Town of Rupert

Hazard Mitigation Plan

June 12, 2014

Town of Rupert
187 East Street
West Rupert, VT 05776

TOWN OF RUPERT SELECTBOARD
P.O. BOX 140 WEST RUPERT, VT 05776
PHONE: 802-394-7728 FAX: 802-394-2524

Resolution of Adoption

Town of Rupert
Select Board
Town Hall
187 East St.
Rupert, VT 05775

A Resolution Adopting Town of Rupert Hazard Mitigation Plan

July 8, 2014

WHEREAS, the Town of Rupert has worked with the Bennington County Regional Planning Commission to identify hazards, analyze past and potential future losses due to natural disasters, and identify strategies for mitigating future losses; and

WHEREAS, the Town of Rupert contains several potential projects to mitigate damage from disasters that could occur in the Town; and

WHEREAS, a duly-noticed public meeting was held by the Town of Rupert Select Board on July 8, 2014 ~~2012~~ to formally adopt the Town of Rupert Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that the Town of Rupert hereby adopts the Town of Rupert Hazard Mitigation Plan.

Select Board Chair

Linda Montague
Select Board

Phil C. Mazzucco
Select Board

Thomas A. Wilcox
Select Board

Select Board

Andrea Lenhardt
Attest, Town of Rupert Town Clerk

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I. Introduction and 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 Rupert, Vermont 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
- Drought
- Wildfire
- Earthquake
- Landslides and Debris Flows

II. Town Profile

Rupert is located in the northern portion of Bennington County, and is bordered to the north by Pawlet in Rutland County, to the east by Dorset, to the south by Sandgate and to the west by Hebron and Salem in Washington County, New York (Map 1). The Town is approximately 44.7 square miles in area. The main roads follow the stream valleys including the Indian River on the west, along which Route 153 and the abandoned railroad traverse; Mill Brook through the center of the town, with Route 315 parallel; and the Mettawee River in the north and east, with Route 30 parallel. The terrain away from these streams consists of several hills, mountains and ridgelines. This terrain historically limited development to the valleys, though more recent developments have occurred in forested and steeper areas. Most of Rupert is forested (78%) with agriculture the second largest cover type (Map 2). Residential and commercial development represents a small portion of the land cover of the town.

The 2010 population was 714, a slight increase from the 704 people counted in 2000 (Vermont Data Center). The summer may add 200 to 300 seasonal residents. In addition, the

town had a higher proportion of senior residents (22.3%) than either the county (16.7%) or the state (12.7%) as of 2000. Household size has declined over the past several decades (Rupert Planning Commission 2005). Table 1 below shows the distribution of building types.

Table 1. Number and type of structures in Rupert. Source: Vermont Center for Geographic Information E911 data. April 12, 2011

Type	Number
Single family residential	356
Seasonal single family	71
Mobile home	21
Other residential	5
Commercial/Industrial	20
Commercial Farm	12
Institutional (school, government, church)	6
Other	24
Total	515

Most people work outside of town, though there remains active farming, forestry, slate quarrying and home-based businesses. Sherman's Store probably one of the more famous commercial sites in the area. Authentic Designs is one of the town's largest employers. On-site water and septic systems serve residential and commercial buildings as there are no public water or sewer systems.

Merck Forest and Farmland Foundation is a large, nonprofit conservation organization owning approximately 3,321 acres. The Vermont Land Trust, Green Mountain National Forest, and the two town forests total approximately 500 acres.

Town services are sufficient to serve a small town. Facilities include a town office on East Road, a library and historical society in the Rupert Village School, the Town Barn, used as a highway garage. The Rupert Fire Department is located on East Rd. and includes a community center and emergency shelter. The Congregational Church located on Route 153 can also be used as a shelter. The State Police are located in Shaftsbury and emergency services are available from Manchester, and from Granville and Salem, NY. Rupert and Pawlet formed the Union School District for education of elementary school children, with the school in Pawlet. Secondary students attend school in Salem, NY.

III. Planning Process

The first hazard mitigation plan for the Town of Rupert was completed in 2004 and adopted by the Rupert Select Board in 2005 as an annex to a multi-jurisdictional plan for the Bennington Region. The plan was offered for public involvement by Town residents as well as to the Local Emergency Planning Committee (LEPC 7) and its Subcommittees. These meetings were public meetings and warned as required. Following consideration of the comments from those forums, the draft plan was presented to the State Hazard Mitigation Committee through the State Hazard Mitigation Officer (SHMO) for review and comment and a recommendation for forwarding to FEMA Region I.

Following an affirmative recommendation for forwarding to FEMA Region I, the multi-jurisdictional plan was presented to each governing body of the communities in the Bennington Region for adoption. The multi-jurisdictional plan was forwarded to FEMA Region I for formal review and approval, and granted on May 23, 2005. The multi-jurisdictional plan expired in 2010.

This plan was developed between 2010 and 2013 and represents a new, single jurisdiction plan. The hazards and risk assessments were completed based on current FEMA guidelines and the Vermont State Hazard Mitigation Plan completed in 2010. The planning goals were reviewed and updated to incorporate the Town of Rupert plan adopted in 2005 and the Bennington County Regional Plan adopted in 2007. Data from State agencies and the National Weather Service were also incorporated. This plan describes, assesses and provides mitigation actions for the same natural hazards addressed in the 2005 plan. Other hazards addressed in the 2005 plan such as terrorism, are not addressed in this plan.

Table 2 shows the members of the Planning Committee and Table 3 provides key dates of public and agency review. The Bennington County Regional Commission provided support.

Table 2. Planning committee members	
Name	Affiliation
Mark Lourie	Select Board Chair
Skip Wilson	Emergency Management Director
George Lewis	Rupert Fire Chief

Table 3. Dates of planning meetings and public and agency review	
Meeting	Date (s)
Select Board appoints planning committee	January 25, 2012
Planning committee meetings	February 10, 2012
Draft presented to public	August 13, 2012
Select Board approves draft for submittal to VEM	August 13, 2012

Comments and information were also solicited from the Town Road Commissioner, long-time residents, volunteer fire personnel and the Zoning Administrator. The plan was also sent to the neighboring towns of Danby, Dorset, Manchester, and Sandgate, as well as Salem and Hebron in New York. The plan was posted on the BCRC website and sent to Local Emergency Planning Committee #7, which includes Rupert, for comment.

