# Town of Dorset
# DRAFT Hazard Mitigation Plan

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PUBLIC HEARING

Town of Dorset
PO Box 715
112 Mad Tom Road
East Dorset, VT 05253

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# I. Introduction

## A. Purpose

Hazard mitigation is intended to reduce potential losses from future disasters. Hazard mitigation plans identify potential natural hazards that could affect a community and the projects and actions that a jurisdiction can undertake to reduce risks and damage from natural hazards such as flooding, landslides, wildland fire, and similar events (FEMA 2011).

This plan is intended to identify, describe and prioritize potential natural hazards that could affect the Town of Dorset and measures to reduce or avoid those effects. The Federal Emergency Management Agency, within the U.S. Department of Homeland Security and the Department of Vermont Emergency Management both advocate the implementation of hazard mitigation measures to save lives and property and reduce the financial and human costs of disasters.

The format of this plan is as follows. Section II provides a profile of the town, including a discussion of the environmental setting, demographics and settlement patterns. Section III describes the planning process along with lists of members of the planning committee and dates of meetings and public and agency review. Section IV analyzes the following natural hazards:

- Floods and Flash Floods
- Winter Storms
- High Wind Events
- Hail
- Temperature Extremes
- Drought
- Wildfire
- Landslides and Debris Flow
- Earthquake
- Hazardous Materials Spill
- Infectious Disease Outbreak
- Invasive Species

## B. Mitigation Goals

The Town identified the following mitigation goals:

1. Significantly reduce injury and loss of life resulting from natural disasters.
2. Significantly reduce damage to public infrastructure, minimize disruption to the road network and maintain both normal and emergency access.

3. Establish and manage a program to proactively implement mitigation projects for roads, bridges, culverts and other municipal facilities to ensure that community infrastructure is not significantly damaged by natural hazard events.
4. Design and implement mitigation measures so as to minimize impacts to rivers, water bodies and other natural features, historic structures, and neighborhood character.
5. Significantly reduce the economic impacts incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters.
6. Encourage hazard mitigation planning to be incorporated into other community planning projects, such as Town Plan, Capital Improvement Plan, and Town Basic Emergency Operation Plan
7. Ensure that members of the general public continue to be part of the hazard mitigation planning process.

Based on the above goals and the assessment of hazards (Section IV), Dorset identified and prioritized mitigation actions which are specifically described in Section V.D.

## II. Town Profile

The Town of Dorset has an area of 30,656 acres or 46.04 square miles, made up of many types of land and waterways: flat valley land, swamps, rolling hills, steep mountains, streams and rivers. 14,228 acres contain slopes in excess of 20%, and 2,880 acres have elevations above 2500 feet.[1]

The physiography of the Town may be described as two roughly north-south valleys, which contain most of Dorset's development, together with parts of three north-south mountainous areas, which define the valleys.

The eastern edge of the Town runs along the western slope of the Green Mountains. The southwestern corner of the Town occupies the northeastern slope of Mother Myrick Mountain, in the Taconic Mountain Range. Thrusting into Dorset from the north is a mountainous area, also part of the Taconic Range, extending south from Dorset Mountain, whose summit, close to the northern town line, is over 3800 feet above sea level. A spine, between 2000' and 2500' high lies between Dorset Mountain and Mount Aeolus (also called Green Peak) about five miles to the south. Land falls southerly from Mount Aeolus to become rolling land extending south to the town line.

Between the Green Mountains and the Taconics lies the well defined and rather narrow Vermont Valley, which is Dorset's eastern valley, and is known in transportation terms as the "Route 7 corridor." The southern portion of this valley is drained by the Batten Kill, which flows mostly west to the Hudson River. The northern portion of the valley is drained by the Otter Creek, which flows northerly to Lake Champlain. The divide between the two watersheds lies a short distance north of the village of East Dorset. The easterly valley contains the villages of East Dorset, South Village of East Dorset, and the cluster of houses known as North Dorset.

[1] Dorset Town Plan 2014

The westerly valley extends diagonally from approximately the midpoint of the southern town line to the midpoint of the western town line. This is the "Route 30 corridor." This valley also drains in two directions, with the watershed divide constituting a Class I wetland, known as the Dorset Marsh, southwest of Dorset Village. Towards the southeast, this drains into a branch of the Batten Kill; towards the northwest the flow is into the Mettawee River, which, like the Otter, flows into Lake Champlain. This westerly valley contains the villages of Dorset and South Dorset.

A subordinate valley, known as Dorset Hollow, is located east of Dorset Village. This valley contains considerable acreage of rolling land, and also the headwaters of the Mettawee River.

Most of dorset is forested, consisting primarily of northern hardwood forests but also of conifer forests, generally at higher elevations. The geography of the Town divides it roughly into two development axes, both of which radiate out from the larger urban center of Manchester to the south. Only one public road within the Town links the two valleys - Morse Hill Road - which climbs over the lower southern side of Mount Aeolus. The Town is bordered by Danby on the north, Manchester on the south, Peru on the east and Rupert on the West (Map 1). According to the 2010 U.S. Census, the population of Dorset is 2,031 persons in 235 households. These are mostly year-round residents, but the figures do include some seasonal residents who maintain residency here even though they are not year-round residents.

Table 1. Number of buildings by type. Source: VCGIS 2014 E911 data

| Type | Number |
|---|---|
| Single-family residential | 1143 |
| Mobile home | 26 |
| Multi-family | 29 |
| Commercial/Industrial | 83 |
| Lodging | 18 |
| Camp | 52 |
| Government | 6 |
| Education | 2 |
| House of Worship | 4 |
| Other | 48 |

## III. Planning Process

The Bennington County Regional Commission began discussions with the Town on developing a hazard mitigation plan in 2012. The Dorset Select Board decided to initiate planning in July of 2014. This is the first hazard mitigation plan for Dorset. The planning team consisted of members listed in Table 2 below

Table 2. Planning committee members

| Name | Affiliation |
|---|---|
| Chris Brooks | Select Board Chair |
| Michael Conners | Select Board |
| Michael Oltedal | Select Board |

| Table 2. Planning committee members | |
|---|---|
| Name | Affiliation |
| Ryan Downey | Select Board |
| Steven Jones | Select Board |
| Danny Pinsonault | Planning Commission |
| Rob Gaiotti | Town Manager |
| Jim Hewes | Road Foreman |

| Table 3. Dates of planning meetings and public and agency review | |
|---|---|
| Meeting | Date (s) |
| Select Board initiates planning process | 8-19-2014 |
| Planning committee organization meeting | 8-19-2014 |
| Planning committee meetings | 9-16-2014<br>10-21-2014<br>11-18-2014<br>12-16-2014 |
| Draft made available for public and agency review by the planning committee | 10-21-2014<br>11-18-2014<br>12-16-2014 |
| Select Board approved the plan for release | 12-16-2014 |
| Redraft of plan again made available for public and agency review | 1-20-2015 |
| Select Board meeting and vote to send to FEMA | 1-20-2015 |

The above meetings were warned and comments were solicited from members of the public, business owners and other stakeholders. The draft plan was put online on the Bennington County Regional Commission and Town of Dorset websites, and notices sent out to members of the public informing them that they could review the plan at that website or in the Town Hall in Dorset, VT.

Comments and information on the draft plan were also solicited from the Town Road Foreman and volunteer fire personnel and a meeting was held by the Select Board to solicit comments from the public. The plan was also sent to the neighboring towns of Danby, Peru, Manchester, and Rupert and to Local Emergency Planning Committee #7, which includes Dorset for comment. The plan was also reviewed by the Vermont Department of Emergency Management and Homeland Security.

The plan was submitted for review by the Federal Emergency Management Agency on DATE. Following FEMA review, the Town Select Board adopted the plan on DATE.

## IV. Hazard Analysis

## A. Hazard Assessment

This section addresses each of the potential natural hazards based on data from the National Climate Data Center (NCDC 2013), the National Weather Service river gauge web site (www.water.weather/ahps/), the Federal Emergency Management Agency list of disasters (http://www.fema.gov/femaNews/disasterSearch.do), the Vermont Department of Forests, Parks, and Recreation and local knowledge. There are no stream gauges located in Dorset. There is a National Weather Service Cooperative Observer Station (SUNV1) located at Longitude -73.1244, Latitude 43.0908 in the Town of Sunderland with data from January 1, 1990 to the present. Information from other observers was incorporated where relevant. Earthquake data came from a run of HAZUS completed by Jon Kim of the Vermont Geological Survey.

### 1. Floods and Flash Floods

### a. Description

Flooding is the most frequent and damaging natural hazard in Vermont. The National Weather Service (2010) defines a flood as "any high flow, overflow, or inundations by water which causes or threatens damage." A flash flood is …"a rapid and extreme flow of high water into a normally dry area, or a rapid water rise in a stream or creek above a predetermined flood level." These are usually within six hours of some event, such as a thunderstorm, but may also occur during floods when rainfall intensity increases, thereby causing rapid rise in flow. The NWS uses the following impact categories:

- Minor Flooding - minimal or no property damage, but possibly some public threat.
- Moderate Flooding - some inundation of structures and roads near stream. Some evacuations of people and/or transfer of property to higher elevations.
- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
- Record Flooding - flooding which equals or exceeds the highest stage or discharge observed at a given site during the period of record keeping.

Floods may reach these magnitude levels in one or more reaches, but not necessarily all. Runoff from snowmelt in the spring, summer thunderstorms, and tropical storms and hurricanes can all result in flooding in Dorset. Ice jam flooding can occur on Vermont rivers when substantial ice forms followed by several days of warmth, snowmelt and any rainfall leading to ice breakup. As the ice breaks up on the rivers, chunks of ice form jams which cause localized flooding on main stem and tributary rivers. Ice jams are most prevalent during the January thaw (late January) and in March and April as spring approaches.

Flash floods can occur after spring melt of mountain snow, following large storms such as Tropical Storm Irene, or after significant thunderstorms. Digital flood zone maps have been prepared and are currently under review. Map 2 shows the location of both flood hazard zones and fluvial erosion hazard zones.

Most development in Dorset is located in the valleys along the Batten Kill, Otter Creek and The Mettawee River. As headwaters, these streams can be very flashy, and while some flood losses are the result of inundation, more often flood losses are caused by fluvial erosion. Fluvial erosion can range from gradual bank erosion to catastrophic changes in the location of the river channel (Vermont River Management Program 2010).

**Photo 1. Damage from fluvial erosion**

## b. Previous Occurrences

Ludlum (1996) describes numerous storm events that have affected Vermont since settlement, but the local impacts of these are difficult to trace. The 1927 flood was the largest disaster in the history of the state. The state received over six inches of rain, with some areas receiving 8-9 inches. Following a rainy October, this storm occurred from November 2$^{nd}$ through the 4$^{th}$ causing extensive flooding. Two storms occurred in March of 1936. Heavy rains and snowmelt caused significant flooding. Two years later, the 1938 hurricane caused both flooding and extensive wind damage.

Table 4 shows a total of 50 flood events in Bennington County from 1990 to 2013, using NCDC data. These have been primarily minor and affected either specific streams, such as the Batten Kill and the Walloomsac or specific towns.

Table 4. Total number of flood events by type and year for Bennington County. Source: NCDC 2012

| Year | Flash Flood | Flood | Total |
|---|---|---|---|
| 1996 | 3 | 6 | 9 |
| 1997 | | | |
| 1998 | 1 | 3 | 4 |
| 1999 | 2 | | 2 |
| 2000 | 4 | 1 | 5 |
| 2001 | | | |
| 2002 | 1 | | 1 |
| 2003 | | 2 | 2 |
| 2004 | 1 | 5 | 6 |
| 2005 | | 5 | 5 |
| 2006 | | | |
| 2007 | 1 | 1 | 2 |
| 2008 | | | |
| 2009 | 2 | | 2 |
| 2010 | | | |
| 2011 | 4 | 4 | 8 |
| 2012 | | | |
| 2013 | 4 | | 4 |
| Total | 23 | 27 | 50 |

Hurricanes and tropical storms that form in tropical waters have historically affected New England, but are relatively infrequent. Besides the 1938 storm, Tropical Storm Belle brought significant rains to Vermont in 1976 and Hurricane Gloria brought rain and wind damage in 1985. Dorset has been subjected to two major tropical storms in the past twenty years.

Table 5 describes ten moderate and extreme events that have occurred since 1990, using the National Weather Service (2010) categories, which likely affected Dorset. These events were described in the National Climate Database records (2012). It should be noted that only the January 1996 event occurred in the winter, with all other events in the spring, summer or fall. Ice jam flooding does occur and one instance of damage is described below.

Table 5. Significant flood events affecting Bennington County. Source: NCDC 2012

| Dates | Type | Description | Area | Category | FEMA |
|---|---|---|---|---|---|
| 19-20 Jan 1996 | Flood | An intense area of low produced unseasonably warm temperatures, high dew points and strong winds resulting in rapid melting of one to three feet of snow. One to three inches of rain fell as the system moved northeast along the coast. This resulted in numerous road washouts and the flooding of several homes across the county. A Cooperative Weather Observer recorded 0.94" of rain in Sunderland. | Countywide | Moderate | DR-1101 1/19 to 2/2 1996 |
| 11-12 May 1996 | Flood | A low pressure system intensified creating a prolonged period of precipitation. Over two inches of rain fell over much of western New England resulting in flooding along the Walloomsac River in Bennington County. A Cooperative Weather Observer recorded 3.5" of rain in Sunderland from May 10-13. | Bennington | Moderate | |
| 8-10 Jan 1998 | Flood | Mild temperatures and rain combined to cause small stream flooding throughout Bennington County The Batten Kill rose over eight feet at the Arlington gage, and the Walloomsac River crested nearly two feet above flood stage at Bennington. The main impact was extensive flooding of fields and roadways. Route 7A north of Arlington was closed due to flooding. A Cooperative Weather Observer recorded 3.81" of precipitation in Sunderland from January 5-10. | Arlington; Bennington; Countywide | Moderate | |
| 16-17 Sept 1999 | Flood | The remnants of Hurricane Floyd brought high winds and heavy rainfall (3-6 inches) to southern Vermont. Many smaller tributaries reached or exceeded bankfull. Estimated wind gusts exceeded 60 mph, especially over hilltowns. Power outages occurred across southern Vermont. A Cooperative Weather Observer recorded 4.94" of rain in Sunderland. | Countywide | Moderate | DR-1307 9/16-21 1999 |

| Table 5. Significant flood events affecting Bennington County. Source: NCDC 2012 | | | | | |
|---|---|---|---|---|---|
| Dates | Type | Description | Area | Category | FEMA |
| 14-17 Jul 2000 | Flash Flood | Thunderstorms caused torrential rainfall with flash flooding washing out sections of roadways in northeast Bennington County and southern Bennington County. Routes 7 and 67 were closed. A Cooperative Weather Observer recorded 3.39" of rain in Sunderland. | Northeast Bennington County; Southern Bennington County; Arlington; Bennington; Shaftsbury | Moderate | DR- 1336 7/14-18 2000 |
| 17 Dec 2000 | Flood | Unseasonably warm and moist air brought a record breaking rainstorm to southern Vermont. Rainfall averaged 2-3 inches. The heavy rain, combined with snowmelt and frozen ground, lead to a significant runoff and flooding. A Cooperative Weather Observer recorded 3.38" of precipitation in Sunderland. | Peru; Dorset: West Rupert | Moderate | DR-1358 12/16-18 2000 (Severe Winter Storm) |
| 21 July to 18 Aug 2003 | | Severe storms and flooding affected Vermont including Bennington County. (Note: this event does not appear in the NCDC data.) A Cooperative Weather Observer recorded sporadic and sometimes large amounts of precipitation during that period in Sunderland. | | | DR-1488 7/21-8/18 2003 |
| 16-17 Apr 2007 | Flood | An intense coastal storm spread heavy precipitation across southern Vermont, starting as a mixture snow, sleet and rain which changed to all rain. Liquid equivalent precipitation totals ranged from three to six inches leading to minor flooding across portions of southern. A Cooperative Weather Observer recorded 3.54 of rain in Sunderland. | Arlington | Minor | DR- 1698 4/15-21 2000 |
| 28-29 Aug 2011 | Flood/Flash Flood | Tropical Storm Irene produced widespread flooding, and damaging winds across the region. Rainfall amounts averaged four to eight inches and fell within a twelve hour period. A Cooperative Weather Observer recorded 5.16" of rain in Sunderland. In Bennington County, widespread flash flooding and associated damage was reported countywide, with many roads closed due to flooding and downed trees and power lines. Strong winds also occurred across southern Vermont, with frequent wind gusts of 35 to 55 mph, along with locally stronger wind gusts exceeding 60 mph. The combination of strong winds, and extremely saturated soil led to widespread long duration power outages. | Countywide | Extreme | DR-4022 8/27-2 2011 |
| 7 Sept 2011 | Flood | Large amounts of moisture from the remnants of Tropical Storm Lee interacted with a frontal system producing heavy rainfall with total rainfall amounts ranging from three to seven inches. led to widespread minor to moderate flooding across southern Vermont. A Cooperative Weather Observer recorded 4.63" of rain between September 5$^{th}$ and 9$^{th}$. | North Bennington; Countywide | Moderate | |

A Cooperative Weather Observer recorded 6.86" of rain from August 6 to 14, 1990, 10.94" from October 8 to 27, 2005 and 6.11" from September 28 to October 8, 2010, but no damage was recorded.

