environmental soundness, and provide quality product and service.
- Research potential sites for new Town water supplies.

- Delineate aquifer protection areas for the Town water supplies.
- Waste material, whether from agricultural, industrial, household, mining or other sources, should be limited at the source and managed to prevent environmental damage, to avoid negative impacts on natural resources, and prevent nuisance to neighbors.
- Coordinate open space plans and river preservation plans to protect the Black River as a valuable scenic and recreational resource.
- Institute measures to reduce the speed at which vehicles travel through our town, especially village areas. These measures may include reducing the posted speeds, posting speed limits, enforcing the limit and introducing traffic calming measures.
- Seek out and apply for federal and state grants that would improve our village pedestrian walkways and tree plantings.
- Keep most of the roads as local town roads. Improve them only as needed for negotiability in winter, protection from washout and economy of maintenance. Minimize any damaging effects of such improvements to scenery, trees, plant life, surface waters, and wildlife areas.
- Special considerations should be observed for development on high elevations and steep slopes to avoid development that would cause soil erosion.
- Special Considerations regarding development are resources which merit special attention and protection. They include: Public Water Supply Source Protection Areas; floodplains, vegetated areas next to surface waters, wetlands, the Black River and corridor, Natural Heritage Inventory sites, critical deer wintering habitat and bear habitat as defined by the Vermont Agency of Natural Resources, regionally significant historic sites, and other locally defined sensitive natural areas and scenic resources. Development should avoid and minimize negative impacts to these resources.

## **6.2 Existing Programs**

The town currently participates in the NFIP program and will continue to regulate floodplain use through the Cavendish Flood Hazard Area Regulations adopted on September 24<sup>th</sup>, 2007. The town has also adopted FEMA floodplain maps that were last revised in 2007 and are currently being updated. The town will continue to enforce these regulations to maintain future NFIP compliance. The town manager is in charge of implementing and advising residents on floodplain development as well as NFIP compliance. No structures within Cavendish have been identified as repetitive loss properties.

The following authorities, policies, programs, and resources related to hazard mitigation are currently in place and/or being implemented in the Town of Cavendish in addition to the NFIP. These programs reduce the effects of hazards to new and future buildings, infrastructure, and critical facilities by preventing their location in identified hazard areas and ensuring that infrastructure and buildings are designed to minimize damage from hazard events. The Committee analyzed these programs for their effectiveness and noted any improvements that may be needed.

**Table 7: Existing Cavendish Resources for Mitigating Hazards: Authorities, Policies and Programs**

Resource	Description	Effectiveness in implementing HM Goals	Opportunities for Improving Effectiveness
Town Plan	Plan for coordinated town-wide planning for land use, municipal facilities, etc.	Effective. Revised and re-adopted in 2011. Currently being updated.	Plan is updated on a five year cycle, the next revision may be strengthened by addressing shortfalls and flood resiliency
Basic Emergency Operations Plan	Basic municipal procedures for emergency response	Outlines procedures for call-outs, evacuations, etc.; last updated in 2014	Plan is reviewed every year following town meeting; statewide template restricts additional functionality
School Emergency Response Protocol	School procedures for emergency response	Utilizes template provided by state, provides a checklist for school administrators and first responders for use in an emergency situation	Coordinating response procedure among planning tools may improve effectiveness
LEPC 3 All Hazards Resource Guide	Outlines resources available to town in emergency situations	Effective through providing data and resources to town first responders	The guide is currently being updated and revised with input from the Town
Mutual Aid – Emergency Services	Agreement for regional coordinated emergency services	Effective in providing additional emergency support during atypical events	Mutual aid agreements have been formalized
Mutual Aid – Public Works	Agreement for regional coordinated emergency highway maintenance services	Effective in providing additional highway support and resources during atypical events	Mutual aid agreements have been formalized
Town Road Standards	Design and construction standards for roads and drainage systems	Effective through continued use. Revised in 2014.	Continued implementation of road standards is critical to effectiveness
Flood Hazard Area Regulations	Regulates development in FEMA flood hazard areas	Effective in limiting development in identified hazard areas.	Continued updates and enforcement are critical for continued effectiveness
National Flood Insurance Program (NFIP)	Provides ability for residents to acquire flood insurance	Effective, Cavendish is compliant with NFIP program	Flood maps should be updated, pursue CRS rating, include FEH language
Maintenance Programs	Bridge & Culvert Inventory	Effective at tracking and planning infrastructure upgrades	Inventories should be updated when feasible
Access Permits	Regulates driveway access along town-maintained roads	Effective in limiting the number of road cuts, thereby reducing the potential for traffic accidents	Continued enforcement of access permit regulations are critical to maintaining effectiveness

Local Emergency Planning Committee 3	Volunteer organization involved in regional hazard mitigation efforts	Effective and important contributor in the hazard mitigation planning process	Greater town participation at the regional level would be beneficial
Southern Windsor County RPC	Regional organization working to further emergency management and hazard mitigation goals	Effective in assisting towns in the adoption of new/updated regulations and the revision of planning documents	The RPC should focus on improving the planning process and investigate additional sources of historical and statistical data for identified hazards
Black River Watershed Ph1 & Ph2 -Stream Geomorphic Assessments	Process for identifying stressors to watershed systems	Effective at assessing potential mitigation projects in the town	Can be used to inform future mitigation activities
Black River Corridor Management Plan	River corridor mapping, Hazard Mitigation Recommendations	Effective at identifying and prioritizing sensitivity of delineated segments and at risk in-stream structures.	Can be used to inform future mitigation activities

### 6.3 2015-2020 Mitigation Strategies, Actions and Projects

The Cavendish Hazard Mitigation Committee along with input from subsequent public meetings have identified the following Mitigation and Preparedness Actions and Projects for the 2015-2020 planning period. It was determined that some of the strategies from the previous plan were still relevant and are included here with some modifications. These mitigation strategies have been chosen by the town as the most appropriate policies and programs to lessen the impacts of potential hazards.

**Table 8: 2015-2020 Mitigation and Preparedness Actions and Projects for Implementation**

MITIGATION ACTION	TYPE OF ACTION	HAZARD ADDRESSED	RESPONSIBLE PARTY	TIME FRAME	FUNDING SOURCE	HAZARD SCORE
Upsize and replace culverts known undersized culverts	Mitigation	Flooding, Erosion, Transportation Disruption	Road Foreman, Town Manager	On-going	Town Budget	10
Actively seek funding to provide back-up power supply for town EOC/Shelter	Preparedness	High Wind, Severe Winter Weather	Emergency Management Director, Town Manager, Selectboard Chair, SWCRPC	2015-2020	HMGP, VEM Generator Grant	9