The plan was made available in the Town Hall for public review and comment on September 17, 2012 and also put online on the Bennington County Regional Commission website. The plan was submitted for review by Vermont Emergency Management and the Federal Emergency Management Agency on September 17, 2012. Following review and

approval by those agencies, the Select Board of the Town of Rupert adopted the plan on July 8, 2014.

IV. Hazard Analysis

A. Hazard Assessment

This section addresses each of the potential natural hazards based on data from the National Climate Data Center, the National Weather Service river gauge web site (www.water.weather/ahps/), 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 weather stations or stream gauges within the boundaries of the town. 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 creeks 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.

The major streams in Rupert are the Indian River on the western side, which flows south to Mill Brook in the southern and central portion of the town, White Creek in the southern portion, which also flows into Mill Brook, and the Mettawee River on the east side of the town and which flows north to Lake Champlain. While these rivers are relatively low gradient, they are also flashy, and flood damage that occurs results from fluvial erosion rather than inundation. This can range from gradual bank erosion to catastrophic changes in the location of the river channel (Vermont River Management Program 2010). Runoff from snowmelt in the

spring, summer thunderstorms, and tropical storms and hurricanes can all result in flooding in Rupert. 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.

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. There are historical accounts of a number of floods that devastated sections of town including an 1810 storm event in Kent and Clark Hollows that flooded White Creek and inundated downtown Salem, and another flood on White Creek in 1832 (Rupert Planning Commission 2005). Table 4 shows the total number of events by year and type.

Table 4. Total number of flood events by type and year for Bennington County. Source: NCDC 2011

Year	Flash Flood	Flood	Total
1993		1	1
1994		1	1
1995	1	1	2
1996	3	5	8
1998		3	3
1999		2	2
2000	2	2	4
2002	1	1	2
2004	1	3	4
2005		3	3
2006		1	1
2007	1	1	2
2009	2		2
2011		2	2
Total	11	31	42

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 2nd through the 4th 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 (Ludlum 1996). A storm in 1949 flooded all of West Rupert (Rupert Planning Commission 2005). Flooding occurred following rain on frozen ground on December 17, 2000 resulting in flooding of White Creek onto a bridge in West Rupert (NCDC 2011). Tropical Storm Irene caused damage to culverts along Mill Brook and to a bridge on White Creek.

Table 5 describes ten moderate and extreme events that have occurred since 1990, using the National Weather Service (2010) categories that likely affected Rupert. These events were described in the National Climate Database records (2011). It should be noted that only the January 1996 event occurred in the winter, with all other events in the spring, summer or fall. There are no records of ice jams causing significant flooding in Rupert.

Table 5. Significant flood events affecting Bennington County. Source: NCDC 2011					
Dates	Type	Description	Area	Category	FEMA
19-20 Jan 1996	Flood	An intense area of low pressure located over the Mid-Atlantic region produced unseasonably warm temperatures, high dewpoints and strong winds. This resulted in rapid melting of one to three feet of snow. In addition to the rapid snowmelt 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.	Countywide	Moderate	DR-1101 1/19 to 2/2 1996
11-12 May 1996	Flood	A low pressure system tracked across New York State and New England and moved to the east coast and intensified creating a prolonged period of precipitation. Rainfall in excess of 2 inches fell during this period over much of western New England. This resulted in flooding along the Walloomsac River in Bennington County.	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 8 feet at the new Arlington gage with substantial flooding reported. The main impact from the flood waters was extensive flooding of fields and roadways. Route 7A north of Arlington was closed due to flooding. The Walloomsac River crested nearly two feet above flood stage at Bennington.	Arlington; Bennington; Countywide	Moderate	
16-17 Sept 1999	Flood	The remnants of Hurricane Floyd moved up the eastern bringing both high winds and heavy rainfall (3-6 inches) to Southern Vermont. Many smaller tributaries reached or exceeded bankfull. Winds from the passage of Floyd were estimated to have gusted to over 60 mph, especially over hilltowns. The combination of the wind and very saturated ground, produce widespread downing of trees and power lines across much of Southern Vermont. As many as 2,000 people lost power in Southern Vermont.	Countywide	Moderate	DR-1307 9/16-21 1999
14-17 Jul 2000	Flash Flood	Thunderstorms caused torrential rainfall with flash flooding which washed out sections of roadways in northeast Bennington County and southern Bennington County. Routes 7 and 67 were closed and some roads were washed out.	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 rain fell very heavily at times, up to an inch per hour. The rain, combined with snowmelt and frozen ground, lead to a significant runoff and flooding.	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 Account. This event does not appear in the NCDC data			DR-1488 7/21-8/18 2003

Table 5. Significant flood events affecting Bennington County. Source: NCDC 2011					
Dates	Type	Description	Area	Category	FEMA
16-17 Apr 2007	Flood	An intense coastal storm spread heavy precipitation across southern Vermont, starting as a mixture of wet snow, sleet and rain, with snow and sleet more prevalent across the higher elevations. The precipitation then changed to plain rain. Liquid equivalent precipitation totals from this storm ranged from 3 to 6 inches. This led to minor flooding across portions of southern Vermont from Monday afternoon into early Tuesday.	Arlington	Minor	DR- 1698 4/15-21 2000
28-29 Aug 2011	Flood/Flash Flood	Tropical Storm Irene tracked north northeast across eastern New York and western New England during Sunday, August 28th, producing widespread flooding, and damaging winds across the region. Rainfall amounts generally averaged 4 to 8 inches. Much of the rain which fell occurred within a 12 hour period, beginning early Sunday morning, and ending Sunday evening. This resulted in widespread flash flooding and river flooding across southern Vermont. 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. Route 9, the main route across southern Vermont, was closed. The city of Bennington was inaccessible for a period of time. Record flooding occurred on the Walloomsac River at Bennington. 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 numerous downed trees and power lines across the region. This also resulted in 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. Total rainfall amounts across southern Vermont for the period from Monday into Thursday ranged from 3 to 7 inches. This heavy rainfall, combined with saturated soil from the excessive rains which fell in late August associated with the passage of Irene, led to widespread minor to moderate flooding on rivers, as well as small streams and creeks across southern Vermont.	North Bennington; Countywide	Moderate	

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. Rupert has been subjected to two major tropical storms in the past twenty years. The primary damage was from flooding with secondary damage from wind.

c. Extent and Location

Flash floods are the most common type of flooding occurring along Mill Brook as waters flow rapidly from higher elevations (Map 3). Thunderstorms have become entrained in the mountains to the east. Routes 153 and 315 are close to the brook, and culverts have been damaged by these flash floods. Generally water recedes quickly after these storms. Flooding can occur after spring melt of mountain snow, following large storms such as Tropical Storm

Irene, or after significant thunderstorms. During Irene, there were washouts along several area roads. On Route 315 a portion of the road was undermined and required construction of a retaining wall. One bridge was undermined and several sections of roadsides required stabilization. The Sandgate Road bridge was damaged when one of the abutments sank during flooding. Portions of a bridge on Saunders Lane were washed out. Approximately 0.7 miles of Cross Road northwest of Route 153 were washed out. Several culverts became blocked resulting in water washing down or over some road sections along Sykes Hollow Road, Perkins Road and Ebenville Road. The Perkins Road culvert has suffered damage in previous flooding as well. Route 153 and near the intersection with East Street was under water. There have been no NFIP-designated repetitive losses within the jurisdiction.