### c. Extent and Location

The primary damages from past events have been from flooding and fluvial erosion with secondary damage from wind. There have been no NFIP-designated repetitive losses within the jurisdiction. There are 6 dams within the Town. Table 6 shows the number of structures, by type, in the special flood hazard and fluvial erosion hazard zones that are shown in Map 2.

Table 6. Structures by type in flood hazard zones in Dorset, VT. Source: Vermont Center for Geographic Information www.vcgi.org

| Type | Number in special flood hazard zone | Number in fluvial erosion hazard zone |
|---|---|---|
| Residential | 22 | 9 |
| Commercial | 4 | 1 |
| Lodging | 1 | 0 |
| Government | 1 | 0 |

Tropical Storm Irene caused significant damage including:

- Ten incidents of damage to the road and culverts along Mad Tom Road. Map 4 shows the locations of these damages.

### d. Probability, Impact, and Vulnerability

Based on data from 1996 to 2012, ten moderate or major flood events have affected Bennington County, resulting in a 50-60% chance of such an event occurring. However, these have not all directly affected Dorset, so that probability should range from 10 to 50%. Dorset has a total of 227 single family residences, 7 mobile homes, 2 commercial establishments, 63 camps, and a small number of multi-family, government, church and school buildings. As shown in Table 6, there are two structures in the special flood hazard area and 14 in the fluvial erosion hazard zone. Therefore, the potential proportion damaged within the town from severe flooding would range from 1-10% with injuries of 1-10%. Most services would be recovered in less than seven days, though help for specific property owners may take significantly longer.

## 2. Winter Storms

### a. Description

Winter storms are frequent in Vermont. Winter storms may consist of heavy snow, mixed precipitation, or ice storms and all may be accompanied by strong winds. Potential damages can include power outages, traffic accidents, and isolation of some areas. For example, the October 4, 1987 storm stranded travelers in the area and knocked out power for several days. In rare cases, the weight of snow may collapse roofs and cause other structural damage. Wind can also accompany snowstorms increasing the effect of the snow damages. In addition to snow, ice storms occur when the lower levels of the atmosphere and/or ground are at or below freezing, and rain is falling through warmer air aloft. The precipitation freezes upon contact with the ground, objects on the ground, trees and power lines.

### b. Previous Occurrences

Table 7. Total number of winter storm events by type and year for Bennington County. Source: NCDC 2014

| Year | Blizzard | Heavy Snow | Ice Storm | Winter Storm | Winter Weather | Totals |
|---|---|---|---|---|---|---|
| 1996 | | 5 | | 2 | | 7 |
| 1997 | | 1 | | 7 | 2 | 10 |
| 1998 | | | | 2 | 1 | 3 |
| 1999 | | | | 4 | | 4 |
| 2000 | | 1 | | 6 | | 7 |
| 2001 | | | | 6 | | 6 |
| 2002 | | | | 2 | | 2 |
| 2003 | | | | 5 | | 5 |
| 2004 | | | | 2 | | 2 |
| 2005 | 1 | 3 | | 2 | | 6 |
| 2006 | | | | | | 0 |
| 2007 | | 3 | 1 | 6 | 4 | 14 |
| 2008 | | 4 | 2 | 1 | 11 | 17 |
| 2009 | | 3 | | 1 | 10 | 14 |
| 2010 | | 3 | | 1 | 2 | 6 |
| 2011 | | | | 5 | 5 | 10 |
| 2012 | | | | 4 | 2 | 6 |
| 2013 | | 1 | | 1 | 3 | 5 |
| Totals | 1 | 24 | 2 | 57 | 40 | 124 |

Table 7 summarizes the 124 winter storm events that have occurred in Bennington County since 1996. As can be seen, a high numbers of events occurred in 1997, 2007, 2008, and 2009. Using NCDC data, we categorized the extent of each storm with storms ranked as “High” if they produced more than twelve inches of snow or were categorized by the NCDC as producing heavy or record snows or blizzards or significant icing. The Blizzard of 1993 was categorized as “Extreme.” The NCDC also reports numerous storms producing one to over three feet of snow in the Green Mountains, but these were not listed as they did not affect major population centers. Table 8 describes these events.

Table 8. Significant winter storm events in Bennington County and Dorset. Source: NCDC 2014

| Dates | Type | Description | Category | Area |
|---|---|---|---|---|
| 13-14 Jan 1993 | Heavy Snow | Snowfall amounts across the state ranged from six to sixteen inches. A Cooperative Weather Observer recorded 10.0” in Pownal. | High | Statewide |
| 16-17 Feb 1993 | Heavy Snow | Snowfall amounts ranged from 6 to 18”. A Cooperative Weather Observer recorded 6.0” in Pownal. | High | Statewide |

Table 8. Significant winter storm events in Bennington County and Dorset. Source: NCDC 2014

| Dates | Type | Description | Category | Area |
|---|---|---|---|---|
| 13-14 Mar 1993 | Blizzard | The "Blizzard of 93", one of the worst storms this century virtually shut down Vermont on the weekend of March 13-14 forcing the closure of roads and airports. This was one of the most powerful snowstorms on record. Snowfall amounts ranged from 10 to 28 inches across the state. A Cooperative Weather Observer recorded 13.0" in Pownal. | Extreme | Statewide |
| 2-4 Mar 1994 | Heavy Snow | Snowfall amounts across the state ranged from 8 to 22 inches with snowfall rates as high as three to four inches per hour during the storm. A Cooperative Weather Observer recorded 8.0" in Pownal. | High | Statewide |
| 4-5 Feb 1995 | Heavy Snow | A low pressure system tracked up the east coast on dumping heavy snow across Vermont. Snowfall amounts ranged from 6 to 20 inches. | High | Statewide |
| 27-28 Feb 1995 | Snow Freezing Rain | A mixture of snow, sleet, and freezing rain fell across Vermont. Snow accumulations ranged from four to eight inches across much of northern Vermont with localized amounts of 8 to 12 inches in Vermont's Green Mountains. A Cooperative Weather Observer recorded 14.0" in Pownal. | High | Central; Southern VT |
| 2-3 Jan 1996 | Heavy Snow | Heavy snow fell across southern Vermont with the average snowfall ranging from 10 to 12 inches. | High | Southern Vermont |
| 12-13 Jan 1996 | Heavy Snow | Heavy snow fell across southern Vermont with snowfall totals ranging from 6 to 10 inches with a few locations reporting up to one foot. A Cooperative Weather Observer recorded 7.0" in Pownal. | High | Southern Vermont |
| 26 Nov 1996 | Winter Storm | Snow and freezing rain downed trees and power lines, with 10,000 customers without power across southern Vermont. | High | Southern Vermont |
| 7-8 December 1996 | Winter Storm | A major storm dumped heavy, wet snow across Bennington and Windham Counties. Approximately 20,000 customers lost power. Cooperative Weather Observers reported 14.5 inches in Pownal and 12.8 inches in Sunderland during the period. | High | Southern Vermont |
| 31 March 1997 to 1 April 1997 | Winter Storm | A late season storm that changed from rain to snow brought 12 inches in Shaftsbury, 12 inches in Peru and 23 inches in Bennington. Power outages were widespread, and Route 9 between Bennington and Brattleboro was closed. | High | Southern Vermont Bennington, Shaftsbury, Peru |
| 29-30 December 1997 | Winter Storm | Heavy snow and gusty winds downed caused power outages across southern Vermont. Route 7 in Bennington County was closed and there was damage to a mobile home park and cinema in Bennington. | High | Southern Vermont Bennington, Peru |
| 14-15 January 1999 | Winter Storm | Snow, followed by sleet and freezing rain , along with very cold conditions resulted in heavy accumulations | High | Bennington County, Dorset |
| 18-19 February 2000 | Winter Storm | Eight to fourteen inches of snow fell in Bennington and Windham Counties. 14.3 inches were recorded in Peru | High | Southern Vermont, Peru |
| 30-31 December 2000 | Winter Storm | 6-12 inches of snow fell, with 13 inches recorded in Pownal and 8 inches in Bennington | Moderate | Southern Vermont |
| 5 February 2001 | Winter Storm | Heavy snow fell resulting in 12 inches in Bennington, 14 inches in Pownal Center and 9.6 inches in Sunderland. | Moderate | Southern Vermont |
| 5-6 Mar 2001 | Winter Storm | This was considered the largest storm since the Blizzard of 93 with two feet of snow in some areas. Cooperative Weather Observers measured 20.0 inches in Peru, 25.0 inches in Pownal and 18.1 inches in Sunderland. | High | Southern Vermont, Pownal, Peru |
| 30-31 March 2001 | Winter Storm | Heavy wet snow resulted in 9.8 inches in Sunderland and 15.0 inches in Peru while Windham County had similar amounts | High | Southern Vermont, Sunderland , Peru |

Table 8. Significant winter storm events in Bennington County and Dorset. Source: NCDC 2014

| Dates | Type | Description | Category | Area |
|---|---|---|---|---|
| 6-7 January 2002 | Winter Storm | A snowstorm produced over a foot of snow across southern Vermont with 17 inches recorded in Peru, 15 inches in Pownal and 14 inches in Sunderland by Cooperative Weather Observers. | High | Southern Vermont, Pownal |
| 17 November 2002 | Winter Storm | A storm started with 2-4 inches of storm but changed to freezing rain and gusty winds. There were power outages from Arlington into New York | High | Southern Vermont, Arlington |
| 25-26 December 2002 | Winter Storm | Snow fell at a rate of 1-3 inches/hour for a time with 16..2 inches in Sunderland, 10.5 inches in Pownal and 16.5 inches in Windham County | High | Southern Vermont |
| 6-8 Dec 2003 | Winter Storm | The first major storm of the season produced 10-20 inches across Southern Vermont. Cooperative weather observers measured 21.5" in Pownal and 21.3 inches in Sunderland. | High | Southern Vermont, Pownal |
| 28 January 2004 | Winter Storm | Extreme southern Vermont experienced 7-13 inches of snow with 12.6 inches in Sunderland, 9 inches in Pownal and 7.5 inches in Windham County | High | Southern Vermont, Sunderland |
| 23 Jan 2005 | Blizzard | Frequent whiteout conditions were observed by plow crews. Whiteout conditions were most prevalent across the Green Mountains. Cooperative Weather Observers recorded 8.0" in Pownal and Sunderland and 14.0 inches in Peru. | High | Countywide |
| 15-16 Jan 2007 | Ice Storm | Significant icing occurred from the freezing rain leading to widespread power outages Strengthening winds in the wake of the storm continued to exacerbate power outages across the region. | High | Southern Vermont |
| 2 March 2007 | Winter Storm | A mix of snow and sleet fell with over one foot in higher elevations and some freezing rain. | High | Southern Vermont, Woodford, Landgrove |
| 16-17 Mar 2007 | Heavy Snow | This storm brought widespread snowfall amounts of 10 to 18 inches across southern Vermont. | High | Southern Vermont |
| 15-16 April 2007 | Winter Storm | A heavy wet snow accumulated to 8 -12 inches with 12 inches in Woodford, 10.5 inches in Landgrove and 11 inches in Windham County. Gusty winds brought down power lines causing widespread outages. Damaging winds were reported by a Cooperative Weather Observer in Sunderland. | High | Southern Vermont |
| 16-17 Dec 2007 | Winter Storm | Snow, sleet and freezing rain, with total snow and sleet accumulations of 8-14 inches affected Bennington County and resulted in traffic problems and power outages. The Cooperative Weather Observer reported 12.4 inches in Sunderland along with damaging winds while 14 inches was reported in Woodford and 11.5 inches in Landgrove. | High | County wide |
| 30-December 2007 to 2 January 2008 | Heavy Snow | This storm brought heavy snow to eastern New York and western New England totaling from 6 to 12 inches across southern Vermont. Snowfall amounts ranged from 6 to 11 inches. This led to treacherous travel conditions and the closings, or delayed openings of numerous schools and businesses. A Cooperative Weather Observer reported just over 12 inches in Sunderland. | High | Southern Vermont |
| 4-5 Mar 2008 | Ice Storm | This storm system spread freezing rain and sleet across higher elevations of east central New York and portions of southern Vermont, resulting in significant ice accumulations of one half, to locally up to one inch in the higher elevations of western Windham county and one quarter to less than one half of an inch in lower elevations. | High | Southern Vermont |

Table 8. Significant winter storm events in Bennington County and Dorset. Source: NCDC 2014

| Dates | Type | Description | Category | Area |
|---|---|---|---|---|
| 11-18 Dec 2008 FEMA DR-1816 | Winter Storm | A series of snowstorms (two events reported by NCDC from 17-20 December) hit eastern New York and western and southern New England during this period resulting in 3-9 inches per storm, but accumulating to over a foot during the period.19 inches were reported by a Cooperative Weather Observer in Sunderland. Icing conditions followed on December 24th | High | Southern Vermont |
| 12 to 22 Feb 2009 | Heavy Snow Winter Storm | Several events were recorded by NCDC with snowfall amounts of 6-12 inches, especially in higher elevations | Moderate | Southern Vermont High Elevations |
| 1-3 Jan 2010 | Heavy Snow | This storm brought widespread snowfall to southern Vermont along with blustery conditions, resulting in blowing and drifting of the snow. Snowfall totals across Bennington and western Windham counties ranged from about 10 inches, up to just over two feet. A Cooperative Weather Observer recorded 19.1" in Pownal from January 1-4 and another CWO reported 21.5 inches in Sunderland. | High | Southern Vermont |
| 23-24 Feb 2010 | Heavy Snow | This system blanketed the area in a heavy wet snow that resulted in treacherous travel conditions and widespread power outages across southern Vermont. Generally 1 to 2 feet of snow accumulated with the highest amounts above 1500 feet. A Cooperative Weather Observer recorded 16.2" in Pownal. | High | Southern Vermont |
| 26-27 Feb 2010 | Heavy Snow | A powerful storm brought heavy rainfall and a heavy wet snow resulting in widespread power outages and dangerous travel conditions across southern Vermont. Strong and gusty winds developed along the east facing slopes of the Green Mountains of southern Vermont with gusts up to 50 mph. Snowfall totals of 1 to 2 feet were reported across the higher terrain, with lesser amounts of 3 to 6 inches below 1000 feet. A Cooperative Weather Observer recorded 23.1" in Pownal. | High | Southern Vermont |
| 26-27 Dec 2010 | Winter Storm | A nor'easter brought snow and blizzard conditions to southern Vermont. A Cooperative Weather Observer measured in Sunderland measured 26.0 inches while the Pownal observer measured 20.0 inches. | High | Southern Vermont, |
| 12 January 2011 | Winter Storm | Heavy snow fell across southern Vermont with snowfall accumulations ranging from 14 inches up to 3 feet with snowfall rates of 3 to 6 inches an hour for a time. A cooperative weather observer measured 20.6" in Pownal. | High | Southern Vermont, Pownal |
| 1-2 February 2011 | Winter Storm | Snow fell at a rate of 1-2 inches/hour with totals of 12-17 inches in southern Vermont. Cooperative Weather Observers reported 7 inches in Pownal and 8 inches in Sunderland. | High | Southern Vermont |
| 29-30 October 2011 | Winter Storm | An early storm produced 5-14 inches in Bennington County and 10-16 inches in Windham County. | High | Southern Vermont |
| 29 February 2012 | Winter Storm | A complex storm resulted in 8-16 inches of snow and sleet across southern Vermont between February 29th and March 1st with 4-8 inches across southeastern Bennington County. | High | Southern Vermont, |

A Cooperative Weather Observer recorded 18.8" in Sunderland between February 14 and 15, 2007 and 19.0" on December 27, 2010, but no damage was reported.