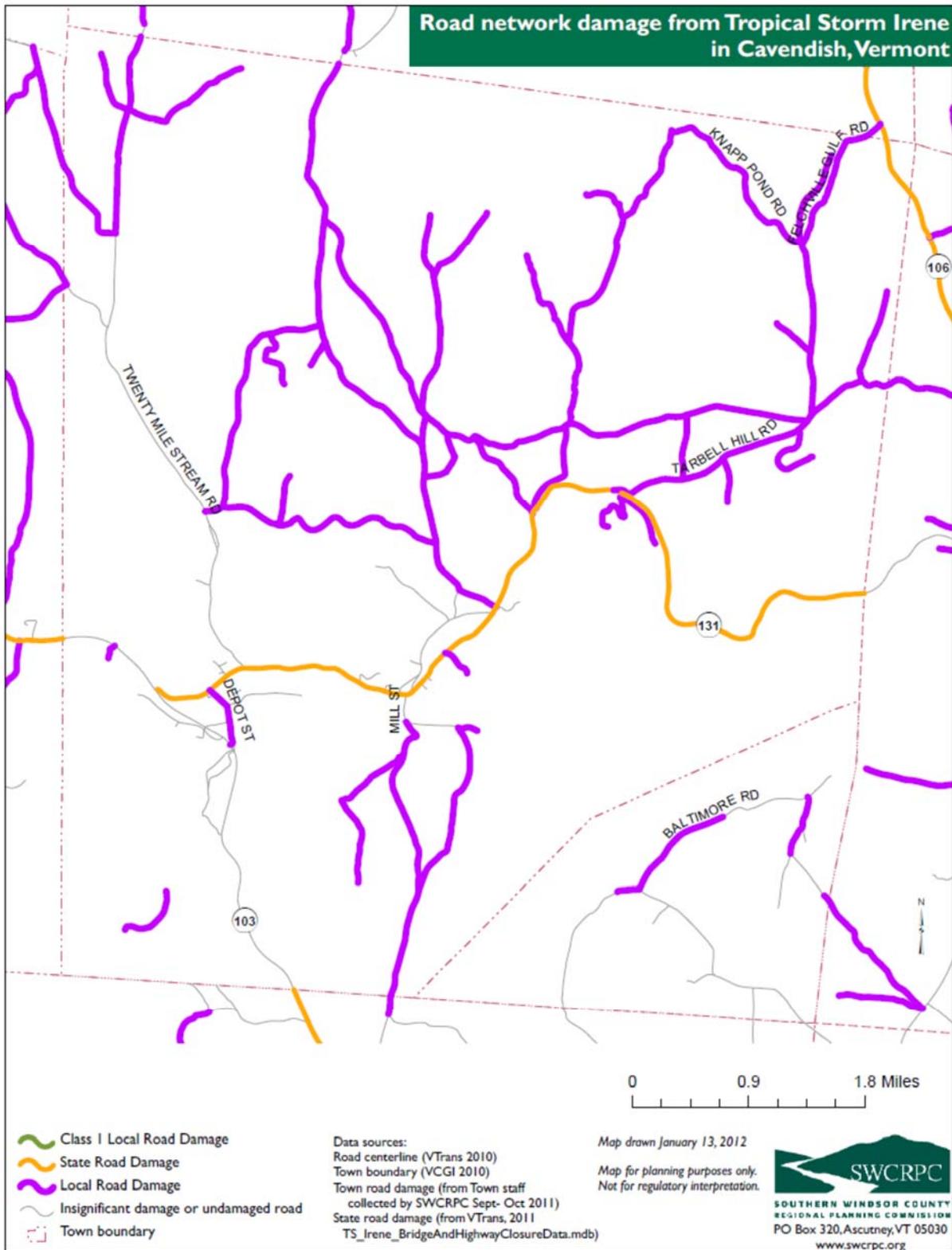
Put in place a schedule to identify and remove high hazard trees to reduce power outages	Mitigation/ Preparedness	High Wind, Severe Winter Weather	Town Manager, GMP, Tree Warden	2015-2020	Utilizing Existing Town Resources	9
Expand outreach on safe winter home heating to homeowners, in addition to school program	Mitigation	Structure fire	Selectboard, SWCRPC, Fire Departments	2016, Annually	Utilizing Existing Town Resources	12
Engage SWCRPC in Commodity Flow Study Review for incorporation into response planning	Mitigation/ Preparedness	Hazardous Materials, Transportation Disruption	Fire Departments, Town Manager, Road Foreman, SWCRPC	2017	Utilizing Existing Town Resources	9
Implement other recommended activities in the 'Firewise' Program	Mitigation, Preparedness	Structure fire, Wildfire	Fire Departments	2016, Ongoing	Utilizing Existing Town Resources	12
Install additional dry hydrants as needed and as funding becomes available	Mitigation, Preparedness	Structure fire, Wildfire	Emergency Management Director, Fire Departments, Selectboard	2015-2020	Town budget, dry hydrant grant program	12
Conduct a site review of identified dam structures and determine if remedial work is needed	Mitigation	Flood, Erosion	Town Manager, ANR-Dam Safety	2015-2017	Utilizing Existing Town Resources	9
Work with State to Mediate High Hazard stone culvert (ID-Singleton's)	Mitigation	Flood, Erosion	Selectboard, State, SWCRPC	2015-2020	State Funding	10
Implement Erosion Hazard Prevention Measures to protect critical Town Infrastructure- Lift	Mitigation	Flood, Erosion	Selectboard, ANR, SWCRPC	2015-2020	Hazard Mitigation Grant	10
Public Outreach Program on Newly Adopted FHR with focus on awareness of structures in river corridor and FEH areas	Mitigation	Flood, Erosion	Selectboard, Emergency Management, Planning Commission	2015-2017	Utilizing Existing Town Resources	10
Incorporate Improved Hydraulics with current Davis Road Bridge Replacement project	Mitigation	Flood, Erosion	Selectboard, Town Manager	2015	Utilizing Existing Town Resources	10

Review Sensitive Areas Identified in River Corridor Plans for consideration in future planning, maintenance, and mitigation	Mitigation	Flood, Erosion	Selectboard, Emergency Management, SWCRPC	2015-2018	Utilizing Existing Town Resources	10
ADDITIONAL?						
<b>PAST HAZARD MITIGATION STRATEGIES, ACTIONS, PROGRAMS –COMPLETED, DROPPED, OR ONGOING</b>						
Maintain a hazardous materials response plan	Preparedness	Hazard Material Incident, Earthquake	Fire Departments	Ongoing	Utilizing Existing Town Resources	
Purchase land along Winery Road for flood storage	Mitigation	Flood	Town Manager	Not Necessary	NA	
Maintain Flood Hazard Regulations to include data from River Corridor Studies	Mitigation	Flood, Erosion	Town Manager, Planning Commission, SWCRPC	Completed 2015, Future Updates	Utilizing Existing Town Resources, SWCRPC	
Retrofit critical facilities for greater protection from earthquake, high winds, and snow load capacity	Mitigation	Earthquake, High Winds, Winter Weather	Town Manager, Selectboard	Low Priority, Not necessary	NA	
Continue Providing Outreach Material on safe winter home heating	Mitigation	Structure Fire	Fire Departments	Ongoing	Utilizing Existing Town Resources	
Continue Town Participation in 'Firewise' Program	Mitigation, Preparedness	Structure Fire, Wildfire, Winter Weather	Fire Departments, Selectboard	Ongoing	Utilizing Existing Town Resources	
Continue Providing 'Be Firewise Around Your home' brochure to property owners	Mitigation, Preparedness	Structure Fire, Wildfire	Fire Departments	Ongoing	Utilizing Existing Town Resources	