Map 3 shows flood zones and fluvial hazard zones within Rupert. Map 4 identifies areas within the town particularly vulnerable to flood damage. The storm caused some debris jams, but the most damage resulted from damage to abutments to the White Creek Bridge.

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

Type	Number in special flood hazard zone	Number in fluvial erosion hazard zone
Single-family	6	13
Mobile Home		2
Government	1	
Commercial	1	
Public Gathering	2	1
Camp	1	2
Total	13	18

No additional dwelling units, government buildings, commercial structures of public gathering places were constructed in the special flood hazard zone since the 2005 Bennington County All-Hazards Plan was completed. Four additional single family dwellings were constructed in the fluvial erosion hazard zone. Mapping of that zone was completed in 2009, and the Rupert Select Board adopted bylaws incorporating the fluvial erosion hazard zone in July of 2011.

d. Probability, Impact, and Vulnerability

Based on data from 1990 to 2011, ten moderate or major flood events have affected Bennington County, resulting in a 50% chance of such an event occurring. However, these have not all directly affected Rupert, so that probability should range from 10 to 50%. While there was damage to roads and bridges, no structures were damaged by flooding. 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. Map 6 shows Critical Facilities including the Rupert Town Hall and Fire Department, which also serves as the town emergency operations center and shelter.

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. 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 below summarizes the 152 winter storm events that have occurred in Bennington County since 1993. As can be seen, a high numbers of events occurred in 1997, 2007, 2008, and 2009.

Table 7 Summary of winter storm events in Bennington County. Source: NCDC 2011

Year	Blizzard	Record Snow	Heavy Snow	Snow	Heavy Mix	Ice Storm	Freezing Rain	Snow/ Freezing Rain	Snow/Sleet	Winter Storm	Winter Weather	Total
1993	1	1	4	5			1					12
1994			4	1	1			1	2			9
1995			3	1				5				9
1996			5							2		7
1997			1				2			7		10
1998				1						2		3
1999										4		4
2000				1						6		7
2001										6		6
2002										5		5
2003										5		5
2004										2		2
2005	1		3							2		6
2007			4			1				6	3	14
2008			5			2				1	13	21
2009			4							1	12	17
2010			3							1	3	7
2011										4	3	7
Totals	2	1	36	9	1	3	3	5	2	54	35	152

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." Table 8 shows the significant winter storm events since 1990.

Table 8. Significant winter storm events in Bennington County and Rupert. Source: NCDC 2011

Dates	Type	Description	Category	Area
13-14 Jan 1993	Heavy Snow	Snowfall amounts across the state ranged from six to sixteen inches	High	Statewide
16-17 Feb 1993	Heavy Snow	Snowfall amounts ranged from 6 to 18.	High	Statewide
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.	Extreme	Statewide
2-4 Mar 1993	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.	High	Statewide
4-5 Feb 1995	Heavy Snow	A low pressure system tracked up the east coast on February 4th reaching the Gulf of Maine on the morning of February 5th 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. Across southern and central Vermont two to five inches of snow fell along with significant ice.	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. Some specific snowfall totals included 7 inches in Pownal in Bennington County.	High	Southern Vermont
23 Jan 2005	Blizzard	Frequent whiteout conditions observed by plow crews. Whiteout conditions were most prevalent across the Green Mountains.	High	Countywide
15-16 Jan 2007	Ice Storm	Significant icing occurred from the freezing rain during Monday, leading to widespread power outages from downed trees and tree limbs, and from power transformers which shorted out. Strengthening winds in the wake of the storm continued to down tree limbs and exacerbate power outages across the region.	High	Southern Vermont
16-17 Mar 2007	Heavy Snow	This storm brought widespread snowfall amounts of 10 to 18 inches across southern Vermont.	High	
30-31 Dec 2007	Heavy Snow	This storm system brought a swath of heavy snow to eastern New York and western New totaling from 6 to 12 inches across southern Vermont. Snowfall amounts ranged from 6 to 11 inches, with 11 inches reported at Woodford, and 6 inches reported at Dorset.	High	Southern Vermont
1-2 Jan 2008	Heavy Snow	Snowfall accumulations of 6 to 12 inches led to treacherous travel conditions and the closings, or delayed openings of numerous schools and businesses.	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 Rupert. Source: NCDC 2011

Dates	Type	Description	Category	Area
11-18 Dec 2008 FEMA DR-1816	Winter Storm	A series of snowstorms 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.	High	Southern Vermont
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.	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.	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 across southern Vermont, downed trees and power lines, treacherous travel and road closures. Strong and gusty winds developed along the east facing slopes of the Green Mountains of southern Vermont with gusts up to 50 mph. By the time the snow came to an end, snowfall totals of 1 to 2 feet were reported across the higher terrain, with lesser amounts of 3 to 6 inches below 1000 feet. The liquid equivalent totals from the storm were 1 to 2 1/2 inches.	High	Southern Vermont

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 12.7 to 17.6 inches (NOAA/National Climate Data Center 2011).

Potential damages can include power outages, traffic accidents, and isolation of some areas. The skill of road crews in Rupert means that only the heaviest storms that reduce visibility in wind, such as the during the March 13-15, 1993 snowstorm. Problems can occur from Route 153 to 315 and from 315 to Route 30 (Map 4) as well as Class 3 roads in the town. NCDC records indicate difficult road conditions occurred during the October 26, 2005 storm which downed trees along Route 153 in West Rupert. Ice storms may more frequently affect traffic depending on timing (e.g., during rush hour) or duration, with long-term events creating power outages.

d. Probability, Impact and Vulnerability

There is a greater than 50% probability of a moderate or greater snowstorm affecting Bennington County, including Rupert. 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 (1-10%). 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

Thunderstorms can produce damaging winds, hail and heavy rainfall, the latter potentially producing flash floods. The NCDC recorded 52 thunderstorms with damaging winds occurring 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. No tornadoes have been recorded in Rupert.

b. Previous Occurrences

Table 9 below summarizes the total number of significant wind events including thunderstorms, strong winds, and tornadoes from 1990 to 2011. Damage was specifically reported in Rupert from storms that occurred on May 11, 1993 and July 18, 1999.