### c. Extent and Location

The average annual snowfall in Bennington County is 64.4 inches, with December, January, February and March as the primary months for snowfall. Extreme snowfall events for one, two and three day events have ranged from 12 to over 20 inches (NOAA/National Climate Data Center 2012 Cooperative Weather Observer reports).

The skill of road crews in Vermont means that only the heaviest snowstorms (>12 inches) or ice storms affect the populations.

### d. Probability, Impact and Vulnerability

There is a 100% probability of a moderate or greater snowstorm affecting Bennington County, including Dorset in any given year. These are large-scale events, though local impacts may vary greatly. Roads and power lines are most vulnerable, with traffic accidents the most likely to create injuries. Power outages could be short term or last seven or more days. Some roads may remain impassable for long periods as well.

## 3. High Wind Events

### a. Description

High wind events can occur during tropical storms and hurricanes, winter storms and frontal passages. Thunderstorms can produce damaging winds, hail and heavy rainfall, the latter potentially producing flash floods. The NCDC recorded 52 thunderstorms with damaging winds in Bennington County since 1990. Events categorized as “strong wind” tended to occur during the winter months.

Tornadoes are formed in the same conditions as severe thunderstorms. Intense, but generally localized damage can result from the intense winds. The primary period for tornado activity in New England is mid-summer (Zielinski and Keim 2003).Tornadoes will generally follow valleys in the northeast and dissipate in steep terrain. The NCDC recorded three tornadoes in Bennington County since 1990.

### b. Previous Occurrences

Table 9 below summarizes the total number of significant wind events including thunderstorms, strong winds, and tornadoes from 1996 to 2012.

Wind speed data is not available for wind events due to the lack of weather stations. NCDC data (2011) did not always include estimates of wind speed. Generally, wind speeds of greater than 55 miles per hour are considered damaging (NOAA Undated). Therefore, events were categorized based on damage assessments in the NCDC database. Damage greater than $10,000 and tornados were categorized as moderate. Most events resulted in minor damage. Significant events are described in Table 10.

Table 9. Summary of wind events in Bennington County. Source: NCDC 2012

| Year | High Wind | Strong Wind | Thunderstorm Winds | Tornado | Totals |
|---|---|---|---|---|---|
| 1996 | 5 | | | | 5 |
| 1997 | 2 | 2 | 6 | | 10 |
| 1998 | 1 | | 8 | 1 | 10 |
| 1999 | 2 | | 4 | | 6 |
| 2000 | 1 | | 1 | | 2 |
| 2001 | | | 3 | | 3 |
| 2002 | | | 3 | 1 | 4 |
| 2003 | 1 | | | 1 | 2 |
| 2004 | | | | | 0 |
| 2005 | 1 | | 3 | | 4 |
| 2006 | 3 | | 3 | | 6 |
| 2007 | 3 | | 6 | | 9 |
| 2008 | | 3 | 5 | | 8 |
| 2009 | 2 | | 1 | | 3 |
| 2010 | 5 | | 3 | | 9 |
| 2011 | 1 | | 8 | | 9 |
| 2012 | | | 3 | | 3 |
| Totals | 28 | 5 | 57 | 3 | 93 |

Table 10. Significant wind events in Bennington County. Source: NCDC 2012

| Dates | Type | Description | Area | Category |
|---|---|---|---|---|
| 21 Aug 97 | Strong Wind | Winds gusting to 40 mph downed trees in Dorset, North Bennington and Sunderland. Approximately 1,000 customers lost power. | Countywide | Moderate |
| 1 Nov 97 | High Wind | Strong and damaging winds caused power outages in Windham and Bennington Counties with approximately 1,000 customers losing power | Southern Vermont | Moderate |
| 27 Nov 97 | High Wind | Passage of a cold front resulted in winds of 40-50 mph and downed trees and power lines in Windham and Bennington counties | Southern Vermont | Moderate |
| 31 May 1998 | Thunderstorm Wind Tornado | Several lines of thunderstorms formed ahead of a front. An F2 tornado that originated in Saratoga and Rensselaer Counties followed Route 67 through North Bennington and South Shaftsbury. Damaging winds were reported by a Cooperative Weather Observer in Pownal. Large hail was reported in Shaftsbury | Countywide; Bennington North Bennington Shaftsbury | High |
| 6 July 1999 | Thunderstorm Wind | A cold front generated thunderstorms in Southern 'Vermont. Power lines and trees were downed in Pownal and Stamford and significant rain fell in Sunderland. Winds were estimated to gust at 90 mph. Damaging winds were reported by the Pownal Cooperative | Southern Vermont | Moderate |

| Table 10. Significant wind events in Bennington County. Source: NCDC 2012 | | | | |
|---|---|---|---|---|
| Dates | Type | Description | Area | Category |
| | | Weather Observer. | | |
| 16 Sept 1999 | High Wind | Winds from remnants of hurricane Floyd gusted to over 60 mph across Southern Vermont. Significant rains fell in Bennington, Peru and Sunderland | Southern Vermont | Moderate |
| 31 May 2002 | Thunderstorm Wind | Thunderstorms caused damage across Bennington County. Cooperative Weather Observers reported damaging winds in Sunderland and Pownal. | Countywide | Moderate |
| 5 Jun 2002 | Thunderstorm Wind Tornado | Thunderstorms that initially developed in New York produced a macroburst in extreme eastern New York and moved into southern Vermont. The storms spawned two tornados, one in Woodford Hollow, Bennington County assessed as an F1with winds of 80-100 mph and the other one near Wilmington, Windham County that was stronger with winds of 125-150 mph. Non-tornadic thunderstorm winds blew some trees down in the town of Pownal. Lightning struck a home in North Bennington causing a very small fire with minimal damage to the structure of the house. | Southern Vermont<br><br>North Bennington; Pownal, Woodford | Moderate |
| 21 July 2003 | Tornado | A tornado touched down in Pownal, moved through Bennington and continued into western Windham County. | Sunderland Bennington Pownal | Moderate |
| 16 April 2007 | High Wind | Low pressure created strong winds resulting in extensive tree damage in Dorset. Damaging winds were reported by a Cooperative Weather Observer in Sunderland. | Dorset | Moderate |
| 16 Dec 2007 | High Wind | A storm brought sleet and snow as well as high winds resulting in downing of trees and power lines. Damaging winds were reported by a Cooperative Weather Observer in Dorset. | Countywide | Moderate |
| 9 Dec 2009 | Wind | A strong low pressure system tracked northeast, into the eastern Great Lakes region creating strong east to southeast winds developed across southern Vermont during Wednesday morning, before gradually diminishing by Wednesday evening. | Countywide; Bennington, Pownal, Shaftsbury, Sunderland, Dorset, Manchester, Dorset | Moderate |
| 22 Aug 2010 | Wind | Strong and gusty east to southeast winds occurred across southern Vermont, with the higher terrain of the southern Green Mountains being impacted the hardest. Trees and wires were reported down due to high winds in Arlington, Sunderland, Shaftsbury and Bennington. Power outages occurred across Bennington County. | Arlington, Sunderland, Shaftsbury, Bennington; Countywide | Moderate |
| 29 May 2012 | Thunderstorm Wind | Strong thunderstorm winds affected Southern Vermont. Falling trees blocked a road in Dorset | Southern Vermont | Moderate |

## c. Extent and Location

Damaging winds, including the previous occurrences described above, are those exceeding 55 miles per hour (NOAA 2006, NOAA undated). During December 2009 event, winds were measured at 59 mph at the Morse Airport in Bennington. Higher winds were likely created during the two tornadoes. High wind events could strike anywhere. Where storms are funneled up the valleys, damage could be significant, but most likely less than 10% of structures would be affected. Again, power outages could last up to seven or more days.

## d. Probability, Impact and Vulnerability

Wind events causing moderate or greater damage occur almost every other year (40-50%) in Bennington County, so the potential expected probability would be 10-100% in Dorset.

## 4. Hail

### a. Descriptions

Hail is frozen precipitation that forms in severe thunderstorms. Hailstones can range in size from ¼" (about the size of a pea) to over four inches (grapefruit sized), though most hail is in the smaller categories of less than 1.5 inches. The strong up and downdrafts within thunderstorms push to freeze and down to collect water and this repeated cycle results in accumulation of ice until gravity pulls the hailstone to Earth.

### b. Past Occurrences

NCDC (2012) and Cooperative Weather Observer reports eighteen hail events since 1996. Table 11 lists all, which were highly localized with little damage.

Table 11. Hail events in Bennington County. Source: NCDC 2012

| Date | Description | Area |
|---|---|---|
| 31 May 1998 | A severe thunderstorm at Shaftsbury in Bennington County produced large hail. This was the same event involving a tornado described above. | Shaftsbury |
| 18 July 2000 | Across southern Vermont, scattered thunderstorms developed ahead of a cold front during the midday. In Bennington county, dime size hail fell at Sunderland, and nickel size hail fell at Bennington. | Bennington<br>Dorset |
| 4 July 2001 | Half dollar sized hail (1.25") fell in Sunderland. | Sunderland |
| 27 June 2002 | Thunderstorms, developing ahead of a cold front, moved into southern Vermont during the late afternoon and early evening. One cell deposited one inch hail in the North Bennington. | North Bennington |
| 24 May 2004 | No description | Bennington |
| 6 June 2005 | One-inch hail was reported by a trained weather spotter. | Dorset<br>Sunderland<br>West Rupert |
| 1 August 2005 | No description | East Dorset |
| 19 June 2006 | A trained spotter reported penny-sized hail in Sunderland. | Dorset |
| 10 May 2007 | Numerous showers and thunderstorms occurred, some became locally severe, and quarter sized hail in Arlington. | Arlington |
| 21 June 2007 | A strong cold front moved through east central New York and western New England producing numerous thunderstorms, some of which were locally severe. Nickel sized hail was reported in Sunderland. | Sunderland |
| 3 August 2007 | Numerous and strong thunderstorms developed over eastern New York and western New England. Ping pong ball sized hail was reported in Shaftsbury. | Shaftsbury |
| 10 June 2008 | A cold front approaching from the west, along with a hot, moist and unstable air mass in place, led to the development of strong thunderstorms across eastern New York and western New England. Nickel size hail was reported near Rupert | Rupert |
| 24 June 2008 | The passage of an upper level trough, and weak cold front produced isolated to scattered thunderstorms during the afternoon. Large hail | Pownal |

| Table 11. Hail events in Bennington County. Source: NCDC 2012 | | |
|---|---|---|
| Date | Description | Area |
| | accompanied some of these thunderstorms with ¼" sized hail reported in Pownal | |
| 6 August 2008 | A low pressure system tracked east across northern New England during the morning hours. An upper level disturbance in the wake of this system, combined with a moist and unstable air mass in place, led to the development of isolated severe thunderstorms across portions of southern Vermont. Quarter size hail fell approximately 4 miles north northeast of Arlington. | Sunderland |
| 15 June 2009 | The combination of a passing upper level trough, and unusually cold air in the mid and upper levels of the atmosphere, led to the development of numerous thunderstorms across southern Vermont, many of which contained large quantities of hail. Quarter size hail was measured at the Bennington Morse State Airport in Bennington. In addition, nickel to quarter size hail was also reported in the city of Bennington. | Bennington |
| 7 July 2009 | A closed upper level low, and pool of unusually cold air in the mid and upper levels of the atmosphere moved over the region, leading to the development of thunderstorms across southern Vermont. Penny size hail was reported in Bennington during a thunderstorm. | Bennington |
| 17 July 2010 | A pre-frontal boundary and upper level disturbance moved across the region creating a cluster of strong to severe thunderstorms developed and moved across southern Vermont. Quarter size hail was reported during a thunderstorm in Bennington. | Bennington |
| 1 June 2010 | Multiple lines and clusters of strong to severe thunderstorms developed during the afternoon and evening hours. Half dollar size hail was reported in Arlington. Multiple reports of large hail were reported during a thunderstorm in Shaftsbury. Hail stones of 3.25 inches and 2.75 inches in diameter were measured. | Arlington Shaftsbury |

Hail was also reported by a Cooperative Weather Observer on August 4, 2001, June 2, 2002 and August 1, 2008 in Sunderland and on May 8, 2001 in Peru.

### c. Extent and Location

Hail can cover wide areas and has the potential for damaging crops, automobiles or glass within structures as well as cause injury. Generally, however, hail storms affect relatively small areas as they form in thunderstorms which are localized.

### d. Probability, Impact and Vulnerability

Hail storms are generally local, affecting subareas within the town, though a group of thunderstorms could cause hail in multiple locations over a wide area. From past occurrences, one thunderstorm per year generates hail that was recorded. So, the possibility of hail occurring in Dorset could range from 10-100%, but impacts would be localized.

## 5. Temperature Extremes

### a. Descriptions

Temperature extremes entail periods of either excessive heat or extreme cold. Excessive heat is generally defined as periods when the normal high temperature is exceeded by ten degrees. So, in the summer, this would equal 88-89 degrees in Dorset. Excessive heat is recorded at other times, but does not have the health consequences of summer periods. In addition, the heat index, which factors in the high relative humidity levels of summer, is also a factor.

Extreme cold is not well defined. For those involved in outdoor activities, extreme cold, accompanied by wind, is when exposed skin would be subject to frostbite. However, for periods of power outages that might accompany winter storms, extreme cold could be thought of as when temperatures fall below freezing as that would not only affect health, but could result in pipes freezing and the loss of water supplies.

Table 12. Dorset normal temperatures and precipitation for 1981 to 2010. Source: National Climate Data Center: http://www.ncdc.noaa.gov/land-based-station-data/climate-normals/1981-2010-normals-data

| Month | High Temperature ($^0$F) | Low Temperature ($^0$F) | Mean Temperature ($^0$F) | Precipitation (in) |
|---|---|---|---|---|
| January | 28.5 | 9.5 | 19.0 | 3.44 |
| February | 33.7 | 11.2 | 22.5 | 2.82 |
| March | 40.9 | 19.5 | 30.2 | 3.55 |
| April | 54.3 | 31.0 | 42.7 | 3.47 |
| May | 65.8 | 41.3 | 53.5 | 4.33 |
| June | 75.3 | 49.6 | 62.5 | 4.66 |
| July | 78.5 | 54.5 | 66.5 | 4.55 |
| August | 77.1 | 53.0 | 65.0 | 4.40 |
| September | 69.6 | 44.2 | 56.9 | 3.83 |
| October | 57.3 | 34.4 | 45.8 | 4.28 |
| November | 45.9 | 27.9 | 36.9 | 3.98 |
| December | 34.4 | 17.2 | 25.8 | 3.95 |
| Annual | 55.1 (Avg) | 32.8 (Avg) | 43.9 | 47.26 |

The station normal report for the Cooperative Weather Observer in Pownal indicates an average of just approximately one day per year when the maximum temperature would equal 90 degrees, 55 days when the maximum temperature would be less than 32 degrees and 172 days when the minimum temperature would be less than 32 degrees.