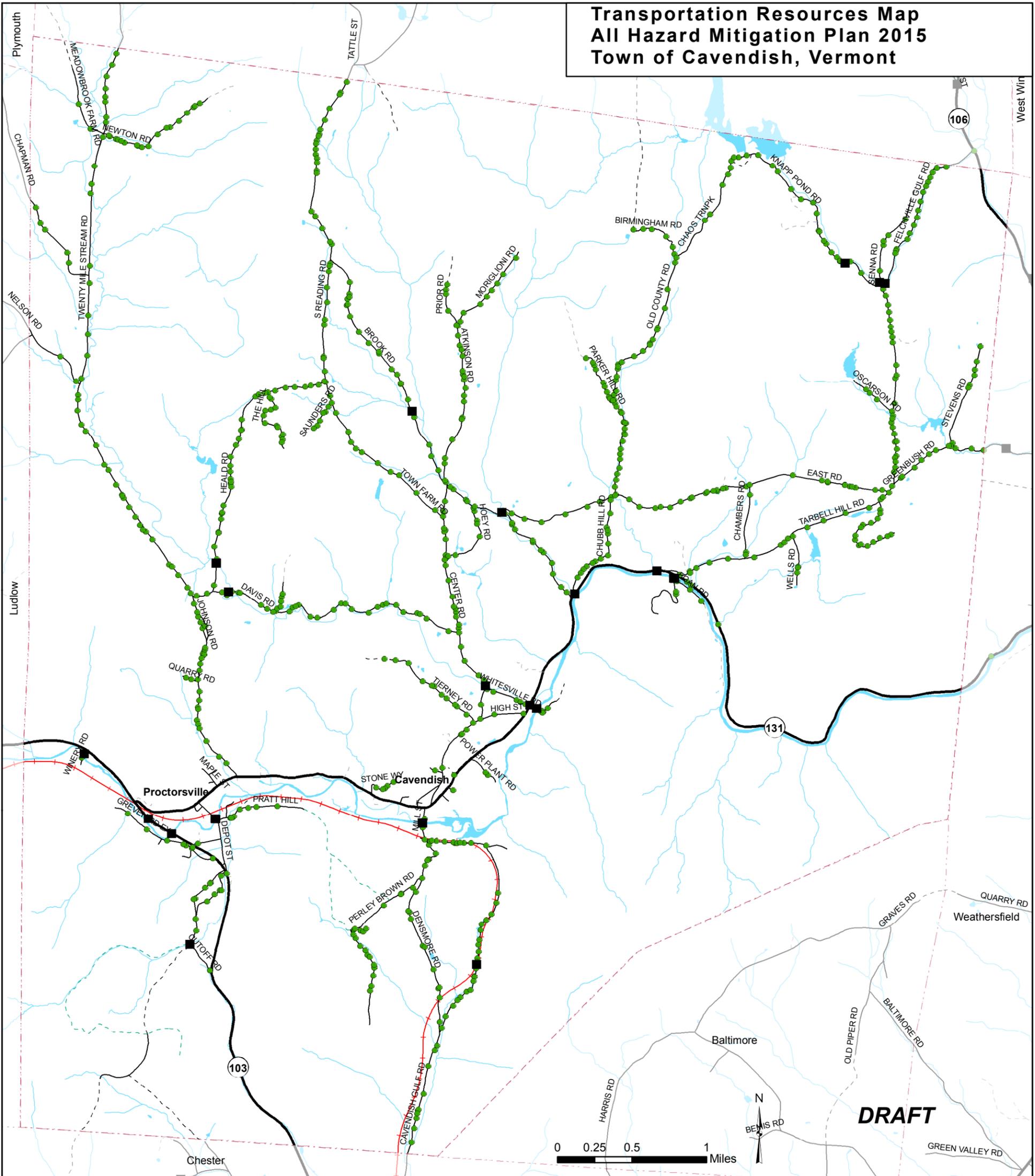
Maintain policy for Tie-down all non-anchored structures, including propane tanks	Mitigation	Earthquake, High Wind, Flood	Homeowners, Planning Commission, Selectboard	Completed 2015, Future Updates	Utilizing Existing Town Resources	
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## Appendix

**Map 1: Road Network Damage from Tropical Storm Irene**



# Transportation Resources Map All Hazard Mitigation Plan 2015 Town of Cavendish, Vermont



- Bridge or Very Large Culvert
- Culvert
- ~ Rivers and Streams
- Lakes and Ponds
- VT State Highway
- Class 2 and 3 Town Highway
- Class 4 Town Hwy & Legal Trail
- Private Road
- State Forest Road
- Railroads
- Town boundary

There are no airports in Town.

Data Sources: Airports (VT Agency of Transportation 2014), State Bridges and Large Culverts (VT Agency of Transportation 2014), Local Bridges and Culverts (Draft 2014 inventory by Southern Windsor County Regional Planning Commission and Town), Roads (VT Agency of Transportation 2014), Railroad (VT Agency of Transportation 2014), Rivers and waterbodies (VT Hydrographic Dataset 2008), Town Boundary (RPC 2014 using Parcels 2009).

VT State Plane, Meters, NAD 83  
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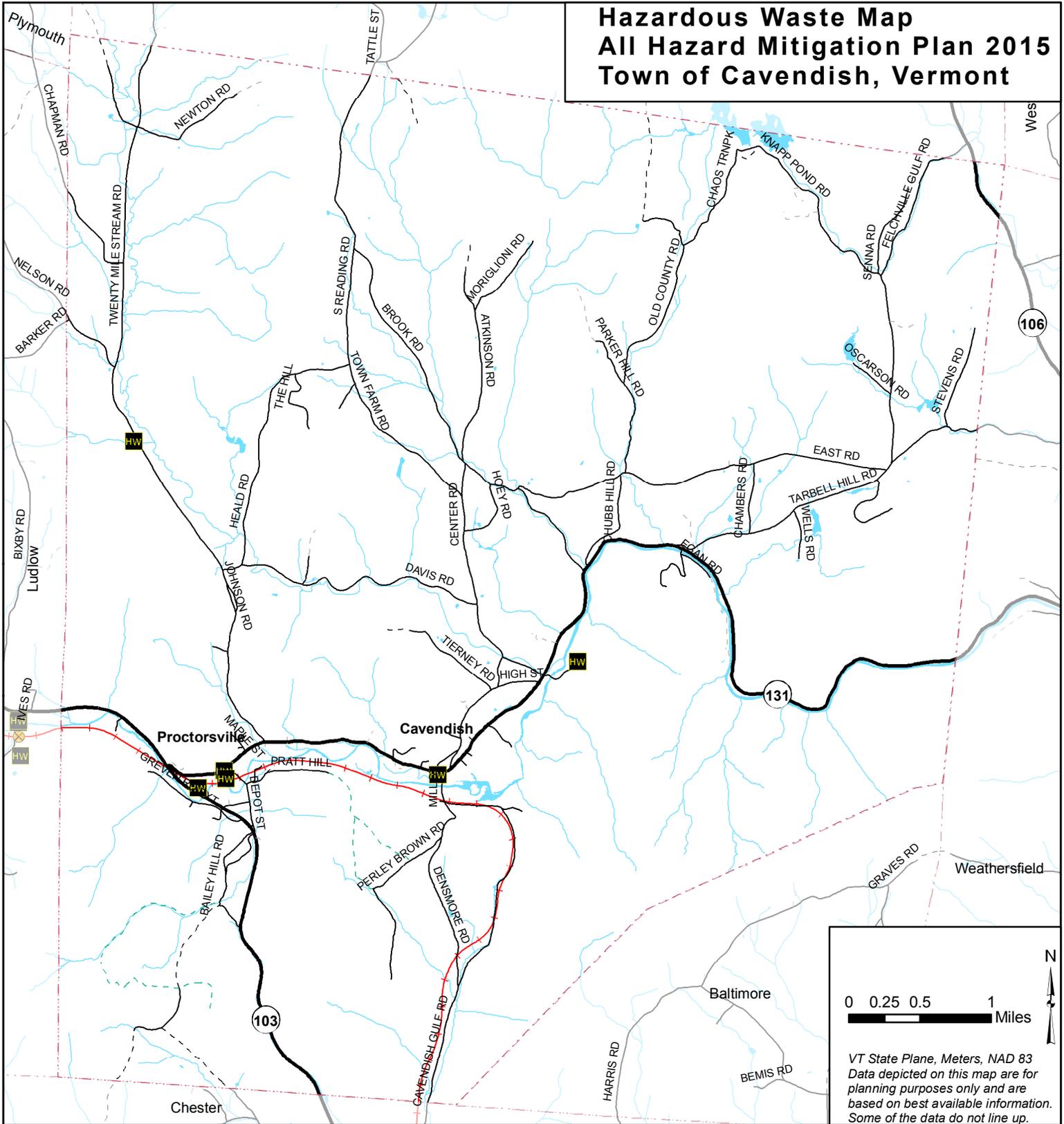
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DRAFT Drawn February 6, 2015

# Hazardous Waste Map

## All Hazard Mitigation Plan 2015

### Town of Cavendish, Vermont



**HW** Hazardous Waste Site

Hazardous Waste Facility Status

- Fully Regulated Generator
- ⊗ Conditionally Exempt Generator
- ⊙ Out of Business
- ⊕ Unknown Status

Rivers and Streams

Lakes and Ponds

VT State Highway

Class 2 and 3 Town Highway

Class 4 Town Hwy & Legal Trail

Private Road

State Forest Road

Railroads

Town boundary

There are no airports in Town.

Data Sources: Hazardous Waste Facilities (VT Dept of Environmental Conservation 2006), Hazardous Waste Sites (VT Dept of Environmental Conservation 2012), Roads (VT Agency of Transportation 2014), Railroad (VT Agency of Transportation 2014), Rivers and waterbodies (VT Hydrographic Dataset 2008), Town Boundary (RPC 2014 using Parcels 2009).