Table 9. Summary of wind events in Bennington County. Source: NCDC 2011

Year	Funnel Cloud	Strong Wind	Thunderstorm Winds	Tornado
1990			2	
1991			4	
1993		2	3	
1994		1	1	
1995		1	2	
1996		5		
1997		4	4	
1998		1	4	1
1999		2	3	
2000		1	1	
2001			2	
2002		1	3	1
2003		1		1
2005		1	3	
2006		5	4	
2007		3	4	
2008		3	3	
2009		1	1	
2010	1	5	3	

Table 9. Summary of wind events in Bennington County. Source: NCDC 2011				
Year	Funnel Cloud	Strong Wind	Thunderstorm Winds	Tornado
2011		1	5	
Totals	1	38	52	6

Windspeed 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. Table 10 shows significant wind events.

Table 10. Significant wind events in Bennington County. Source: NCDC 2011				
Dates	Type	Description	Area	Category
11-May-93	Thunderstorm	A storm caused damage in Rupert	Rupert	Minor
14-Sep-95	Thunderstorm	Severe thunderstorms produced damaging winds which downed trees and wires in a couple of locations in Bennington County.	Countywide	Minor
6-Mar-97	Wind	During the morning of March 6, deep low pressure off the coast of New England produced damaging winds across parts of Bennington County. The damaging winds brought trees and power lines down, which resulted in power outages.	Countywide	Minor
7-Sep-98	Thunderstorm	A derecho ahead of a strong cold front, which had moved east from southern Ontario across New York, weakened considerably as it moved into southern Vermont.	Countywide	Minor
18-July-1999	Thunderstorm	A severe thunderstorm downed power lines along Route 153 in Rupert.	Rupert	Minor
24-25 Dec 2008	Wind	A low pressure system tracked from the Great Lakes to off the northern New England coast. Strong winds developed immediately ahead of, and with a cold frontal passage Wednesday night, and persisted into Thursday morning. Wind gusts reached 40 to 55 mph, with the strongest winds occurring across the higher elevations of eastern Bennington County, and western Windham County.	Eastern Bennington County	Minor
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	Moderate
22 Aug 2010	Wind	Trees and wires were reported down due to high winds in Arlington, Sunderland, Shaftsbury and Bennington. Power outages occurred across Bennington County	Countywide	Moderate
9-Jun-11	Thunderstorm	A series of discrete storms developing into a broken line, which eventually evolved into an organized line of severe storms that created damaging winds.	Countywide	Minor

c. Extent and Location

Damaging winds, including the previous occurrences described above, are those exceeding 55 miles per hour (NOAA 2006, NOAA undated). Most development is along the major roads, Routes 153 and 315. Damage to powerlines along these areas is most likely to cause widespread outages.

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 10-50% in Rupert.

4. Drought

a. Description

There are several types and definitions of drought: meteorological, climatological, atmospheric, agricultural and hydrological. The latter, which is based on stream flow and groundwater availability, is probably most important from a natural hazard assessment perspective. Reductions in water availability can be critical in rural communities like Rupert 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. When levels are that low, 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.

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 11). When the index is less than or equal to -2.00, 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 11. Palmer drought indices from 1980 to 2011 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	20.8	-2.87	-2.87
1980	Feb	0.67	16.7	-3.42	-3.42
1980	Mar	3.05	30.1	-2.73	-2.73
1980	Apr	2.34	44.3	-2.9	-2.9
1980	May	1.54	56.5	-3.5	-3.5
1980	June	2.62	61.9	-3.6	-3.6

Table 11. Palmer drought indices from 1980 to 2011 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	July	4.4	69.7	-3.12	-3.12
1980	Aug	4.58	69	-2.68	-2.68
1980	Sept	4.09	57.5	-2.16	-2.16
1980	Oct	2.54	44.8	-2.01	-2.01
1981	Jan	0.59	8.5	-2.59	-2.59
1987	Apr	1.99	48	-2.33	-2.33
1987	May	2.01	55.3	-2.72	-2.72
1987	Aug	2.73	65.1	-2.23	-2.23
1988	June	2.28	62.5	-2.16	-2.16
1988	July	3.61	71.6	-2.34	-2.34
1988	Sept	1.83	56.6	-2.44	-2.44
1988	Oct	2.01	43.3	-2.75	-2.75
1988	Nov	5.15	38.3	-2.02	-2.02
1988	Dec	1.11	21.7	-2.57	-2.57
1989	Jan	0.82	22.7	-3.1	-3.1
1989	Feb	1.28	18.4	-3.24	-3.24
1989	Mar	2.66	27.3	-2.79	-2.79
1989	Apr	2.2	40.5	-2.79	-2.79
1989	May	4.17	58.2	0.17	-2.33
1995	June	1.32	66	-2.89	-2.89
1995	July	4.04	71.6	-2.87	-2.87
1995	Aug	4.42	67.2	0.02	-2.56
1995	Sept	3.67	55.2	0.05	-2.26
1999	June	2.15	67.5	-2.24	-2.24
1999	July	3.46	71.1	-2.49	-2.49
1999	Aug	2.5	66	-3.05	-3.05
2001	Aug	2.61	69.9	-2.41	-2.41
2001	Sept	3.2	59.2	-2.54	-2.54
2001	Oct	1.52	49.2	-3.32	-3.32
2001	Nov	2.28	40.3	-4.22	-4.22
2001	Dec	2.07	31.9	-4.64	-4.64
2002	Jan	1.85	27	-4.4	-4.4
2002	Feb	3.23	25.7	0.78	-3.17
2002	Mar	2.74	31.4	0.86	-2.68

c. Extent and Location

Moderate droughts (PHDI -3.0 to -4.0) occurred in 1999 and 2001 and severe droughts (<-4.0). According to the Town Plan (Rupert Planning Commission 200), there has been no extensive mapping of groundwater resources in Vermont, but fractured bedrock in the town's upland areas, and permeable sand and gravel deposits in the lowlands, are known to be important recharge areas for local water supplies. A preliminary "Groundwater Favorability Map" created by the state in 1966, in association with the US Geological Service, identified areas of low groundwater potential in the vicinity of West Rupert and along the Mettawee River valley north of East Rupert, but much more favorable potential south of East Rupert to Dorset. Potential bedrock and sand and gravel recharge areas also have been identified by NRCS from related soil associations.