### c. Extent and Location

Extreme temperature is a widespread phenomenon. The populations affected could be small if one is considering outdoor workers or the entire town in a power outage.

### d. Probability, Impact and Vulnerability

Extreme heat is relatively rare with approximately occurrences of less than one day a year. Extreme cold, here defined as less than freezing temperature, is a frequent phenomenon in Vermont. Impacts of either type of event could be widespread, and vulnerability is dependent on the populations exposed.

## 6. Drought

### a. Description

There are several types and definitions of drought: meteorological, climatological, atmospheric, agricultural and hydrological. The latter is based on stream flow and groundwater availability and is probably most important from a natural hazard assessment perspective. Reductions in water availability can be critical in rural communities like Pownal where residents are dependent on groundwater for potable water. Reductions in precipitation over long enough periods, particularly during the growing season when plants take up moisture, can result in hydrologic drought.

### b. Past Occurrences

Data on the Palmer Hydrologic Data Index for western Vermont indicates forty months since 1980 when that index was below -2.00 (Table 13). Levels less than -2.00 indicate that reservoirs and groundwater supplies are likely to be low. NCDC data shows ten recorded periods of drought and extreme heat, so this may occur more frequently.

Table 13. Palmer drought indices from 1980 to 2012 for western Vermont (including Bennington County). Months shown were when Palmer Hydrologic Drought Index (a measure of groundwater and reservoir levels) is <=-2.00. Source: http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp

| Year | Month | Precipitation Index | Temperature Index | Palmer Drought Severity Index | Palmer Hydrologic Drought Index |
|---|---|---|---|---|---|
| 1980 | Jan | 0.91 | 20.80 | -2.93 | -2.93 |
| 1980 | Feb | 0.67 | 16.70 | -3.47 | -3.47 |
| 1980 | Mar | 3.05 | 30.10 | -2.77 | -2.77 |
| 1980 | Apr | 2.34 | 44.30 | -2.94 | -2.94 |
| 1980 | May | 1.54 | 56.50 | -3.53 | -3.53 |
| 1980 | June | 2.62 | 61.90 | -3.63 | -3.63 |
| 1980 | July | 4.40 | 69.70 | -3.18 | -3.18 |
| 1980 | Aug | 4.58 | 69.00 | -2.75 | -2.75 |
| 1980 | Sept | 4.09 | 57.50 | -2.23 | -2.23 |
| 1980 | Oct | 2.54 | 44.80 | -2.07 | -2.07 |
| 1981 | Jan | 0.59 | 8.50 | -2.64 | -2.64 |
| 1987 | Apr | 1.99 | 48.00 | -2.32 | -2.32 |
| 1987 | May | 2.01 | 55.30 | -2.70 | -2.70 |

Table 13. Palmer drought indices from 1980 to 2012 for western Vermont (including Bennington County). Months shown were when Palmer Hydrologic Drought Index (a measure of groundwater and reservoir levels) is <=-2.00. Source: http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp

| Year | Month | Precipitation Index | Temperature Index | Palmer Drought Severity Index | Palmer Hydrologic Drought Index |
|---|---|---|---|---|---|
| 1987 | Aug | 2.73 | 65.10 | -2.21 | -2.21 |
| 1988 | June | 2.28 | 62.50 | -2.13 | -2.13 |
| 1988 | July | 3.61 | 71.60 | -2.34 | -2.34 |
| 1988 | Sept | 1.83 | 56.60 | -2.46 | -2.46 |
| 1988 | Oct | 2.01 | 43.30 | -2.77 | -2.77 |
| 1988 | Nov | 5.15 | 38.30 | -2.06 | -2.06 |
| 1988 | Dec | 1.11 | 21.70 | -2.59 | -2.59 |
| 1989 | Jan | 0.82 | 22.70 | -3.12 | -3.12 |
| 1989 | Feb | 1.28 | 18.40 | -3.26 | -3.26 |
| 1989 | Mar | 2.66 | 27.30 | -2.81 | -2.81 |
| 1989 | Apr | 2.20 | 40.50 | -2.80 | -2.80 |
| 1989 | May | 4.17 | 58.20 | 0.17 | -2.35 |
| 1995 | June | 1.32 | 66.00 | -2.85 | -2.85 |
| 1995 | July | 4.04 | 71.60 | -2.90 | -2.90 |
| 1995 | Aug | 4.42 | 67.20 | -0.02 | -2.62 |
| 1995 | Sept | 3.67 | 55.20 | 0.03 | -2.32 |
| 1999 | June | 2.15 | 67.50 | -2.23 | -2.23 |
| 1999 | July | 3.46 | 71.10 | -2.52 | -2.52 |
| 1999 | Aug | 2.50 | 66.00 | -3.11 | -3.11 |
| 2001 | Aug | 2.61 | 69.90 | -2.43 | -2.43 |
| 2001 | Sept | 3.20 | 59.20 | -2.56 | -2.56 |
| 2001 | Oct | 1.52 | 49.20 | -3.33 | -3.33 |
| 2001 | Nov | 2.28 | 40.30 | -4.24 | -4.24 |
| 2001 | Dec | 2.07 | 31.90 | -4.74 | -4.74 |
| 2002 | Jan | 1.85 | 27.00 | -4.58 | -4.58 |
| 2002 | Feb | 3.23 | 25.70 | 0.78 | -3.33 |
| 2002 | Mar | 2.74 | 31.40 | 0.86 | -2.83 |
| 2002 | Apr | 4.12 | 45.50 | 1.25 | -2.05 |

### c. Extent and Location

Moderate droughts (PHDI -3.0 to -4.0) occurred in 1999 and 2001 and severe droughts (<-4.0). Droughts would most likely affect those properties with shallow wells. Map 4 shows private and public well locations as well as groundwater source protection areas, rivers and streams and wetlands mapped as part of the National Wetlands Inventory. There are 843 private wells scattered throughout the town (VT ANR 2013).

### d. Probability, Impact and Vulnerability

Based on the Palmer Drought Severity data, there is a 3% chance of a drought occurring in any one year. Groundwater resource mapping has not been completed, and areas that could be affected by drought are unknown, but any houses with shallow wells are most likely to be affected. Drought may affect the potential for wildfire, which is discussed below.

## 7. Wildfire

### a. Description

Wildfire or wildland fire is any unplanned fire affecting open lands including forests, grasslands or other features. The potential for wildland fire is dependent on fuel types, which vary with vegetation, topography and weather. Fire intensity, measured by the amount of energy released in a fire and exhibited by the length of flames, and rates of spread dictate the degree of wildland fire hazard and methods of control.

Table 14 shows how wildfires can be categorized based on size.

Table 14. Wildland fire size classes. Source: NWCG 2011

| Magnitude (Size) | Description | Probability |
|---|---|---|
| Class A | < ¼ acre | High |
| Class B | ¼ to 10 acres | High |
| Class C | 10 to 100 acres | Moderate |
| Class D | 100 to 300 acres | Low |
| Class E | 300 to 1000 acres | Very low |
| Class F | 1000 to 5000 acres | Very low |
| Class G | >5000 acres | Very low |

In the northeastern United States, forests tend to be dominated by northern hardwood species such as sugar maple (*Acer saccharum*), birch (*Betula* spp.), white pine (*Pinus strobus*) and hemlock (*Tsuga canadensis*). These species tend to create relatively low flammability fire, so that surface fires have low intensity and rates of spread, thereby limiting fire hazard (Anderson 1982). Most of the land area in Dorset is covered by broadleaf litter fuels that exhibit fires of low intensity and slow rates of spread.

In both forested and open settings, structures may be threatened by even small wildfires. These wildland-urban interface areas are the most likely areas where resources will be needed to suppress wildland fire and to reduce potential hazards.

Fire behavior is most extreme during periods when the relative humidity is low, generally less than 35-45%. These conditions are most prevalent in the spring, following snow

melt, between March and late May or early June. After that, vegetation becomes increasingly green, and the resulting moisture in the live vegetation (fuel) reduces flammability significantly. Precipitation and evapotranspiration increase ambient relative humidity levels so that fires in the summer are generally rare and limited in size.

Fall again brings drying fuels and weather conditions increasing fire hazard. However, relative humidity levels increase after dark, and shorter days also limit the amount of time for fuels to dry and intense, fast moving fires to occur (North Central Research Station 2005).

### b. Past Occurrences

According to records from the Vermont Department of Forests, Parks and Recreation, from 1992 to 2010, 156 wildfires occurred in Bennington County, five of which occurred in Dorset.

### c. Extent and Location

Of the five fires, three were Class A, one was Class B, and one was Class C. Low intensity fires with slow rates of spread could occur in the forested areas which comprise most of Dorset's land cover. Throughout the town there may be pockets of heavier fuel loads, such as brush, or more flammable fuels, such as cured herbaceous vegetation and shrubs. These areas are generally located in the valleys near developed areas.

### d. Probability, Impact and Vulnerability

Natural fire return intervals in most forests in Vermont are greater than 50 years (Malamud et al. 2005), and more likely greater than 200 years, as reported in Landfire data for this area. Recurrence is likely related to precipitation rather than the buildup of fuels, so drought recurrence is already factored into these interval estimates. Therefore, the potential for large fires is very limited due to the fuel characteristics. However, large roadless areas and steep topography can make suppressing wildland fires that do occur very difficult. Settled areas have a low vulnerability to fire.

## 8. Landslide and Debris Flow

### a. Description

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include saturation by water, steepening of slopes by erosion or

construction, and alternate freezing or thawing. Table 15 shows how landslides can be categorized.

Table 15. Landslide and debris flow types. Source: USGS 2006

| Magnitude | Description | Probability |
|---|---|---|
| Localized | Falls: abrupt movements of rocks and boulders, generally on steep slopes | Low to moderate |
| Topples | Topples: movements involving some forward rotation as material moves downhill | Low to moderate |
| Flows | A range of land movement generally involving a mass of loose soil, rock, organic matter, air and water moving downhill rapidly and possibly covering a wide area<br><br>One form called creep involves slow movement of material and is often recognizable by trees growing so as to remain vertical while bent near the ground as they grow to keep up with the slow material flow. | Highly variable but can be fairly common. |

### b. Past Occurrences

Several small landslides occurred during Tropical Storm Irene, along the Otter Creek and on a ridge between Beech Ridge and Mad Tom notch. In addition, a portion of Dorset Mountain experienced 3 landslides in the 1980's.

### c. Extent and Location

All of the mapped landslides would be categorized as localized. Map 3 shows locations of damages, including landslides that occurred during Tropical Storm Irene. No rockfalls were identified in Dorset by the Vermont Agency of Transportation (Eliason and Springston 2007).

### d. Probability, Impact and Vulnerability

Previous landslides occurred during a major storm event, Tropical Storm Irene, and were located along Otter Creek near Mad Tom Road. Impacts can include destabilization of roads and debris jams as material that has slid from slopes then flows downstream. The probability of occurrence would be the same as for flooding with the potential proportion damaged within the town ranging from 1-10% and injuries of 1-10%. Most services would be recovered in less than seven days, though repair to some infrastructure may take significantly longer.

## 9. Earthquake

### a. Description

Vermont has no active faults, but has experienced minor earthquakes. Table 16 below shows the most recent occurring within the state, though there have been others, located outside, that have been felt in Vermont (Springston and Gale 1998). The U.S. Geological Survey predicts a two percent probability of an earthquake causing considerable damage in Vermont sometime in the next 50 years (Springston and Gale 1998).

### b. Past Occurrences

Table 16. Earthquakes in Vermont. Source: Vermont Geological Survey: http://www.anr.state.vt.us/dec/geo/EBEL.htm consisting of excerpts from: A Report on the Seismic Vulnerability of the State of Vermont by John E. Ebel, Richard Bedell and Alfredo Urzua, a 98 page report submitted to Vermont Emergency Management Agency in July, 1995.

| Location | Date | Magnitude | Mercalli Intensity |
|---|---|---|---|
| Swanton | July 6, 1943 | 4.1 | Felt by nearly everyone; many awakened with some dishes and windows broken and unstable objects overturned |
| Brandon | March 31, 1953 | 4.0 | Felt indoors by many, but by few outdoors. Sensation would be similar to a heavy truck striking a building |
| Middlebury | April 10, 1962 | 4.1 | Felt by nearly everyone; many awakened with some dishes and windows broken and unstable objects overturned |

### c. Extent and Location

In 2003, the Vermont Geological Survey completed simulations using FEMA HAZUS software of potential damage within Bennington County from a 500 year recurrence earthquake centered in Middlebury, VT, Tamworth, NH and Goodnow, NY. The results indicated minimal damage and injury from any of these events to Dorset (Kim 2003).

### d. Probability, Impact and Vulnerability

Based on the 2003 HAZUS analyses, both the probability and impact of an earthquake of a magnitude that could potentially occur in Vermont are low. However, earthquake prediction science is very limited.

## 10. Hazardous Materials Spill

## a. Descriptions

Hazardous wastes are materials that are flammable, corrosive, toxic, flammable or labeled with warning or caution labels. These materials are used in industry, in the home or on farms and are transported regularly.