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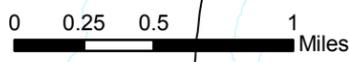
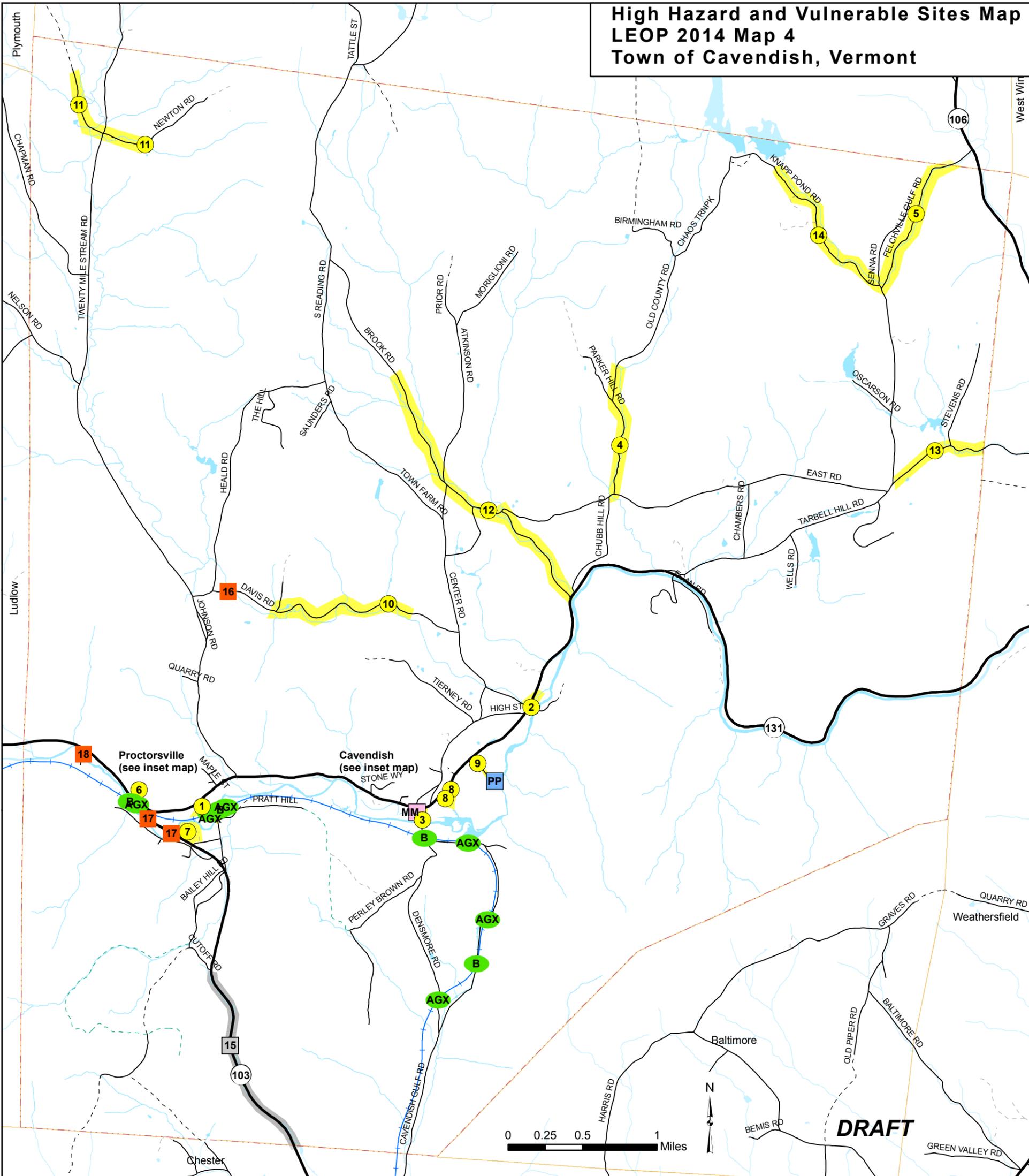


**SOUTHERN WINDSOR COUNTY  
REGIONAL PLANNING COMMISSION**

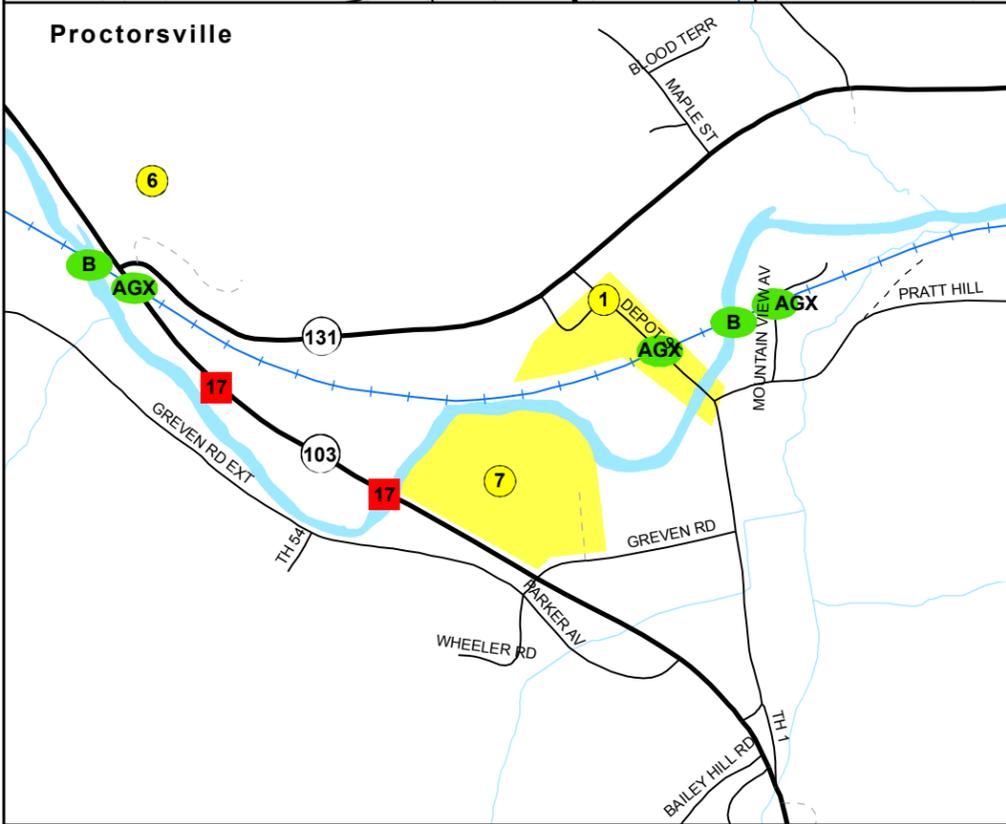
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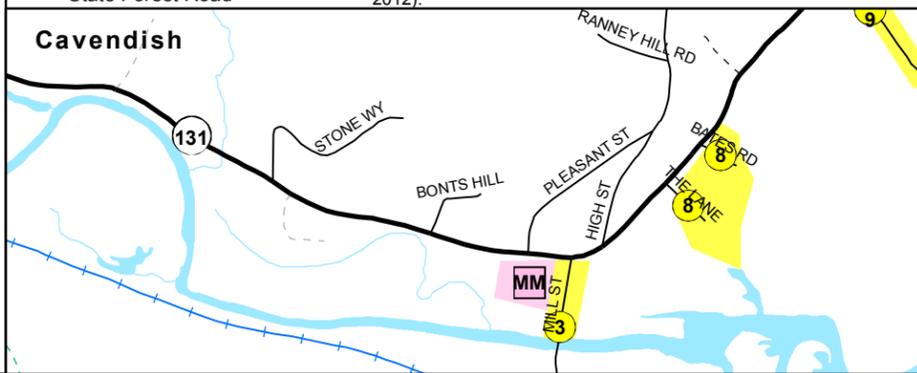
# High Hazard and Vulnerable Sites Map LEOP 2014 Map 4 Town of Cavendish, Vermont