According to the Town Plan, 211 wells have been dug in Rupert since 1966 to serve private and public water supplies. Available well log data indicate that:

- most wells in Rupert are drilled bedrock wells
- wells range in depth from 44 to 900 feet
- the average depth is 285 feet
- well yields range from 0 to 100 gallons per minute
- the average yield is 7 gallons per minute – sufficient for most domestic uses (a minimum of 2 GPM is recommended).

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. Since most development is in the village centers, and many houses there have shallow wells, those areas are most affected by droughts that lower the water table (Map 4).

To date there is only one state-designated "Source Protection Area (SPA)" in Rupert, located on the eastern slopes of Spruce Peak. This SPA is for a public water supply in Dorset, but extends over the town line into Rupert. Source protection areas are designated to protect public water supplies from potential sources of contamination, in accordance with a state-approved source protection plan. This can include local protection through the purchase of easements, or zoning regulations that restrict allowed uses within these areas.

Shallow wells are especially susceptible to drought and contamination. Based on the Agency of Natural Resources data, 24 wells are less than 100 feet deep. Common sources of contamination include septic systems, waste disposal sites, junkyards, leaking underground fuel storage tanks, road salt, agricultural pesticides, and alpha radiation from naturally occurring sources (e.g., radioactive bedrock or radon gas).

5. 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 12 shows how wildfires can be categorized based on size.

Table 12. 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). Map 5 shows fuel types mapped as part of the Landfire program (http://www.landfire.gov/), a national program to provide spatial and other data on fuels, topography and potential fire behavior. Most of the land area 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% (Michael S. Batcher, personal observation). 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 1990 to 2010, 156 wildfires were reported in Bennington County. Fourteen occurred in Rupert, all caused by human activity (debris burning, cigarette, wood stove ashes) and ranged from less than 0.1 to 25 acres (Table 13). Merck Forest in Rupert has some areas where road access may limit the ability of fire departments to effectively suppress wildfires.

Table 13. Wildfires reported in Rupert. Source: Vermont Department of Forestry, Parks and Recreation.

Date	Cause	Size (acres)
04/07/92	Burning Barrel	0.1
03/29/95	Unknown	2
07/16/95	rekindle/fire7/13/95	0.01
03/29/96	burning barrel	0.1
04/12/97	careless burning	0.5
4/5/1999	burning barrel	1.5
4/14/2001	debris burning	4
5/1/2001	turkey hunter/cigarette	2.5
04/09/05	Debris Burning	4.00
03/22/06	Dumping Hot Ashes	0.25
04/15/06	Debris Burning	25.00
04/09/08	spark from tractor?	0.50
04/09/08	Wood Stove Ashes	0.25
9/25/2010	unknown	0.75

c. Extent and Location

Most of the fires were Class A or B and one was a Class C. The potential for low intensity fires with slow rates of spread is basically throughout the town, though there may be pockets of heavier fuel loads, such as brush, or more flammable fuels, such as cured herbaceous vegetation and shrubs. High risk areas include old fields that have been invaded by bush honeysuckle (*Lonicera* spp.) and multiflora rose (*Rosa multiflora*).

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. 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.

6. 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 14 shows how landslides can be categorized.

Table 14. 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 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.

Areas of steep topography that might be subject to landslide or debris flow are in the high elevation areas, away from roads and development. There are no reports of damage in Rupert from these kinds of events.

b. Past Occurrences

One slide occurred during Tropical Storm Irene along Route 315 near Pawlet Mountain Road. The town had to build a retaining wall as part of road reconstruction. Other slides have occurred along White Creek and Mill Brook.

c. Extent and Location

There have been no studies of landslide potential in Rupert.

d. Probability, Impact and Vulnerability

Based on previous history, the probability, impact and vulnerability are all low.

7. Earthquake

a. Description

Vermont has no active faults, but has experienced minor earthquakes. Table 15 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 15. 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 little or damage and injury from any of these events, though the most severe shaking would occur in the northwestern part of the county, which includes Rupert, from a Goodnow event (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.

B. Vulnerability Assessment

The vulnerability assessment combines the results of data from the National Climate Data Center, the Vermont Department of Forests and Parks and local knowledge. Criteria are shown in Tables 16 and 17.

Table 16. Hazard frequency. Source VEM 2010.

Frequency	Occurrence in Vermont	Annual Probability
Rare	May never have occurred	1% or less
Very low	Has occurred	1% to 4%
Low	Has occurred	4% to 10%
Occasional	Occurs occasionally	10% to 50%
Frequent	Occurs often, but degree varies	50% or more

Table 17. Severity definitions. Source: VEM 2010

Proportion of Properties Damaged	Loss of facilities/services	Injuries	Response
< 10%	Minimal	Minimal	Local
10% to < 25%	Up to 7 days	<=1%	State resources needed
25% to 50%	7-14 days	1-10% and few deaths	Federal resources possibly needed
>50%	>14 days	>10% and multiple deaths	Federal resources required

The Planning Team assessed each of the natural hazards described in Section B above. The results are shown in Table 18.

Table 18. Vulnerability assessment for the Town of Rupert. Appendix I has data from the National Climate Data Center and from the Vermont Department of Parks, Forestry and Recreation on events.