## b. Past Occurrences

The Vermont spill site list indicates there have been 53 spills reported in Dorset since 1979, and these are listed in Table 17 below.

| Report # | Year | Facility Name | Address | Responsible Party | Date Reported | Date Closed |
|---|---|---|---|---|---|---|
| WMD120 | 2006 | A O T garage | | A O T | 3/16/2006 | 3/16/2006 |
| WMD042 | 2003 | AOT District garage | Rt 7 | William Daley Inc | 2/18/2003 | 2/18/2003 |
| WMD448 | 2008 | AOT Garage | | VTrans | 9/15/2008 | 9/18/2008 |
| 203 | 1993 | Battenkill River | Rt 7 | N/A | 7/14/1993 | 7/14/1993 |
| WMD080 | 2011 | Brownlee Property | 2741 Rte 30 | Dorr Oil | 2/17/2011 | 3/7/2013 |
| WMD015 | 2004 | Clubb Residence | 40 Cheney Rd | James Clubb | 1/12/2004 | 2/10/2004 |
| WMD163 | 2007 | CVPS transformer | 93 Teace St | CVPS | 4/18/2007 | 4/18/2007 |
| WMD363 | 2008 | Diana Giddings Property | 216 Village St | Giddings | 7/25/2008 | 7/30/2008 |
| WMD140 | 2008 | Dorset Village properties | 3390 Rte 30 | Kevin O'Toole | 3/9/2008 | 4/28/2008 |
| WMD429 | 2009 | E. Dorset Garage | off Rte. 7 | VTRANS | 9/21/2009 | 9/21/2009 |
| WMD073 | 2013 | East Dorset AOT Garage | 18 Village Street | VTrans | 2/15/2013 | 2/15/2013 |
| WMD409 | 1997 | East Dorset Garage | Rt 7 | A O T | 11/24/1997 | 7/19/2000 |
| WMD427 | 2014 | East Dorset General Store | 2045 Route 7 | East Dorset General Store | 8/28/2014 | 9/2/2014 |
| WMD549 | 2007 | East Dorset Town Garage | | Vtrans | 12/31/2007 | 12/31/2007 |
| WMD063 | 2011 | East Dorset Vtrans Garage | Route 7 | VTrans | 2/9/2011 | 2/9/2011 |
| WMD217 | 1994 | Esposito Residence | | Alice Esposito | 7/6/1994 | 10/6/1994 |
| WMD169 | 1995 | Esposito Residence | Benedict Rd | John Esposito | 6/9/1995 | 7/20/1995 |
| WMD334 | 1997 | Fiori Residence | 1275 Danby Mtn Rd | Dorr Oil Co | 9/22/1997 | 10/2/1997 |
| WMD588 | 2006 | Hawkiins Residence | 2116 Rt 30 | John Hawkins | 12/27/2006 | 2/7/2008 |
| WMD022 | 2012 | intersection of road | Rte 11 & South Rd. | VTrans | 1/18/2012 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| WMD217 | 2011 | JK Adams | 1430 RT 30 | JK Adams | 4/28/2011 | 5/4/2011 |
| 185 | 1990 | JK Adams Co | Route 30 | J.k. Adams Co. | 8/8/1990 | 8/8/1990 |
| WMD376 | 2001 | Mettawee Mill Nursery | Route 30 | Mettawee Mill Nursery | 9/25/2001 | 11/15/2001 |
| WMD193 | 2005 | N/A | Marshall Lane | CVPS | 6/1/2005 | 6/1/2005 |
| WMD271 | 2006 | N/A | Mad Tom Rd | CVPS | 6/10/2006 | 6/12/2006 |
| WMD442 | 2006 | N/A | Spruce Lane | CVPS | 9/24/2006 | 9/24/2006 |
| WMD231 | 2008 | N/A | 25 Marsh Lane | CVPS | 4/24/2008 | 4/25/2008 |
| 324 | 1992 | N/A | Mad Tom Rd | N/A | 11/28/1992 | 2/16/1993 |
| 370 | 1993 | N/A | Rt 30,snow Rd | Haskins Gas | 12/27/1993 | 12/27/1993 |
| WMD122 | 1996 | N/A | Rt 30 Dorset,rt103 Chstr | Bear Paw Lumber | 4/24/1996 | 4/29/1996 |
| 71 | 1980 | N/A | Dorset Elem. School | N/A | 6/18/1980 | 1/1/2000 |
| 97 | 1982 | N/A | Rt 7 | N/A | 5/19/1982 | 1/1/2000 |
| 44 | 1983 | N/A | Snow Fall Inc | Jack Heaton | 3/21/1983 | 1/1/2000 |
| 138 | 1983 | N/A | Tin Rd Trailer Park | Charles Wilson | 8/8/1983 | 1/1/2000 |
| 137 | 1987 | N/A | Rt 30, Dorset | Haskins Gas Service | 6/23/1987 | 6/25/1987 |
| 43 | 1988 | N/A | Route 7 | George Connors | 3/2/1988 | 3/2/1988 |
| 25 | 1989 | N/A | Rt 30 | Mehawee Mill Nursery | 1/30/1989 | 1/31/1989 |
| 73 | 1989 | N/A | Photo Shop | John Conti | 3/28/1989 | 4/3/1989 |
| 227 | 1989 | N/A | Battenkill River | Heaslip Fuel | 10/20/1989 | 10/22/1989 |
| WMD106 | 2010 | power pole | 1776 Rte 30 | CVPS | 2/27/2010 | 2/27/2010 |
| WMD391 | 2012 | Prentiss Pond | Church Street | None | 8/1/2012 | 8/1/2012 |
| 93 | 1993 | Railroad Station | Rt 7 | Connors Family | 4/17/1993 | 4/19/1993 |
| WMD032 | 2010 | Roadside | Route 7 | VTrans | 1/1/2010 | 1/20/2010 |
| WMD460 | 2012 | roadway | 18 Village St | VTrans | 9/12/2012 | 9/17/2012 |
| WMD444 | 2013 | Roadway | Intersection of Rt. 7/Village Street | | 9/27/2013 | 9/27/2013 |
| WMD122 | 1994 | Rogers Corp | Rt 30 | Roger Rumney | 4/12/1994 | 10/12/1994 |
| WMD094 | 1995 | Rogers Corp | Rt 30 | Rogers Corp | 4/4/1995 | 4/4/1995 |
| WMD901 | 2011 | VTrans District Garage | Route 7 | VTrans | 12/23/2011 | 12/23/2011 |
| WMD404 | 2014 | VTrans Dorset Garage | 18 Village Street East Dorset | VTrans | 8/4/2014 | |
| WMD285 | 2008 | VTrans Garage | 18 Village St | VTrans | 6/5/2008 | 6/5/2008 |
| WMD509 | 2008 | Vtrans Garage | 15 Village Street | Vtrans | 10/27/2008 | 10/27/2008 |
| WMD124 | 2009 | VTrans Garage | | unknown | 3/18/2009 | 3/24/2009 |
| WMD147 | 2008 | VTrans | 18 Village Street | VTrans | 3/12/2008 | 3/12/2008 |

### c. Extent and Location

All of the spills listed above affected small sites or areas. Route 7, Route 7A and Route 30 carry substantial traffic, and a spill on these roads could affect a large portion of the town. Of particular concern in any hazardous materials spill would be the impact on water resources. Map 4 shows the transportation system in relation to surface waters including streams and wetlands. Hazardous intersections have been identified by the Vermont Agency of Transportation and the planning committee. Roads with average grades greater than 10% also present hazards, particularly when roads are wet or during winter storms.

### d. Probability, Impact and Vulnerability

Given the number of past spills, hazardous materials spills occur less than annually and affect very small areas. Increased truck traffic also increases the possibility of a major spill. However, many areas are vulnerable due to the extensive transportation system and proximity of surface and groundwater resources to that system. Most hazardous materials are transported via Vermont Route 7 and Route 30. However, all local roads carry materials that could spill and affect aquatic resources as well as individual wells.

The overall likelihood of a hazardous materials spill on an annual basis is probably between one and ten percent. Injuries, except in the case of direct injuries from a traffic accident, are likely low. However, the long term impacts of a spill could be extensive if aquatic resources and/or water supplies were affected.

## 11. Infectious Disease Outbreak

### a. Descriptions

Infectious diseases are caused by bacterial infections, viruses, fungi and other organisms that can spread through the human population.

### b. Past Occurrences

Infectious diseases are a regular occurrence. The Vermont Department of Health (2013) lists ten different diseases occurring in Bennington County as of June of 2013 with Lyme disease the highest with sixteen cases.

### c. Extent and Location

In general, individuals and families are most affected by infectious diseases, but schools could be affected as well.

### d. Probability, Impact and Vulnerability

Given past history, there is a low probability of a disease affecting a large portion of the town, but high probability of continued, isolated occurrences.

## 12. Invasive Species

### a. Descriptions

Invasive species are organisms that are not native to a geographic area and which could or do cause economic or environmental harm. Invasive species are characterized by organisms that spread rapidly, can displace native species, and have few or no predators to keep their populations in check. At the same time, they have characteristics that may reduce the value and use of natural resources. For example Japanese barberry (*Berberis thunbergii*) can become a dominant, short shrub in some forests and, given that this is a thorny plant, can reduce the use of an area for recreational purposes (Vermont Agency of Natural Resources 2010).

Vermont has two invasive species lists: Class A species are on the Federal Noxious Weed List but are not known to occur in Vermont. There are listed in 7 C.F.R. 360.200, a section of the Code of Federal Regulations. Class B species are known to occur in the state and are considered a threat.

Table 18. Designated Class B noxious weeds in Vermont. Source: Vermont Agency of Agriculture, Food and Markets: http://agriculture.vermont.gov/plant_pest/plant_weed/invasive_noxious_weeds/noxious_weeds_list
Those with a * have been identified in Bennington County. Source: Early Detection and Mapping System: http://www.eddmaps.org/tools/query/

| Scientific Name | Common Name |
|---|---|
| *Acer ginnala** | Amur maple |
| *Acer platanoides* | Norway maple |
| *Aegopodium podagraria** | Bishop's goutweed |
| *Ailanthus altissima* | Tree of heaven |
| *Alliaria petiolata** | Garlic mustard |
| *Berberis thunbergii** | Japanese barberry |
| *Berberis vulgaris** | Common barberry |
| *Butomus umbellatus* | Flowering rush |
| *Celastrus orbiculatus** | Oriental bittersweet |
| *Euonymous alatus** | Burning bush |
| *Fallopia japonica* | Japanese knotweed |

| Table 18. Designated Class B noxious weeds in Vermont. Source: Vermont Agency of Agriculture, Food and Markets: http://agriculture.vermont.gov/plant_pest/plant_weed/invasive_noxious_weeds/noxious_weeds_list<br>Those with a * have been identified in Bennington County. Source: Early Detection and Mapping System: http://www.eddmaps.org/tools/query/ | |
|---|---|
| Scientific Name | Common Name |
| *Hydrocharis morsus-ranae* | Frogbit |
| *Iris pseudacorus** | Yellow flag iris |
| *Lonicera japonica* | Japanese honeysuckle |
| *Lonicera maackii* | Amur honeysuckle |
| *Lonicera morrowii** | Morrow honeysuckle |
| *Lonicera tatarica** | Tartarian honeysuckle |
| *Lonicera x bella** | Bell honeysuckle |
| *Lythrum salicaria** | Purple loosestrife |
| *Myriophyllum spicatum** | Eurasian watermilfoil |
| *Najas minor* | European naiad |
| *Nymphoides peltata* | Yellow floating heart |
| *Phragmites australis** | Common reed |
| *Potamogeton crispus* | Curly leaf pondweed |
| *Rhamnus cathartica** | Common buckthorn |
| *Rhamnus frangula** | Glossy buckthorn |
| *Trapa natans* | Water chestnut |
| *Vincetoxicum nigrum* | Black swallow-wort |

In addition, the Agency for Natural Resources lists the following as aquatic invasive species

| Table 19. Aquatic invasive species in Vermont. Source: Watershed Management Division, Vermont Department of Environmental Conservation: http://www.vtwaterquality.org/lakes/htm/ans/lp_ans-index.htm | |
|---|---|
| Scientific Name | Common Name |
| *Dreissena polymorpha* | Zebra mussel |
| *Alosa pseudoharengus* | Alewife |
| *Orconectes rusticus* | Rusty crayfish |
| *Didymosphenia geminata* | Didymo |

### b. Past Occurrences

Invasive species are present and represent a continuous hazard that will vary with their abundance and their impacts on structures and infrastructure.

### c. Extent and Location

The extent has not been fully mapped. In addition to the species listed above, the following are potential invasive species:

*Pastinaca sativa* (Wild parsnip) is abundant along roadsides and can cause skin burns when chemicals in the plant on exposed skin interact with sun. *Anthriscus sylvestris* (cow parsely also dominates roadsides and can invade meadows. *Phalaris arundinacea* (reed canary grass) can invade wetlands and crowd out native plants.
*Adelges tsugae* (Hemlock wooly adelgid) has dramatically reduced hemlock trees south of Vermont and was recently found in Pownal, Vt. *Agrilus planipennis* (Emerald Ash Borer) is a significant threat to forests as it kills all ash species. Borers are often dispersed through movement of firewood.

### d. Probability, Impact and Vulnerability

The likelihood of increased abundance of invasive species is 75-100% and potential impacts to forested areas are very high. Invasive insects that can cause tree death, particularly the emerald ash borer, could result in road closures, power outages and property damage.

## B. Vulnerability Analysis

The vulnerability assessment combines the results of data summarized in the previous section along with local knowledge. Table 20 summarizes the potential impacts from each hazard.

Table 20. Hazard impact summary

| Hazard | Potential Impacts |
|---|---|
| Floods and flash floods | Damage or loss of structures and infrastructure<br>Loss of life and injury |
| Winter storms | Power outages<br>Road closures |
| High wind events | Power outages<br>Road closures |
| Hail | Property damage<br>Crop damage or loss |
| Temperature extremes | Loss of life and injury<br>Water supply loss |
| Drought | Water supply loss<br>Crop damage or loss |

| Table 20. Hazard impact summary | |
|---|---|
| Hazard | Potential Impacts |
| Wildfire | Damage or loss of structures and infrastructure<br>Loss of life and injury<br>Loss of forest resources |
| Landslide and debris flow | Damage or loss of structures and infrastructure<br>Loss of life and injury<br>Road closures<br>Power outages |
| Earthquake | Damage or loss of structures and infrastructure<br>Loss of life and injury<br>Road closures<br>Power outages<br>Water supply loss |
| Hazardous materials spill | Loss of life and injury<br>Road closures<br>Water supply loss |
| Infectious disease outbreak | Loss of life and injury |
| Invasive species | Road closures<br>Power outages<br>Loss of forest resources<br>Loss of life and injury |

Table 21 summarizes probabilities, area affected and likely warning times for each hazard. Floods and flash floods have caused the greatest damage in the past and are likely to be the priority hazard in the future. In addition, threats to water supplies such as drought or hazardous materials spills could affect large portions of the community. Other hazards would likely be very localized, but could affect vulnerable populations such as the elderly, the young or those who might be particularly affected by power outages or isolation during storm events. Mobile homes, particularly mobile home parks, can be particularly vulnerable to hazards (Vermont Department of Housing and Community Development 2013). There are 18 mobile homes in Dorset, but these are scattered and none are in mobile home parks.

| Table 21. Vulnerability assessment for the Town of Dorset. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Hazard | Date/Event (# events) | Recurrence Interval | Geographic Extent | Proportion of town damaged | Injuries/ deaths | Loss of facilities/services | Vulnerable Facilities/Populations | Warning Time |
| Flood/Flash Flood | 1927<br>1987<br>1996 (2)<br>1998<br>1999<br>2000 (2)<br>2003<br>2007<br>2011 (2) | 10-100% probability in next ten years | Community to statewide | <10% | 1-10% | Minimal to seven days. Roads may become impassable and power outages in some areas | Roads, bridges and culverts town wide | >12 hours |
| Winter storm (snow and ice) | 1987 (Oct)<br>1993 (2)<br>1994<br>1995 (2)<br>1996 (4)<br>1997 (2)<br>1999<br>2000<br>2001<br>2002 (3)<br>2003<br>2004<br>2005<br>2007 (5)<br>2008 (3)<br>2010 (4)<br>2011 (3)<br>2012 | 100% probability in any given year | Community to statewide | <10% | 1-10% primarily traffic accidents | Minimal to seven days with some areas impassable and power outages in some areas | Primarily power supplies but also roads | >12 hours |

| Table 21. Vulnerability assessment for the Town of Dorset. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Hazard | Date/Event (# events) | Recurrence Interval | Geographic Extent | Proportion of town damaged | Injuries/ deaths | Loss of facilities/services | Vulnerable Facilities/Populations | Warning Time |
| High Wind Event | 1995<br>1997 (3)<br>1998<br>1999 (2)<br>2002<br>2003<br>2007 (2)<br>2010<br>2012 | 10-100% occurrence in next ten years | Community to region-wide | <10% | <=1% | Minimal for the entire town, but may be significant in localized areas. Power outages may occur. | Power lines primarily | 3 to > 12 hours |
| Hail | 2010 (2)<br>2009 (2)<br>2008 (3)<br>2007 (3)<br>2006<br>2005 (2)<br>2004<br>2002<br>2001<br>2000<br>1998 | 1-10% probability in any given year | Subarea of community | <=1% | M=1% | Minimal | Minimal | 3 to 12 hours |
| Temperature Extremes | Annual >90 F 1 day<br>Annual < 32 F | 1-10% probability in any given year | Community to statewide | 100% | <=1% | Minimal | Elderly and ill individuals without adequate heating or air conditioning | >12 hours |
| Drought | 1980<br>1981<br>1987<br>1988<br>1989<br>1995<br>1999<br>2001<br>2002 | 1-10% probability in any given year | Community to statewide | <10% | <=1% | Minimal but water could be unavailable for significant lengths of time. | Homes with shallow wells lose water | >12 hours |

| Table 21. Vulnerability assessment for the Town of Dorset. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Hazard | Date/Event (# events) | Recurrence Interval | Geographic Extent | Proportion of town damaged | Injuries/ deaths | Loss of facilities/services | Vulnerable Facilities/Populations | Warning Time |
| Wildfire | 1994<br>2002<br>2010 | 1-10% probability in any given year | Subarea of community | <10% | <=1% | Minimal | Likely confined to the upland forests. | None or minimal |
| Landslide/Debris Flow | Small scale events along The Otter Creek<br>Several small post-Irene slides | 1-10% probability in any given year | Subarea of community | <10% | <=1%, but traffic accidents possible | Minimal depending on scale and ability to remove material | Most likely along streams and affecting properties adjacent or downstream. | None or minimal |
| Earthquake | 2011 | <1% probability in any given year | Community to region-wide | <10% | <=1%, but larger in a significant earthquake | Minimal | Town wide | None or minimal |
| Hazardous Materials Spill | See Table 17 | 1-10% probability in any given year | Community to region-wide | <=1% | <=1% | Minimal | Water supplies and aquatic resources | None or minimal |
| Infectious Disease Outbreak | Annual | 1-10% probability in any given year | Community to state-wide | <=1% | <=1% | Minimal | Varies with type of infectious disease | None or minimal |
| Invasive Species | Ongoing | 100% probability in any given year | Community to state-wide | 1-10% | <=1% | Power outages from tree fall | Forests, roadsides, water bodies and streams | >12 hours |

# V. Mitigation Programs

## A. Mitigation Goals for the Town of Dorset

The Town identified the following mitigation goals:

1. Significantly reduce injury and loss of life resulting from natural disasters.
2. Significantly reduce damage to public infrastructure, minimize disruption to the road network and maintain both normal and emergency access.
3. Establish and manage a program to proactively implement mitigation projects for roads, bridges, culverts and other municipal facilities to ensure that community infrastructure is not significantly damaged by natural hazard events.
4. Design and implement mitigation measures so as to minimize impacts to rivers, water bodies and other natural features, historic structures, and neighborhood character.
5. Significantly reduce the economic impacts incurred by municipal, residential, agricultural and commercial establishments due to disasters.
6. Encourage hazard mitigation planning to be incorporated into other community planning projects, such as Town Plan, Capital Improvement Plan, and Town Basic Emergency Operation Plan
7. Ensure that members of the general public continue to be part of the hazard mitigation planning process.