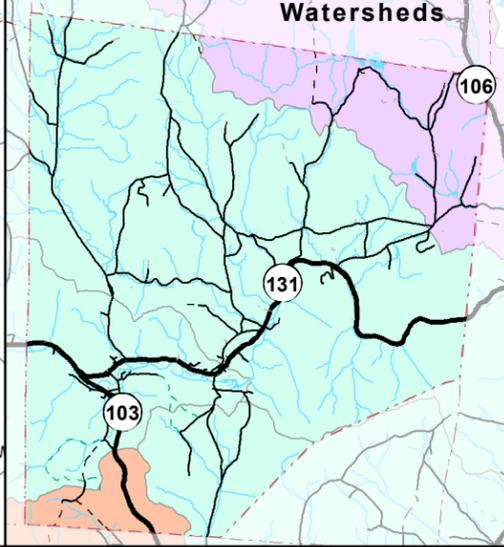
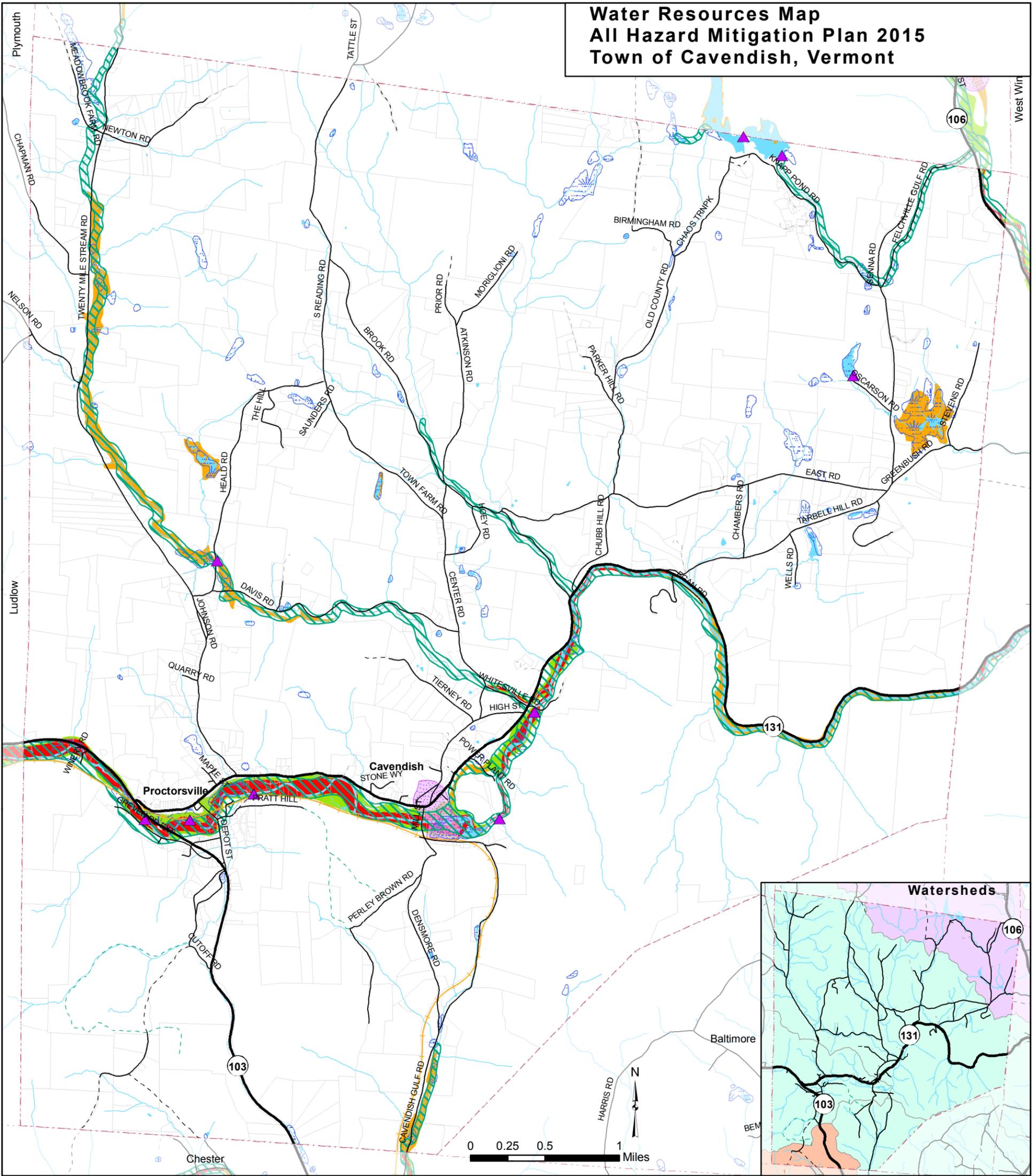
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<ul style="list-style-type: none"> <li><span style="color: yellow;">●</span> Low lying/ flood prone areas</li> <li><span style="background-color: gray; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Ice and Falling Rock Zone</li> <li><span style="color: orange;">■</span> Bridges</li> <li><span style="color: green;">●</span> Railroad bridge or crossing</li> <li><span style="background-color: pink; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Chemicals, Flammables, Fuels</li> <li><span style="background-color: blue; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Switching/ Hydro Plant</li> <li><span style="color: blue;">—</span> Railroads</li> <li><span style="color: black; font-weight: bold;">—</span> VT State Highway</li> <li><span style="color: black; font-weight: bold;">—</span> Class 2 and 3 Town Highway</li> <li><span style="color: black; font-weight: bold;">—</span> Class 4 Town Hwy &amp; Legal Trail</li> <li><span style="color: gray; font-weight: bold;">—</span> Private Road</li> <li><span style="color: green; font-weight: bold;">—</span> State Forest Road</li> </ul>	<ul style="list-style-type: none"> <li><span style="color: blue;">—</span> Rivers and Streams</li> <li><span style="background-color: lightblue; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Lakes and Ponds</li> <li><span style="border-top: 1px dashed red; width: 10px; display: inline-block;"></span> Cavendish Town Boundary</li> <li><span style="border-top: 1px dashed orange; width: 10px; display: inline-block;"></span> Other Town Boundary</li> </ul>	<p>VT State Plane, Meters, NAD83 Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.</p> <div style="text-align: center;">  <p><b>SOUTHERN WINDSOR COUNTY REGIONAL PLANNING COMMISSION</b> P.O. Box 320, Ascutney, VT 05030 802-674-9201 www.swcrpc.org</p> </div> <p>Data Sources: High Hazard and Vulnerable Sites (Town/ RPC 2014), Railroads (VTrans 2003), Waterbodies (VHD 2008), Road centerline (VTrans 2013), Town Boundary (RPC 2012 using Parcels 2012).</p> <p>For planning purposes only Not for regulatory interpretation Drawn October 7, 2014</p>
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# Water Resources Map All Hazard Mitigation Plan 2015 Town of Cavendish, Vermont