Hazard	Date/Event	Recurrence Interval	Proportion damaged	Injuries/ deaths	Loss of facilities/services	Vulnerability Facilities/Populations
Flood	1927 1949 1987 1996 (2) 1998 1999 2000 (2) 2003 2007 2011 (2))	Occasional; spring floods occur after ice melts; two tropical storms	<10%	1-10%	Minimal	Primarily along Mill Brook
Winter storm (snow and ice)	1987 (Oct) 1993 (4) 1995 (2) 1996 2005 2007 (3) 2008 (3) 2010 (3) 2011 (Oct)	Frequent (annual) in winter months	<10%	Minimal	Minimal to a day or two	Minimal as road crews can handle storm, but power outages may persist.
Wind Event	1993 1995 1997 1998 2002 2008 2009 2010 2011 (2)	Occasional to frequent	<10%	Minimal	Minimal	Power outages can occur
Drought	1980 1981 1987 1988 1989 1995 1999 2001 2002	Low to occasional	<10%	<=1%	Minimal but water could be unavailable for significant lengths of time.	Homes with shallow wells lose water
Wildfire	1992 1995 (2) 1996 1997 1999 2001 (2) 2005 2006 (2) 2008 (2) 2010	Rare	<10%	Minimal	Minimal	Likely confined agricultural fields and some forested areas, particularly Merck Forest
Earthquake	2011	Rare	<10%	Minimal	Minimal	No specific areas
Landslide/Debris Flow	None recorded	Very low	<10%	Minimal,	Minimal	None

V. Mitigation Programs

A. Review of Existing Plans that Support Hazard Mitigation

1. Town of Rupert Plan (adopted 2005)

The 2005 Town Plan identifies the following goals:

Resource Protection:

a. Rugged, forested, and poorly accessible upland areas should remain free from development, to be reserved for forestry, wildlife habitat, and recreational uses that are appropriate to their wilderness character. Telecommunications and wind towers that do not have an undue adverse affect on the environmental or scenic qualities of these areas may be allowed (p. 38).
b. No new structures intended for human occupancy should be located within designated flood hazard areas. Development that does occur in these areas should be sited and designed to avoid impeding the flow of floodwater or endangering the health, safety and welfare of the public. Preferred uses within these areas include agriculture, outdoor recreation, resource conservation (e.g., buffer zones) and open space (p. 38).

Support System:

a. Town roads should be upgraded or improved in accordance with an adopted management plan and road ordinance. The Selectboard should consider downgrading existing town roads that do not serve year-round residents to Class IV roads or legal trails, to reduce maintenance costs but retain rights-of-way for public use and access (p. 56).

Land Use:

a. Intensive residential and commercial development should be allowed within designated Village Districts to reinforce and revitalize these areas as the town's traditional centers. Strip development should be avoided outside of designated Village Districts. Public investments, including the construction or expansion of infrastructure, should also reinforce the traditional character and densities of development within these areas (p. 71).

b. New residential development should be located primarily in areas served by existing roads and infrastructure, including designated Village and Rural Residential Districts. Higher density multi-family and senior housing, consisting of three or more units per structure, should be located within the Village District, or allowed as an adaptive reuse of a historic structure in any district (p. 71).

2. Bennington Regional Plan

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)

Rupert was one of 13 jurisdictions in Bennington County that adopted a multi-jurisdiction hazard mitigation plan in 2005. The Rupert annex listed the following actions (p. 190):

Table 19. Status of actions from 2005 Bennington County Multijurisdictional Hazard Mitigation Plan					
Priority Score	Status	Mitigation Action	Who is Responsible	Approx. Time Frame & Potential Funding Sources	Initial Implementation Steps
33	The Rupert Local Emergency Operations Plan is revised annually (Table 20)	Update Rapid Response Plan at least annually	Select Board & Em Mgt Director	• Short Term • Local Resources	Technical assistance from BCRC
27	Town has upgraded numerous structures. Action retained in 2014 Rupert Hazard Mitigation Plan (Table 20) for others identified needing upgrading.	Upgrade flood drainage structures	Select Board w/ support from Road Foreman	• Short to Long Term • Local & State Resources • PDM-c Funds	Conduct "needs assessment"; Technical assistance from BCRC & VEM
27	Completed	Assess White Creek Watershed (including its potential for flooding due to streambank erosion, gravel deposits, and forest debris blockage.	Select Board, Road Foreman, Private Owners	• Med. to Long Term • Local & State Resources • PDM-C Funds	Assistance from BCRC, VEM, ANR, private residents & land owners; Hire consultant
28	Retained in 2014 Rupert Hazard Mitigation Plan (Table 20)	Flood-proofing structures within Flood Hazard Areas	Select Board, Private Owners	• Med. to Long Term • Local & State Resources • PDM-C Funds	Conduct assessment of needs and options

The mitigation priorities have not changed since the 2005 hazard mitigation plan. Rupert 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 White Creek and Mill Brook and river corridor plans completed listing restoration actions. The town has been working with the Bennington County Conservation District to implement these. There are no repetitive loss properties in Rupert, 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 actions is also retained (Table 20).

4. State of Vermont Hazard Mitigation Plan (2007)

The State Hazard Mitigation Plan describes fifteen planning assumptions (p. 12) that include the following:

a. Although the majority of disasters in Vermont are managed locally, a disaster will occur with little or no warning, and will escalate to exceed the response capability of any single local authority or responding organization.

b. Achieving and maintaining effective individual and community preparedness is the first line of defense against disasters and can reduce the immediate stress on response organizations. This level of preparedness requires continual public awareness and education to ensure residents and businesses take precautions to reduce their emergency vulnerability, especially during and immediately after disaster impact.

c. Local officials involved in emergency management initiate actions that save lives and protect property and the environment while maintaining direction and control of resources within their areas based on procedures outlined in a local Emergency Operations Plan (EOP).

B. Mitigation Goals

The 2004-05 Bennington Region Hazard Mitigation Plan identified Flood/Flash Flood, Hazardous Materials, Structure Fire, Winter Storm, High Winds, Earthquake, Landslide/Erosion/Avalanche, Terrorism, and Drought/Wildfire as priority hazards. This plan describes, assesses and provides mitigation actions for Floods and Flash Floods, Winter Storms, High Wind Events, Drought, Wildfire, Earthquake and Landslide and Debris Flows. This plan expands the number and type of actions to address all potential hazards assessed by the planning team. Hazardous materials and terrorism were not addressed in the Rupert annex to 2005 plan. Structure fires were addressed in the Rupert annex and are addressed through the local emergency operations plan rather than this plan. Therefore, the priority natural hazards remain the same for both the 2005 and 2014 plans.

For this 2014 plan, 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. 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.

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. Rupert 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. Currently there are six polices in effect for a total value of $1.5 million. 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 will be reviewed and amended to reflect changes in the flood insurance maps prepared by FEMA. The current FIRM is dated September 18, 1985. 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 can use the Rupert Fire House as a shelter, and it is equipped with a generator. though some improvements are necessary. The Town can also use the Congregational Church as a shelter, though it is not well equipped. Map 6 is a composite map of hazard zones and critical facilities. These include the Town Hall, the Town Highway Garage and the Rupert Fire Department, which also serves as an emergency shelter and the Town Emergency Operations Center. Critical facilities such as the Town Hall and Fire Department are outside of the flood or fluvial hazard zones (Map 6).