## B. Review of Existing Plans and Programs that Support Hazard Mitigation in Dorset

### 1. Dorset Town Plan (adopted 2014)

The 2014 Town Plan identifies the following goals which support hazard mitigation planning:

Land Use and Economy

1. Encourage a pattern of development which can reasonably be provided with needed public facilities and services.

2. Limit development to areas along or near existing public roads, thus avoiding unnecessary new road mileage and costly servicing. This applies equally to second homes which may, in the future, be occupied by year-round residents. Access roads will remain private with recorded maintenance agreements.

3. Provide for review of subdivisions of land to ensure proper design of roads, proper site

development, and protection of agricultural and forestry lands, natural resource and natural hazard areas, and water resources.

4. Accommodate the changing needs of the Town through a continuous and comprehensive planning program.

**Transportation**

1. Provide for safe, convenient, economic, and energy efficient transportation systems within the Town.

2. Control development along Route 7/7A, with the aim being to maintain the present alignment, avoiding duplication of this road through the Town by extension of limited access Route 7.

3. Encourage the State in its various transportation planning studies to carry out all highway improvements and reconstructions in the Town in a safe manner, and with sufficient width to provide for bicycle use.

4. Encourage State and federal implementation of traffic calming measures along major corridors through the village areas in addition to law enforcement.

**Natural, Scenic, Historic Resources**

1. Protect aquifers and recharge areas, groundwater and our Class A and B streams, so that the Town may have a continuing supply of pure water for domestic (which includes drinking water) and recreational use.

2. Keep the rugged and poorly accessible mountain and forest areas free from development, reserved for forestry and other uses appropriate to their character.

3. Retain as much permanent open space as possible through cluster development, preservation of natural resource lands and natural hazard areas, and encouragement of agricultural and forest practices.

4. Count as developable land, whether for cluster or traditional subdivision, only the net developable area after removing wetlands, flood hazard areas, steep slopes 20% or greater, public water aquifers, spring recharge areas, and other similar resource lands.

**Energy Conservation**

1. Promote energy conservation, and the use of renewable and/or alternative energy resources.

**Wise Use of Natural Resources and Efficient Use of Extractive Resources**

1. Allow reasonable and responsible use of the Town's underground extractive resources, in a manner which minimizes negative impacts on the surrounding area.

2. Require rehabilitation and redevelopment of extractive sites as they are completed.

3. Protect natural resources including agricultural and forest lands, wetlands, water resources, wildlife habitats, fragile areas, and rare plant habitats.

**Housing**

1. Encourage the development of housing that will be safe, sanitary, and conveniently located**,** and will not impact negatively on neighboring development in terms of health and safety.

**Public Facilities and Services**

1. Provide for public facilities and services needed to serve the Town.

2. Allow for the expansion of public and/or private community water supply where practical, and protect current and future water supply sources.

3. Control the rate of development of residential units so that public facilities and services such as emergency services, schools, water systems, and local government are not overburdened by sudden increases in demand, thus allowing for planned capital budgeting for those facilities and services.

**Surface Water and Flood Resiliency Policies and Actions**

Surface Waters Policy: The ecological and hydrological integrity of rivers, streams and wetlands should be maintained to provide key ecosystem services such as water purification, pollutant abatement, nutrient dispersal and cycling and flood water retention. Rivers, streams and wetlands should also be protected to allow for continued recreational use and to provide valuable scenic resources. Development within identified Special Flood Hazard Areas and Fluvial Erosion Hazard Zones should be avoided. The Town, BCRC and Vermont ANR should work cooperatively to complete and maintain updated flood hazard and fluvial erosion hazard maps and identify specific areas of concern.

Actions:

1. The Town and organizations including the Vermont Agency of Natural Resources, BCRC, the Batten Kill Watershed Alliance, the Bennington County Conservation District and others

should work together to maintain and enhance the ecological integrity of rivers, streams, wetlands and upland forests.

2. An undisturbed buffer of natural vegetation should be established between rivers, streams and other water bodies to reduce nutrient input and attenuate overland flow. This buffer should be at least 50 feet for streams such as Gilbert Brook with minimal potential for lateral or vertical adjustment or 100 feet for streams such as The Mettawee with significant potential for such adjustment.

3. Developments or activities that would adversely affect the quality of the Town's surface waters shall be prohibited.

Flood Resiliency Policy: To protect the public health, safety and welfare, new development should be avoided in identified Special Flood Hazard Areas and Fluvial Erosion Hazard Zones.

Flood Resiliency Actions:

1. The Town should maintain current flood hazard regulations to control and limit development in flood hazard areas. These regulations are designed to protect property and the health and safety of the population against the hazards of flood water inundation, and to protect the community against the costs which may be incurred when unsuitable development occurs in areas prone to flooding. Development in flood hazard areas must be carefully controlled in accordance with the Town's flood hazard regulations.

2. New development in Special Flood Hazard Areas and the Fluvial Erosion Hazard Zones should be avoided where possible. Any new development that does occur should be designed and sited so as to avoid any increase in flooding or erosion.

3. Support acquisition by public entities or conservation organizations of buffers and Fluvial Erosion Hazard Zones, especially those identified in hazard mitigation and river corridor plans.

4. Dorset should adopt the most recent Town Road and Bridge Standards from the current 2014-2016 VTrans Orange Book: Handbook for Local Officials and updates as they are developed. Bridge and culvert repairs and replacements should be designed following hydraulic studies to avoid constrictions that would accelerate flow and to allow for passage by aquatic organisms.

5. Existing and local bridges and culverts that would impede flow during flooding events should be reconstructed or replaced.

6. Forested lands should be protected to assure that precipitation can be absorbed by forest soils and litter and the peak flow attenuated. Acquisition of land or easements or Current Use assessment should be used to protect these areas, especially along the tributaries.

7. The Town should collaborate with other municipalities, the BCRC, and the States of Vermont and New York in planning for the use and protection of regional water resources such as the Batten Kill and Mettawee. This could involve an inter-municipal agreement between these towns and communities in New York State for the long-term protection of these resources and to address flood hazards.

8. The Town should provide outreach to property owners within the flood zones to support flood proofing or buy-outs of structures subject to repeated flooding and eligible for funding under the FEMA Hazard Mitigation Grant Program.

9. The Town should participate in the FEMA Community Rating System program by implementing projects that would ultimately lead to rate reductions in flood insurance premiums for residents and businesses.

10. The Town should encourage owners in flood hazard zones to secure propane tanks, fire wood, boats and other items that could float away in a flood, thereby creating hazards for those downstream.

11. The Town should maintain a current Local Emergency Operations Plan that provides for emergency response and flood preparedness.

12. The Town should adopt a hazard mitigation plan that fulfills FEMA requirements.

## 2. Bennington Regional Plan Policies and Actions (adopted May 17, 2007)

The Bennington Regional Plan lists the following policies and actions supporting hazard mitigation:

a. Intensive development should be directed to areas where physical conditions such as elevation, slope, and soils are most capable of supporting such development. (p. 13).

b. Growth should be restricted in areas of high elevation, steep slopes, or poor soils where environmental damage is likely to occur as a result of development. Special attention must be given to the need to prevent soil erosion,

contamination of surface and ground water, and degradation of natural ecological communities in these areas (p. 13).

c. Development in floodplains must be carefully controlled in accordance with flood hazard are regulations. Development is strongly discouraged in flood hazard areas (p. 48).

d. Aquifers and ground water recharge areas (including all designated source protection areas) must be protected from activities or development that would adversely affect the quantity or quality of available ground water. Municipal subdivision and health ordinances and the regulations of the Vermont Agency of Natural Resources must be strictly enforced to protect individual water supplies (p. 48).

e. The surface waters of the Bennington region are extraordinarily valuable natural resources that must be protected from incompatible development and land uses. The natural characteristics and values of these resources should be preserved. An undisturbed buffer of at least 50 feet in width should be maintained, wherever possible, between any developed area and a river, stream, lake, pond, or wetland to ensure that water quality and natural ecosystems are protected. Greater buffer distances often will be required depending on the nature of the land and affected waterway (p. 47).

f. New roads, driveways, and drainage systems should be designed, constructed, and maintained in accordance with the municipal subdivision regulations, street standards, and other local and state requirements (p. 75).

## 3. Hazard Mitigation Plan for the Bennington Region (Multi-Jurisdictional)

Dorset was one of 13 jurisdictions in Bennington County that adopted a multi-jurisdiction hazard mitigation plan in 2005. The Dorset annex listed the following actions:

Table 22

| Mitigation Action | Who is Responsible | Approx. Time Frame & Potential Funding Sources | Initial Implementation Steps | Status |
|---|---|---|---|---|
| Update Rapid Response Plan at least annually | Select Board & Em Mgt Director | • Short Term<br>• Local Resources | Technical assistance from BCRC | Revised annually |
| Upgrade stormwater drainage structures | Select Board w/ support from Road Foreman | • Short to Long Term<br>• Local & State Resources<br>• PDM-c Funds | Conduct “needs assessment”; Technical assistance from BCRC & VEM | Town has upgraded numerous stormwater structures. Action retained for others identified needing upgrading. |

| | | | | |
|---|---|---|---|---|
| Assess Mad Tom Beaver Dam. | Select Board, Road Foreman, Private Owners | • Med. to Long Term<br>• Local & State Resources<br>• PDM-C Funds | Assistance from BCRC, VEM, ANR, private residents & land owners; conduct assessments and explore options | On-going |
| Flood-proofing structures within Flood Hazard Areas | Select Board, Private Owners | • Med. to Long Term<br>• Local & State Resources<br>• PDM-C Funds | Conduct assessment of needs and options | Retained in this plan Ttable 20) |

Dorset updated their Basic Emergency Operations Plan in 2012. The town has been upgrading culverts and other drainage structures over time and as a result of flood damage. Phase I and II geomorphic assessments have been completed for both the Batten Kill and Mettawee River and river corridor plans completed listing restoration actions. The town has been working with the Bennington County Regional Commission, Bennington County Conservation District, The Batten Kill Watershed Alliance and Vermont Agency of Natural Resources to implement these river corridor plans. There are no repetitive loss properties in Dorset, and no owners have expressed interest in flood proofing. This action will be retained if structures needing flood proofing are identified. In addition, while numerous culverts have been upgraded, further work may be needed, so this action is also retained (Table 23).

## 4. Vermont Hazard Mitigation Plan (2013)

The Vermont Hazard Mitigation Plan identified a series of hazards shown in Table 22 below along with those we considered in this plan. The Dorset plan tracks the state plan except some hazards are combined and a few, including nuclear plant accident, were not considered.

Table 22 Comparison of hazards considered in the draft Vermont Hazard Mitigation Plan vs. the Dorset Hazard Mitigation Plan

| VT Hazard Mitigation Plan | Alternative |
|---|---|
| **Atmospheric Hazards** | **Natural Hazards** |
| Drought | Drought |
| Earthquake | Earthquake |
| Flooding | Flooding/Flash Floods/Fluvial Erosion/Ice Jams |
| Fluvial Erosion | *See Flooding/Flash Floods/Fluvial Erosion/Ice Jam* |
| Hail | Hail |
| High Winds | High Winds |
| Hurricane/Tropical Storm | *See High Winds and Flooding/Flash Floods/Fluvial Erosion/Ice Jams* |
| Ice Storm | *See Severe Winter Weather/Ice Storm* |
| Ice Jams | *See Flooding/Flash Floods/Fluvial Erosion/Ice Jam* |
| Infectious Disease Outbreak | Infectious Disease Outbreak |
| Landslide/Debris Flow | Landslide/Debris Flow |

| Table 22 Comparison of hazards considered in the draft Vermont Hazard Mitigation Plan vs. the Dorset Hazard Mitigation Plan | |
|---|---|
| VT Hazard Mitigation Plan | Alternative |
| Severe Thunderstorm | *See High Winds and Flooding/Flash Floods/Fluvial Erosion/Ice Jams* |
| Severe Winter Weather | Severe Winter Weather/Ice Storm |
| Temperature Extremes | Temperature Extremes |
| Tornado | *See High Winds* |
| Wildfire | Wildfire |
| **Technological Hazards** | **Technological Hazards** |
| Dam Failure | Dam Failure |
| Hazardous Materials Spill | Hazardous Materials Spill |
| Invasive Species | Invasive Species |
| Nuclear Power Plant Accident | Not addressed |
| Rock Cuts | *See Landslide/Debris Flow* |
| Terrorism | Not addressed |

The draft Vermont Hazard Mitigation Plan identified flooding and fluvial erosion, winter storms, high winds and severe thunderstorms as high risk for Bennington County and radiological accident risk and hazardous materials spills as moderate risk. There are no vulnerable state facilities in Dorset.

## C. Current Programs

Vermont, municipalities have the authority to regulate development in flood hazard areas under 24 Vermont Statues Annotated (VSA), Chapter 91. Under 10 VSA, Chapter 32, the Secretary of the Agency of Environmental Conservation has the authority to designate flood hazard areas and to assist the towns with flood hazard regulations. Dorset participates in the National Flood Insurance Program (NFIP) and has bylaws in place to implement that program. This program is overseen by the Town Zoning Administrator. The Town also has a fluvial erosion zone hazard ordinance. In some cases, land may fall into a fluvial erosion hazard zone but not in the flood zones identified in FEMA flood map. Therefore, property owners who own land in the fluvial erosion hazard zone should be encouraged to purchase flood insurance.

The Town bylaws have been reviewed and amended to reflect changes in the flood insurance maps prepared by FEMA. The current FIRM is dated November 29, 1977. More recently, DFIRM maps have been developed using LIDAR, a technology that can be used to develop highly accurate elevations and, thereby, predict potential flood elevations from different storm events (FEMA 2010).