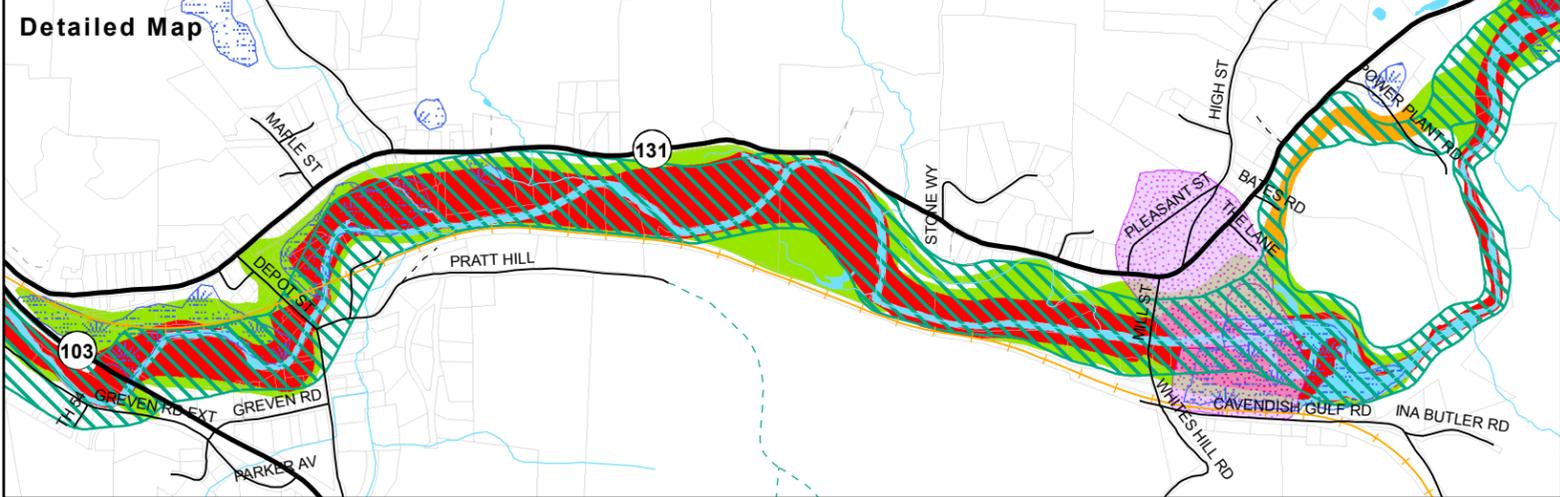


- |                                |                                |                                      |
|--------------------------------|--------------------------------|--------------------------------------|
| Dam                            | VT State Highway               | Major Watersheds (in small map only) |
| Floodway (Zone AE)             | Class 2 and 3 Town Highway     | Black River                          |
| Floodplain (Zone A)            | Class 4 Town Hwy & Legal Trail | North Branch Black River             |
| Floodplain (Zone AE)           | Private Road                   | Williams River                       |
| River Corridor Protection area | State Forest Road              |                                      |
| Groundwater Protection Area    | Railroads                      |                                      |
| Wetland                        | Parcels (Cavendish only)       |                                      |
| Rivers and Streams             | Town boundary                  |                                      |
| Lakes and Ponds                |                                |                                      |

There are no surface water protection areas within the town (VT Agency of Natural Resources 2010).

Data Sources: Dams (VT Agency of Natural Resources 2008), Floodplain and Floodway (Special Flood Hazard Areas) (Federal Emergency Management Agency 2008), River Corridor Protection Area (VT Agency of Natural Resources, January 2, 2015), Wetlands (VT Significant Wetlands Inventory) (VT Agency of Natural Resources 2010), Groundwater Protection Area (also known as Wellhead Protection Areas) (VT Agency of Natural Resources 2011), Surface Water Protection Area (VT Agency of Natural Resources 2010), Railroads (VT Agency of Transportation 2014), Road centerline (VT Agency of Transportation 2014), Waterbodies and Watersheds (VT Hydrographic Dataset 2008), Town Boundary (Southern Windsor County Regional Planning Commission 2014 using Parcels 2009), Parcels (Cartographic Associates 2009).

## Detailed Map



VT State Plane, Meters, NAD 83  
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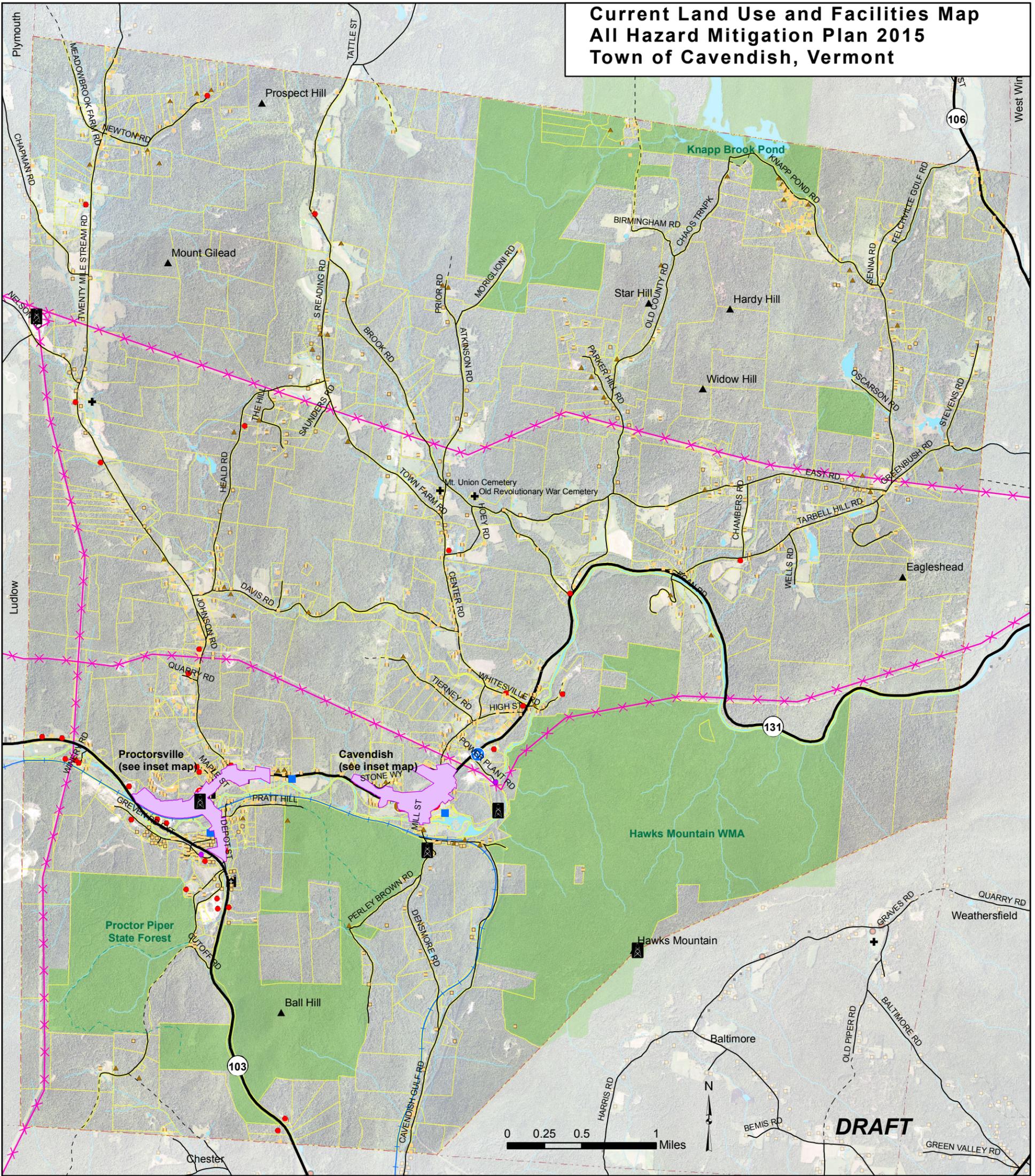
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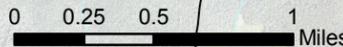
# Current Land Use and Facilities Map