D. Mitigation Projects

Table 20 below lists mitigation actions for each of those hazards. Some will be implemented by the Town of Rupert 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?

The following projects were given high priority as they met all of the above criteria:

- Upgrading the shelter at the fire house to Red Cross standards
- Educating landowners on the need to secure propane tanks, boats and other items that could float away in a flood and cause downstream damage

- Provide educational materials, especially with regard to fluvial erosion, on techniques to avoid storm damage
- Work with the Poultney-Mettawee Natural Resource Conservation District on studies along the Indian River
- Distribute materials to residents on how to prepare for an emergency
- Prior to the implementation of any action, a benefit-cost analysis would be completed to assure the action would be feasible and cost-effective.
- Resize and replace culverts, such as the one on Perkins Road, to better accommodate channel hydraulics following an assessment of culvert condition.

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 20. Mitigation actions						
Hazard	Preparedness or Mitigation	Action	Responsible Party	Time Frame	Funding Source(s)	Priority
All hazards	Preparedness	Upgrade shelter at Congregational church	Rupert	1 year	State funding	Medium
All hazards	Mitigation	Put power lines underground from main lines to the Town Hall and Fire Department if necessary	Town of Rupert	2-5 years	Town of Rupert FEMA	Medium
All hazards	Preparedness	Upgrade the Town Shelter to Red Cross standards	Town of Rupert Red Cross	1 year	Red Cross Town of Rupert	High
All hazards	Preparedness	Maintain current shelter at Rupert fire house	Rupert	Ongoing	Town funds	High
All Hazards	Mitigation	Provide educational materials for landowners on NFIP, proper construction techniques, and utility maintenance to reduce damage from storms	Town of Rupert	1 year	Town funds	High

Table 20. Mitigation actions						
Hazard	Preparedness or Mitigation	Action	Responsible Party	Time Frame	Funding Source(s)	Priority
All Hazards	Preparedness	Distribute materials from VEM and other sources to residents on preparing for emergencies.	Town of Rupert	1 year	Town of Rupert	High
All Hazards	Preparedness	Update Local Emergency Operations Plan annually	Town of Rupert	Annually	Town of Rupert	High
Flood/Flash Flood/Wind Event	Mitigation	Educate landowners of the necessity of securing propane tanks, boats, outbuildings, mobile homes and other similar items and structures from wind and flood	Town of Rupert	1 year	Town funds	High

Table 20. Mitigation actions						
Hazard	Preparedness or Mitigation	Action	Responsible Party	Time Frame	Funding Source(s)	Priority
Flood/Flash Flood	Mitigation	Work with the Poultney - Mettawee Natural Resource Conservation District on studies of the Indian River.	Town of Rupert Poultney-Mettawee NRCD	2-5 years	State funding	Medium
Flood/Flash Flood	Mitigation	Complete an assessment of culverts and their condition	Town of Rupert BCRC	2-3 years	State funding	Medium
Flood/Flash Flood	Mitigation	Based on the above assessment, replace culverts, such as the Perkins Road culvert, to better accommodate hydraulic conditions	Town of Rupert	2-5 years	FEMA State funding	High
Flood/Flash Flood	Mitigation	Flood proof structures within flood hazard areas	Town of Rupert Private owners	2-5 years	FEMA Private	Medium
Winter storm (snow and ice)	Preparedness	Construct shelter for salt and sand	Town of Rupert	1 year	Town funds State funds	High

Table 20. Mitigation actions						
Hazard	Preparedness or Mitigation	Action	Responsible Party	Time Frame	Funding Source(s)	Priority
Wind Event	Mitigation	Work with utility companies to prioritize and treat vegetation clearing on vulnerable lines	CVPS	1 year	Utility companies	Medium
Drought	Mitigation	Identify areas with shallow wells susceptible to drought	Town of Rupert	1 Year	Town funds	Medium
Earthquake	Mitigation	Identify any older buildings that may be subject to damage from earthquakes	Town of Rupert	2-5 years	Town funds	Low
Landslide/Debris Flow	Preparedness	Complete a study of areas potentially subject to landslide	Town of Rupert BCRC Vermont Geological Survey	2-5 years	State funds	Low
Wildfire/Drought	Mitigation	Develop community wildfire plan in coordination with adjacent municipalities	Town of Rupert, BCRC	2-5 years	U.S. Forest Service	Low to Medium

Table 20. Mitigation actions						
Hazard	Preparedness or Mitigation	Action	Responsible Party	Time Frame	Funding Source(s)	Priority
Wildfire/Drought	Mitigation	Educate property owners to reduce hazardous fuel loads near structures and to establish maintained defensible space zones where necessary	Property Owners Town of Rupert US Forest Service	1-3 years	FEMA Property Owners US Forest Service Town of Rupert	Low
Earthquake	Mitigation	Educate property owners on proper construction techniques to reduce potential damage from earthquakes	Town of Rupert	2-4 years	Town of Rupert	Low

E. Monitoring

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 will initiate a review of the plan, by:

1. Updating the analyses of events using new information since completion of the 2012 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 2012 plan.
4. Review of completed hazard mitigation projects
5. Identification of new projects given the revised hazard evaluation

The Town of Rupert 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 Rupert Select Board 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, Rupert 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 plan, 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. These plans also allow for documenting the steps used to address an incident. These plans should be updated regularly.