The Town has an active program to maintain roads and bridges and has upgraded all of the bridges and culverts based on hydraulic studies completed by the Agency of Transportation.

The Town has 2 emergency shelters. These shelters include: The Dorset School and the East Dorset Fire Station. The locations of critical facilities are shown on Maps 3, 5, and 7.

## D. Mitigation Projects

Table 23 below lists mitigation actions for each of those hazards. Some will be implemented by the Town of Dorset and others by agencies such as the Vermont Agency of Transportation. Mitigation actions are listed by the type of hazard. The following criteria were used in establishing project priorities, with ranking based on the best available information and best judgment as these proposed projects would need further study and design work:

1. The overall assessment of the potential damage from a given hazard.
2. Whether the proposed action reduce potential damage from the hazard.
3. Consistency of the proposed action consistent with the goals of the town.
4. Whether the action could be implemented within the specified time frame.
5. Whether the proposed action was technically feasible.
6. Whether the action could be implemented to reduce potential damage at a reasonable economic cost while avoiding or mitigating potential impacts to natural, cultural, social and economic resources.

Prior to the implementation of any action, a benefit-cost analysis would be completed to assure the action would be feasible and cost-effective.

| Table 23. Mitigation actions | | | | | | |
|---|---|---|---|---|---|---|
| Hazard | Type[2] | Actions | Responsible Parties | Time Frame | Funding Source(s) | Priority |
| All Hazards | Education and Outreach | Provide a "be prepared" section of the Town website with links to information for residents | Town Select Board | 6 -18 months | Town general fund | High |
| All Hazards | Local Planning and Regulations | Encourage proper construction techniques and use of appropriate materials to address hazards, particularly flooding, winter storms, wind events, earthquakes, landslides and wildfire | Town Planning Commission; Zoning Administrator | 6-18 months | Town general fund | High |
| All Hazards | Education and Awareness | Identify and develop methods to communicate with populations vulnerable to potential hazards, particularly drought, extreme temperatures and infectious diseases, but also those in need of assistance for evacuation and/or sheltering | Town Emergency Management Director | 6-18 months | Town general fund | High |
| All Hazards | Local Planning and Regulations | Assess need for driveway standards to assure adequate emergency access particularly to assure adequate access in winter storms, floods and for wildfire protection | Town Planning Commission | 6-18 months | Town general fund | High |
| Floods and Flash Floods | Education and Awareness | Educate owners on importance of securing propane tanks and other items that could float or blow away in storms | Town Zoning Administrator | 6-18 months | Town general fund | Medium |
| Floods and Flash Floods | Local Planning and Regulations | Adopt and enforce updated flood hazard and fluvial erosion hazard zone bylaws | Town Planning Commission; Zoning Administrator | 6-18 months | Town general fund | High |
| Floods and Flash Floods | Local Planning and Regulations | Participate in the Community Rating System to help reduce flood insurance premiums | Town Select Board | 12-24 months | Town general fund | High |
| Floods and Flash Floods | Local Planning and Regulations | Encourage appropriate stormwater and erosion control measures in new developments | Town Planning Commission | 1-5 years | Town general fund | High |
| Floods and flash floods | Local Planning and Regulations | Prepared draft contract for company to provide services if debris pile up bridges and culverts to prevent blockages and resulting flooding. | Town Select Board; Town Road Foreman | 6-18 months | Town highway fund | High |
| Floods and flash floods | Structure and Infrastructure Projects | Road crew should regularly survey culverts for blockages including photographs and records of damages and costs | Town Road Foreman | 1-5 years | Town highway fund | High |

[2] Follows FEMA 2013 Mitigation ideas; a resource for reducing. Federal Emergency Management Agency, U.S. Department of Homeland Security, Washington, DC

Table 23. Mitigation actions

| Hazard | Type[2] | Actions | Responsible Parties | Time Frame | Funding Source(s) | Priority |
|---|---|---|---|---|---|---|
| Floods and flash floods | Structure and Infrastructure Projects | Adopt the 2013 and updates to the Vermont Town Road and Bridge Standards | Town Select Board | 6-12 months and as updated | Town general fund | High |
| Floods and flash floods | Structure and infrastructure projects | Identify and replace culverts and bridges that do not meet current Vermont Town Road and Bridge Standards | Town Road Foreman | 1-5 years | Town highway fund State of Vermont AOT FEMA HMGP, PDM, FMA | High |
| Floods and flash floods | Structure and infrastructure protection | Encourage property owners in flood or fluvial erosion hazard zones to consider selling their properties (buy out) or implementing flood proofing including elevating structures | Town Select Board | 1-5 years | FEMA HMGP, PDM, FMA | High |
| Floods and flash floods | Structure and infrastructure protection | Implement corridor protection, buffer plantings, structure and berm removal and other projects listed in the 2007 Batten Kill corridor plan (Field 2007) | Town Select Board; Batten Kill Watershed Alliance | 1-5 Years | FEMA HMGP, FMA, PDM Vermont Ecosystem Restoration Program, Vermont Watershed Grant | Medium to High |
| Floods and flash floods | Natural Systems Protection | Acquire lands or work with conservation organizations to acquire lands subject to frequent flooding or wetlands within or adjacent to flood prone areas to provide flood storage | Town Select Board; Batten Kill Watershed Alliance: Vermont Land Trust | 1-5 years | State of Vermont Watershed Grants, Vermont Ecosystem Restoration Program, Nonprofit organizations | Medium |

| Table 23. Mitigation actions | | | | | | |
|---|---|---|---|---|---|---|
| Hazard | Type[2] | Actions | Responsible Parties | Time Frame | Funding Source(s) | Priority |
| Winter storms | Education and Outreach | Provide educational materials on sheltering in place and preparation for winter storms, including long-term power outages | Town Emergency Management Director | 6-18 months | Town general fund | High |
| Winter storms | Education and Awareness | Provide materials for residents on methods to protect property from wind events | Town Emergency Management Director; Zoning Administrator | 12-24 months | Town general fund FEMA HMGP, PDM, FMA | High |
| Winter storms | Local Planning and Regulations | Develop agreements with adjacent towns for sharing of highway equipment | Town Select Board; Town Road Foreman | 6-12 months | Town general fund | High |
| Winter storms | Structure and Infrastructure Projects | Place utilities underground for critical facilities | Town Select Board | 6-24 months | FEMA HMGP, PDM, FMA | Medium |
| High wind events | Education and Outreach | Provide educational materials on sheltering in place and preparation for winter storms, including long-term power outages | Town Emergency Management Director | 6-12 months | Town general fund | High |
| High wind events | Local Planning and Regulation | Require boats, propane tanks and other items stored outdoors to be secured | Town Planning Commission; Zoning Administrator | 6-18 months | Town general fund | Medium |
| High wind events | Local Planning and Regulation | Encourage appropriate plantings to avoid future damage from downed trees | Town Emergency Management Director | 6-18 months | Town general fund | Medium |
| High wind events | Local Planning and Regulation | Encourage protection and planting of wind breaks in new developments | Town Emergency Management Director; Zoning Administrator | 6-24 months | Town general fund | Medium |
| High wind events | Structure and Infrastructure Projects | Retrofit existing buildings to withstand high winds including protection of power lines and other utilities | Town Select Board Private Owners | 1 to 5 years | FEMA HMGP, PDM | Medium |

| Table 23. Mitigation actions | | | | | | |
|---|---|---|---|---|---|---|
| Hazard | Type[2] | Actions | Responsible Parties | Time Frame | Funding Source(s) | Priority |
| High wind events | Structure and Infrastructure Projects | Place utilities underground for critical facilities | Town Select Board; Private Owners | 12-48 months | FEMA HMGP, PDM | Medium |
| Hail | Structure and Infrastructure Projects | Retrofit existing buildings to minimize hail damage | Town Select Board; Private Owners | 24-48 months | FEMA HMGP, PDM | Low |
| Temperature extremes | Education and Awareness | Identify vulnerable community members through a survey and outreach | Town Emergency Management Director | 6-18 months | Town general fund FEMA HMGP, PDM | High |
| Temperature extremes | Local Planning and Regulation | Develop cooperative agreement with Manchester for sheltering of vulnerable populations | Town Select Board; Emergency Management Director | 6-12 months | Town general fund | High |
| Drought | Local Planning and Regulation | Monitor drought conditions | Town Emergency Management Director | 1-5 years | Town general fund | Medium |
| Drought | Education and Awareness | Provide educational materials on dealing with drought | Town Emergency Management Director | 12-24 months | Town general fund FEMA HMGP, PDM | Medium |
| Drought | Natural System Protection | Develop improved assessment of groundwater sources and amend bylaws to assure their protection | Vermont Geological Survey Town Planning Commission | 24-36 months | FEMA HMGP, PDM State of VT | Medium |
| Drought | Local Planning and Regulation | Incorporate planning for droughts in the emergency management plan | Town Emergency Management Director | 6-18 months | Town general fund | Medium |
| Wildfire | Education and Outreach | Acquire materials from Firewise for homeowners and provide to Dorset to make available for landowners | BCRC | 6-12 months | BCRC | Medium |
| Wildfire | Education and Outreach | Provide information on outdoor burning safety prior to the spring and fall fire seasons | Fire wardens | 1-5 years | Fire wardens | Medium |

| Table 23. Mitigation actions | | | | | | |
|---|---|---|---|---|---|---|
| Hazard | Type[2] | Actions | Responsible Parties | Time Frame | Funding Source(s) | Priority |
| Wildfire | Education and Outreach | Provide a review of properties where owners request assessment of their properties for wildfire safety and adequate defensible space | BCRC, Dorset Fire Departments | 1-5 years | BCRC, Arlington FD | Medium |
| Wildfire | Education and Outreach | Encourage owners to maintain defensible space around structures and to mow fields along road edges to prevent wildfire | Town Emergency Management Director; Dorset Fire Departments | 1-5 years | Town general fund | Medium |
| Wildfire | Local Planning and Regulations | Encourage defensible space around structures | Town Planning Commission | 1-5 years | Town general fund | Medium |
| Wildfire | Structure and Infrastructure Projects | Assure adequate water supplies are available including areas identified as gaps in the 2013 Community Wildfire Protection Plan | Town Select Board; Emergency Management Director, Dorset Fire Departments | 1-5 years | Town general fund /State of Vermont grants for dry hydrants/ Vermont Department of Parks, Forestry and Recreation | Medium |
| Wildfire | Natural Systems Protection | Implement fuel reduction, particularly in grass fields | Dorset Fire Departments/Green Mountain National Forest | 1-5 years | Arlington FD/Green Mountain NF | Medium |
| Landslide and debris flow | Local Planning and Regulations | Map known landslides and identify potential landslide areas | Town/BCRC/State of Vermont | 12-24 months | FEMA HMGP, PDM | High |
| Landslide and debris flow | Local Planning and Regulations | Adopt fluvial erosion hazard bylaws | Town Select Board; Town Planning Commission | 6-12 months | Town general fund | High |
| Landslide and debris flow | Structure and Infrastructure Projects | Implement visual monitoring in potential landslide areas | Town Emergency Management Director | 12-24 months | Town general fund | High |

Table 23. Mitigation actions

| Hazard | Type[2] | Actions | Responsible Parties | Time Frame | Funding Source(s) | Priority |
|---|---|---|---|---|---|---|
| Landslide and debris flow | Structure and Infrastructure Projects | Stabilize and replant stream corridor areas subject to landslides | Batten Kill Alliance | 1-5 years | State of VT Watershed grants | High |
| Earthquake | Education and Awareness | Educate property owners on proper construction techniques to reduce potential damage from earthquakes | Town Zoning Administrator | 6-24 months | Town general fund | Medium |
| Hazardous materials spill | Local Planning and Regulation | Complete an assessment of hazardous materials and potential accident locations. Based on DEC info. | LEPC 7 | 24-48 months | State of VT DEC funds | High |
| Hazardous materials spill | Structure and Infrastructure Projects | Work with VT AOT to identify and mitigate high accident intersections | VT AOT | 12-36 months | State AOT funds | Medium |
| Hazardous materials spill | Natural Systems Protection | Identify groundwater source areas and develop ordinances to protect those areas | Vermont Geological Survey | 12-36 months | VT Geological Survey funds | Medium |
| Infectious disease outbreak | Local Planning and Regulations | Monitor disease occurrences and potential outbreaks, partnering with the VT Dept. of Health | Town Health Officer | 1-5 years | State of VT Dept. of Health | High |
| Infectious disease outbreak | Education and Outreach | Provide educational materials in printed form and on the town web site on potential infectious diseases | Town Health Officer | 12-36 months | Town general fund /State of Vermont Health Department | High |
| Invasive species | Local Planning and Regulations | Monitor extent of invasive species, particularly forest invasive species such as Emerald Ash Borer | Town Select Board | 1-5 years | Town general fund | Medium |
| Invasive species | Local Planning and Regulations | Complete surveys for ash trees vulnerable to Emerald Ash Borer in town highway ROW | BCRC; Bennington County Conservation District | 6-24 months | FEMA HMGP, PDM VT Department of Forests, Parks and Recreation | Medium |

| Table 23. Mitigation actions | | | | | | |
|---|---|---|---|---|---|---|
| Hazard | Type[2] | Actions | Responsible Parties | Time Frame | Funding Source(s) | Priority |
| Invasive species | Local Planning and Regulations | Survey for invasive species (e.g., Japanese knotweed)s along streams to identify potential erosion areas | Batten Kill Watershed Alliance/ Dorset Conservation Commission | 12-24 months | State of Vermont Department of Parks, Forestry and Recreation | Medium |
| Invasive species | Local Planning and Regulations | Encourage use of native species in plantings for commercial and residential development | Town Planning Commission | 1-5 years | Town general fund | Medium |
| Invasive species | Education and Awareness | Provide outreach materials for landowners on using native plants and controlling invasive species | Bennington County Conservation District | 6-18 months | Town general fund /State of Vermont Department of Parks, Forestry and Recreation | High |

## E. Monitoring and Revising This Plan

### 1. Annual Review

This plan will be integrated into existing planning efforts when appropriate. During the annual budget process, the status of proposed projects as well as any newly identified projects will be reviewed by the Select Board. If necessary, the plan will be amended to include these new projects. During Town Meeting Day, members of the public will be afforded the opportunity to comment on the status of any projects and on any needed changes to the hazard mitigation plan.

Toward the end of the five year period covered by this plan, the Select Board Chair will initiate a review of the plan, by:

1. Updating the analyses of events using new information since completion of the 2014 draft
2. Identification of any new structures
3. Evaluation of potential probability and extent of hazards based on any new information since completion of the 2014 plan.
4. Review of completed hazard mitigation projects
5. Identification of new projects given the revised hazard evaluation

The Select Board will hold open meetings to solicit opinions and to identify issues and concerns from members of the public and stakeholders. The Town of Dorset Select Board Chair will work with the Bennington County Regional Commission and the State Hazard Mitigation Officer (SHMO) to review and update their programs, initiatives and projects based on changing local needs and priorities. BCRC will assist in any necessary coordination and communication with neighboring towns to assure that mitigation actions address regional issues of concern. The revised plan will be submitted for review by the State Hazard Mitigation Officer and FEMA and revised based on their comments. Following approval by FEMA, the Select Board will adopt the completed plan.

Should a declared disaster occur, Dorset may undertake special review of this plan and the appropriate updates made. After Action Reports, reviews, and debriefings should be integrated into the update process. The plan should also be updated to reflect findings of the river corridor plans, culvert study and other studies.

### 2. Emergency Operations Plan

Emergency Operation Plans provide contact information and list the steps to setting up an incident command structure, assessing risks and vulnerabilities, and providing for resources and support.