## All Hazard Mitigation Plan 2015

### Town of Cavendish, Vermont

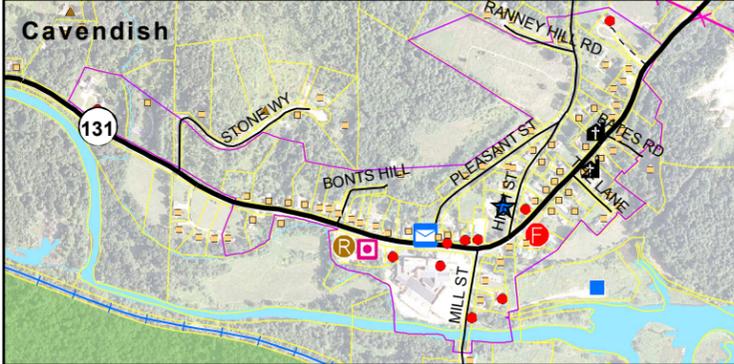
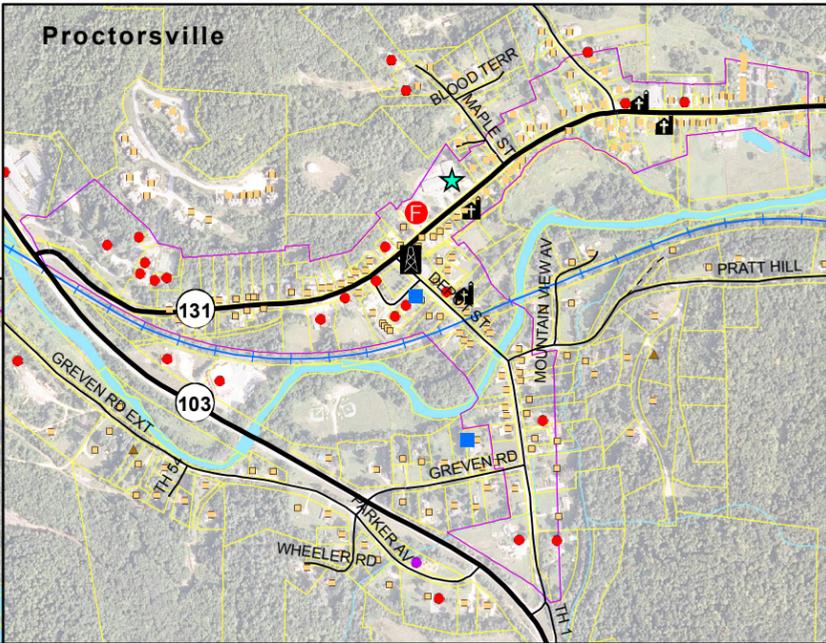


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- |                                 |                                   |                              |
|---------------------------------|-----------------------------------|------------------------------|
| ★ Town Office                   | ✚ Cemetery                        | □ Parcels                    |
| ★ Elementary School and Library | ▲ Hill/ Mountain Summit           | ▭ Village Center Designation |
| 🚒 Fire Station                  | 📶 Telecommunications Tower        | ⬭ Town Boundary              |
| 🚚 Town Highway Garage           | ✚ Transmission Line               |                              |
| 🏠 Town Water Treatment Plant    | 🚊 Railroads                       |                              |
| 📧 Other Town Facility           | 🛣️ VT State Highway               |                              |
| 📧 Post Office                   | 🛣️ Class 2 and 3 Town Highway     |                              |
| 🏠 Historical Society            | 🛣️ Class 4 Town Hwy & Legal Trail |                              |
| 🏠 House of Worship              | 🛣️ Private Road                   |                              |
| 🏭 Industrial                    | 🛣️ State Forest Road              |                              |
| 🔴 Commercial                    | 🌊 Rivers and Streams              |                              |
| 🏠 Residential                   | 🟦 Lakes and Ponds                 |                              |
| 🏕️ Camp                         | 🟢 Conserved Lands                 |                              |

Data Sources: Facilities in town (VT E911 April 2013 and Southern Windsor County Regional Planning Commission 2014), Buildings (VT E911 April 2013), Cemeteries (VT Agency of Transportation 2001), Transmission Lines (VT Center for Geographic Information 2003 and Southern Windsor County Regional Planning Commission 2013), Telecommunications Towers (VT Natural Resources Board 2007 and Southern Windsor County Regional Planning Commission 2013), Railroads (VT Agency of Transportation 2014), Conserved Lands (VT Agency of Natural Resources 2012), Waterbodies (VT Hydrographic Dataset 2008), Hill/Mountain Summit (Unknown source), Road centerline (VT Agency of Transportation 2014), Village Center Designation Boundary (Southern Windsor County Regional Planning Commission 2013), Town Boundary (Southern Windsor County Regional Planning Commission 2014 using Parcels 2009), Aerial (National Agricultural Imagery Program 2009), Parcels (Cartographic Associates 2009).



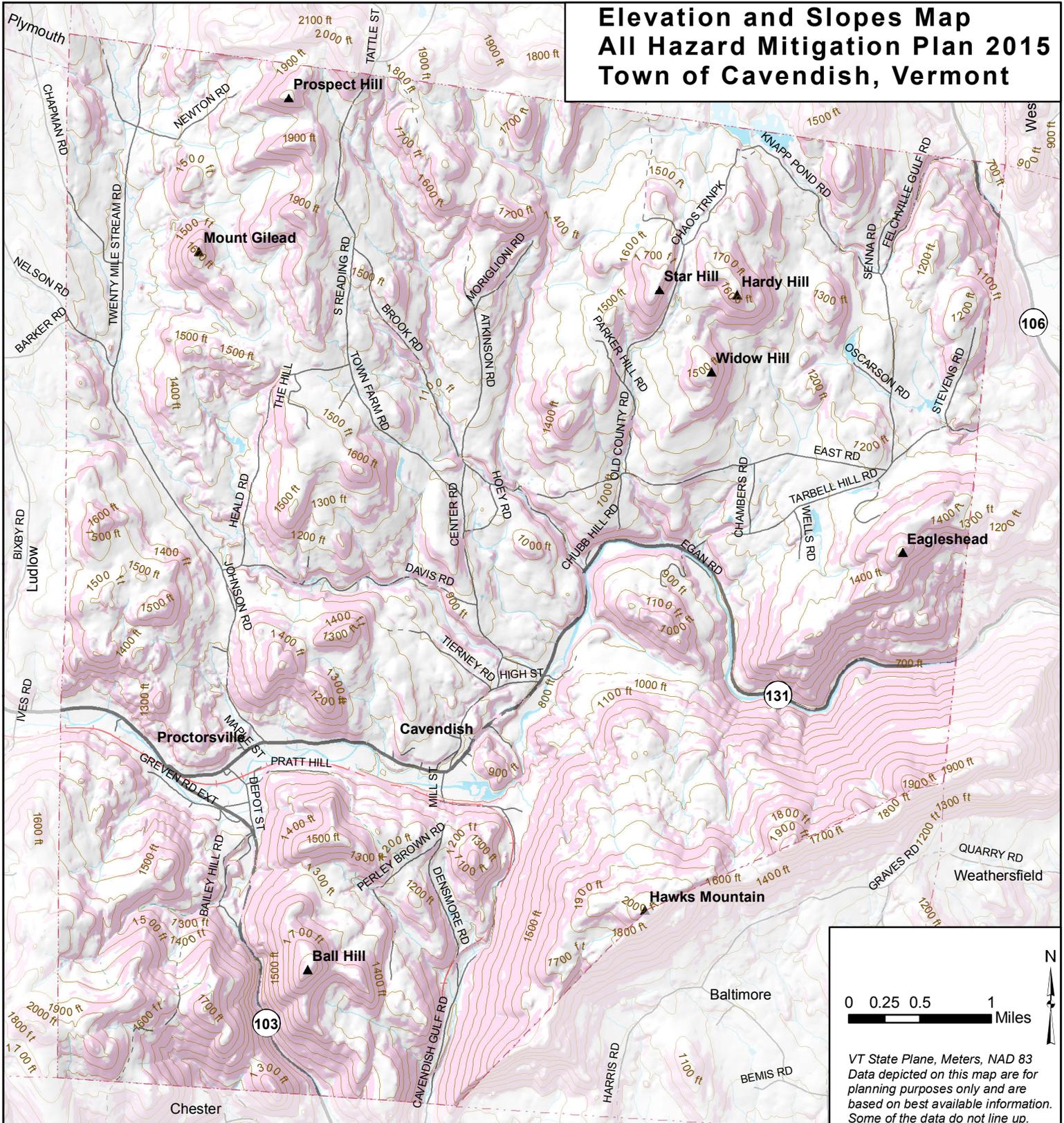
VT State Plane, Meters, NAD 83  
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.



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# Elevation and Slopes Map All Hazard Mitigation Plan 2015 Town of Cavendish, Vermont



- ▲ Hill/ Mountain Summit
- ~ 100ft Contour Line
- Steep slope of 24% or above
- ~ Rivers and Streams
- Lakes and Ponds
- ~ VT State Highway
- ~ Class 2 and 3 Town Highway
- ~ Class 4 Town Hwy & Legal Trail
- ~ Private Road
- ~ State Forest Road
- ~ Railroads
- ~ Town boundary

0 0.25 0.5 1 Miles

VT State Plane, Meters, NAD 83  
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.

Data Sources: Contours, steep slopes and hillshade (derived from 10m Digital Elevation Model, US Geological Survey/ VT Center for Geographic Information 2012), Hill/Mountain Summit (Unknown Source), Roads (VT Agency of Transportation 2014), Railroad (VT Agency of Transportation 2014), Rivers and waterbodies (VT Hydrographic Dataset 2008), Town Boundary (RPC 2014 using Parcels 2009).

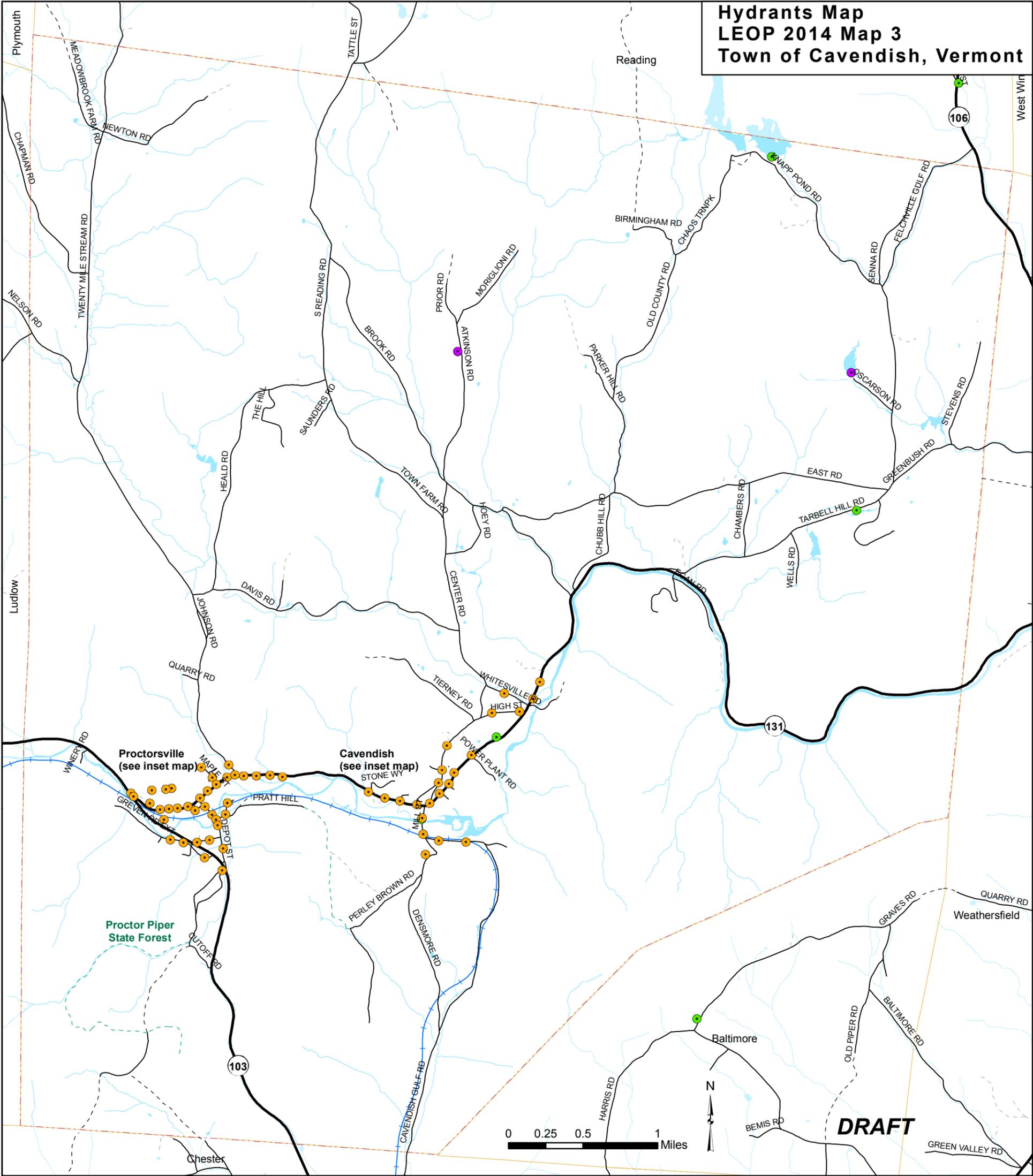
**DRAFT**

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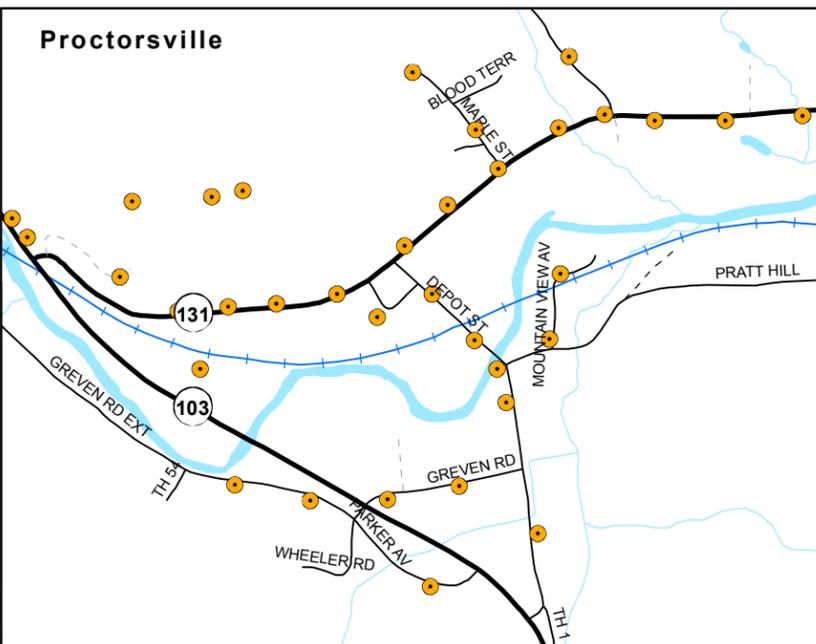
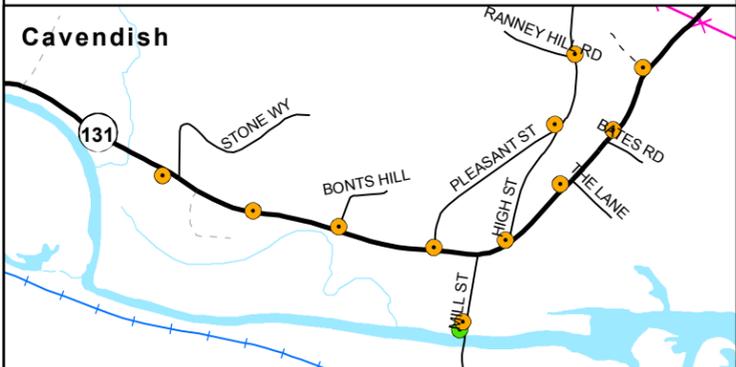
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# Hydrants Map LEOP 2014 Map 3 Town of Cavendish, Vermont



- Municipal Hydrant
- Dry Hydrant
- Drafting Site for Hydrant
- Railroads
- VT State Highway
- Class 2 and 3 Town Highway
- Class 4 Town Hwy & Legal Trail
- Private Road
- State Forest Road
- Rivers and Streams
- Lakes and Ponds
- Cavendish Town Boundary
- Other Town Boundary

Drafting Site - potential water drafting site, fire pond  
 Dry Hydrant - non-pressurized rural water supply hydrant  
 Municipal Hydrant - pressurized municipal rural water supply hydrant (pressurized from pond supply being higher than hydrant site)



Data Sources:  
 Hydrants (E911 April 2013), Railroads (VTrans 2003), Waterbodies (VHD 2008), Road centerline (VTrans 2013), Town Boundary (RPC 2012 using Parcels 2012)

VT State Plane, Meters, NAD 83  
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