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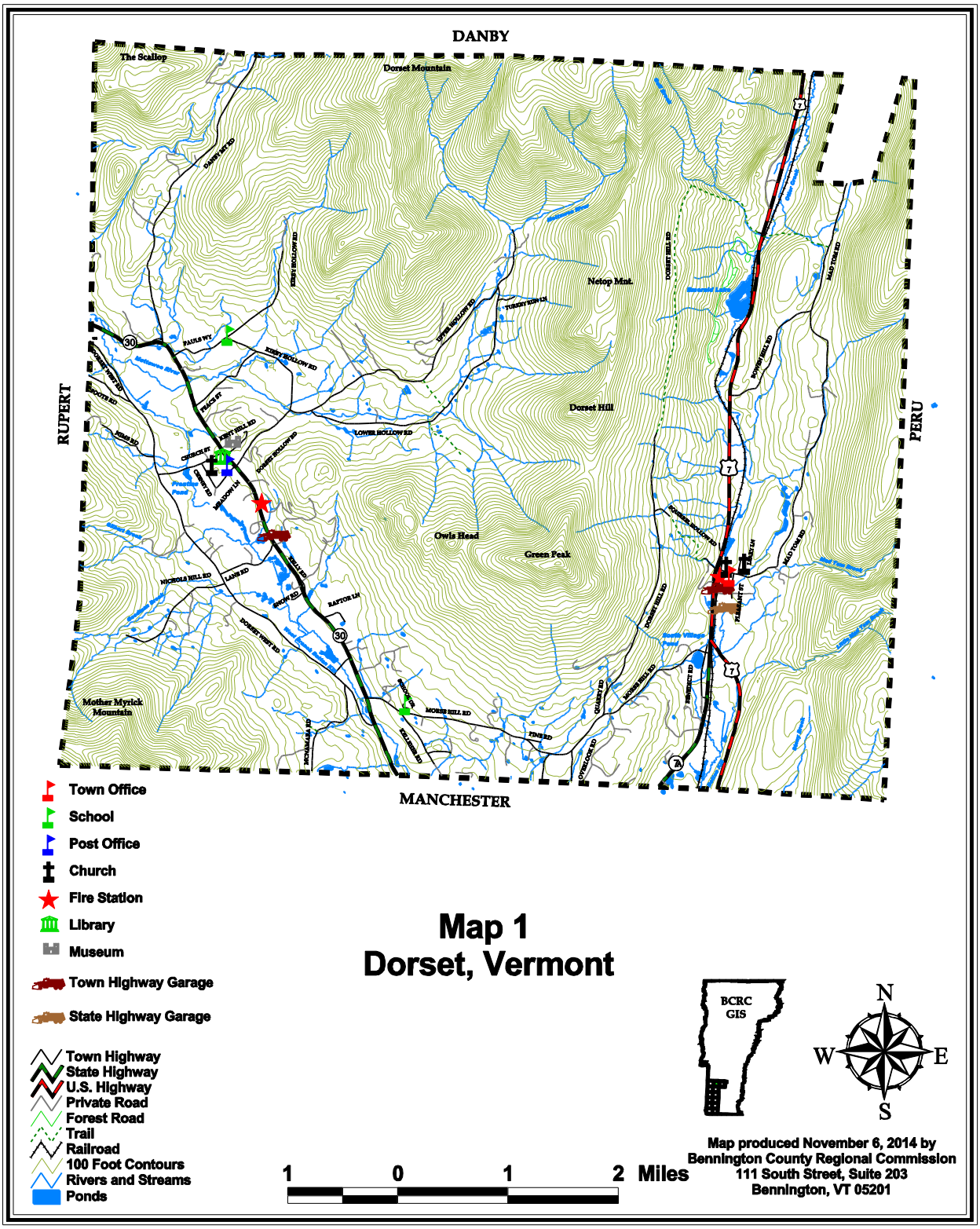
DANBY
The Scallop
Dorset Mountain
Netop Mtn.
Dorset Hill
Owls Head
Green Peak
Mother Myrick Mountain
RUPERT
PERU
MANCHESTER
Town Office
School
Post Office
Church
Fire Station
Library
Museum
Town Highway Garage
State Highway Garage
Town Highway
State Highway
U.S. Highway
Private Road
Forest Road
Trail
Railroad
100 Foot Contours
Rivers and Streams
Ponds
Map 1
Dorset, Vermont
BCRC GIS
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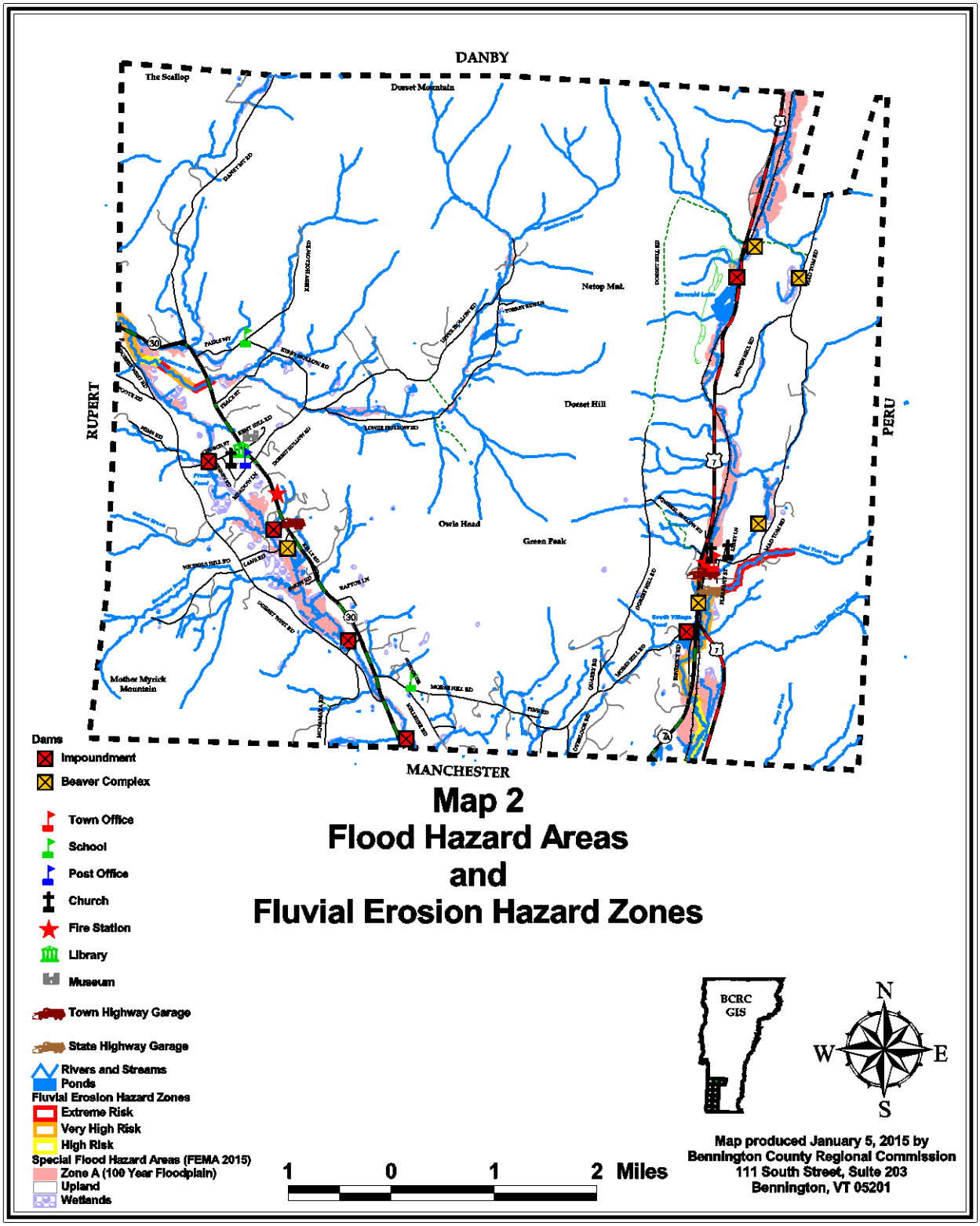
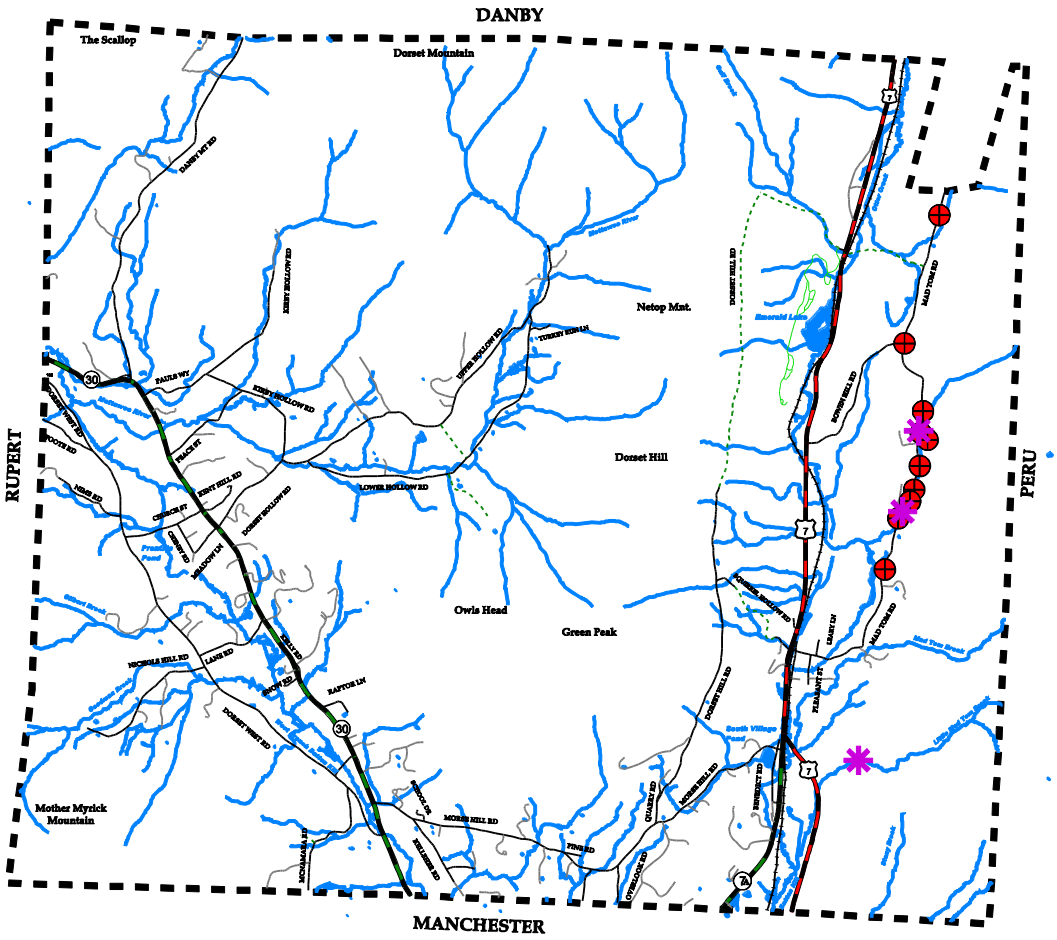
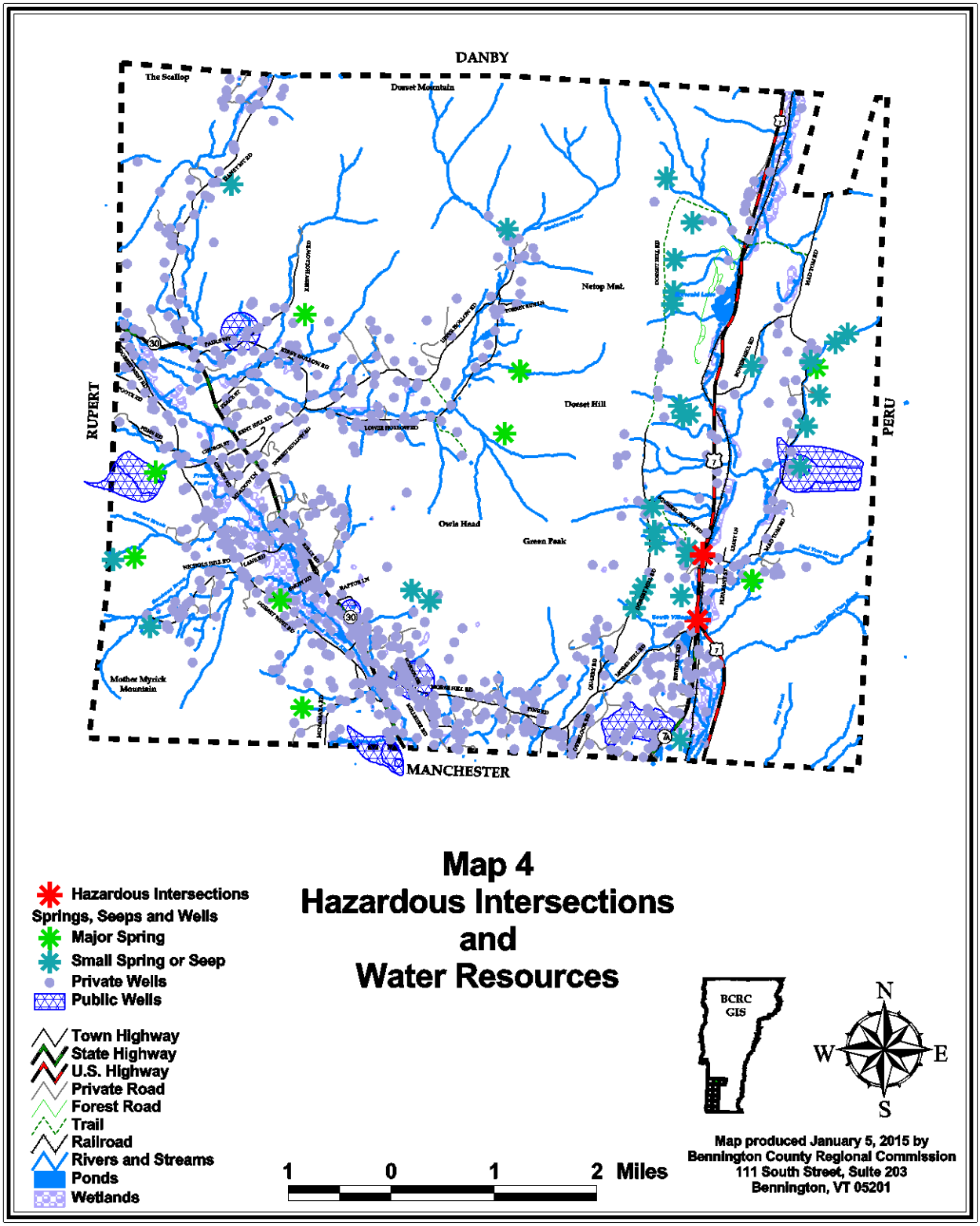
Map produced November 6, 2014 by
Bennington County Regional Commission
111 South Street, Suite 203
Bennington, VT 05201




# Map 2
# Flood Hazard Areas
# and
# Fluvial Erosion Hazard Zones




# Map 3
# Tropical Storm Irene Damages


DANBY
The Scallop
Dorset Mountain
Netop Mtn.
Dorset Hill
Owls Head
Green Peak
Mother Myrick Mountain
RUPERT
PERU
MANCHESTER
Map 4
Hazardous Intersections
and
Water Resources
Hazardous Intersections
Springs, Seeps and Wells
Major Spring
Small Spring or Seep
Private Wells
Public Wells
Town Highway
State Highway
U.S. Highway
Private Road
Forest Road
Trail
Railroad
Rivers and Streams
Ponds
Wetlands
1 0 1 2 Miles
BCRC
GIS
N
W
E
S
Map produced January 5, 2015 by
Bennington County Regional Commission
111 South Street, Suite 203
Bennington, VT 05201