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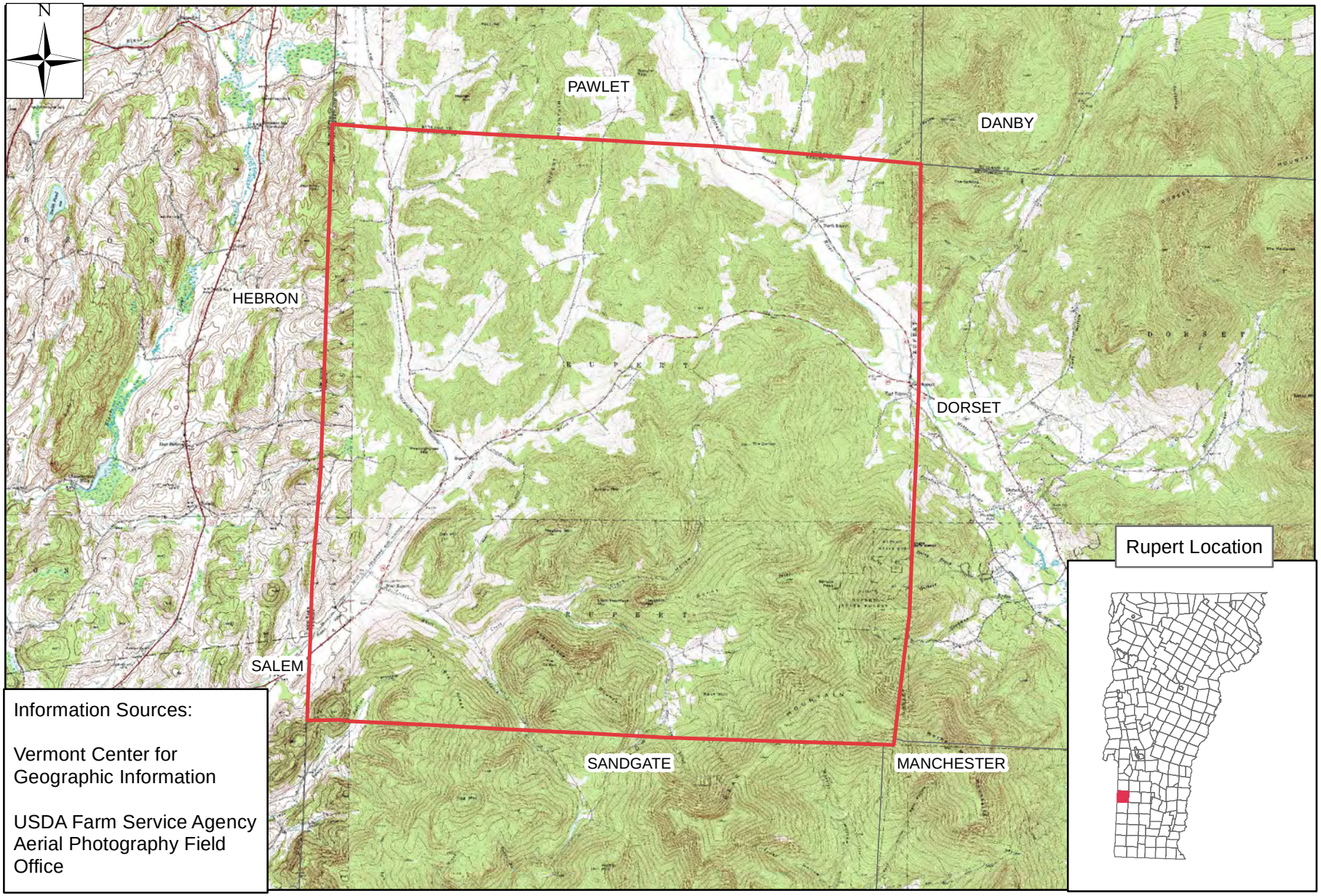
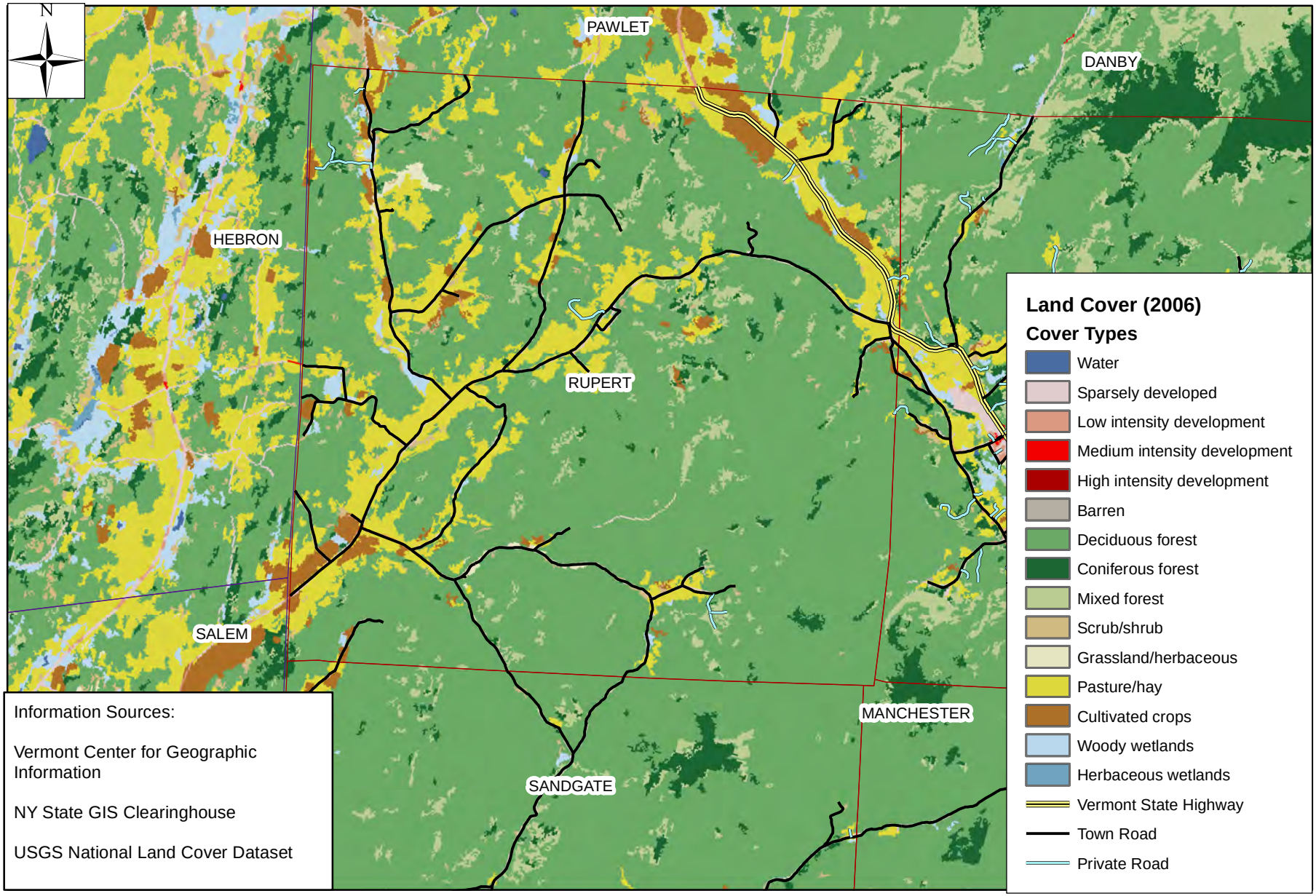
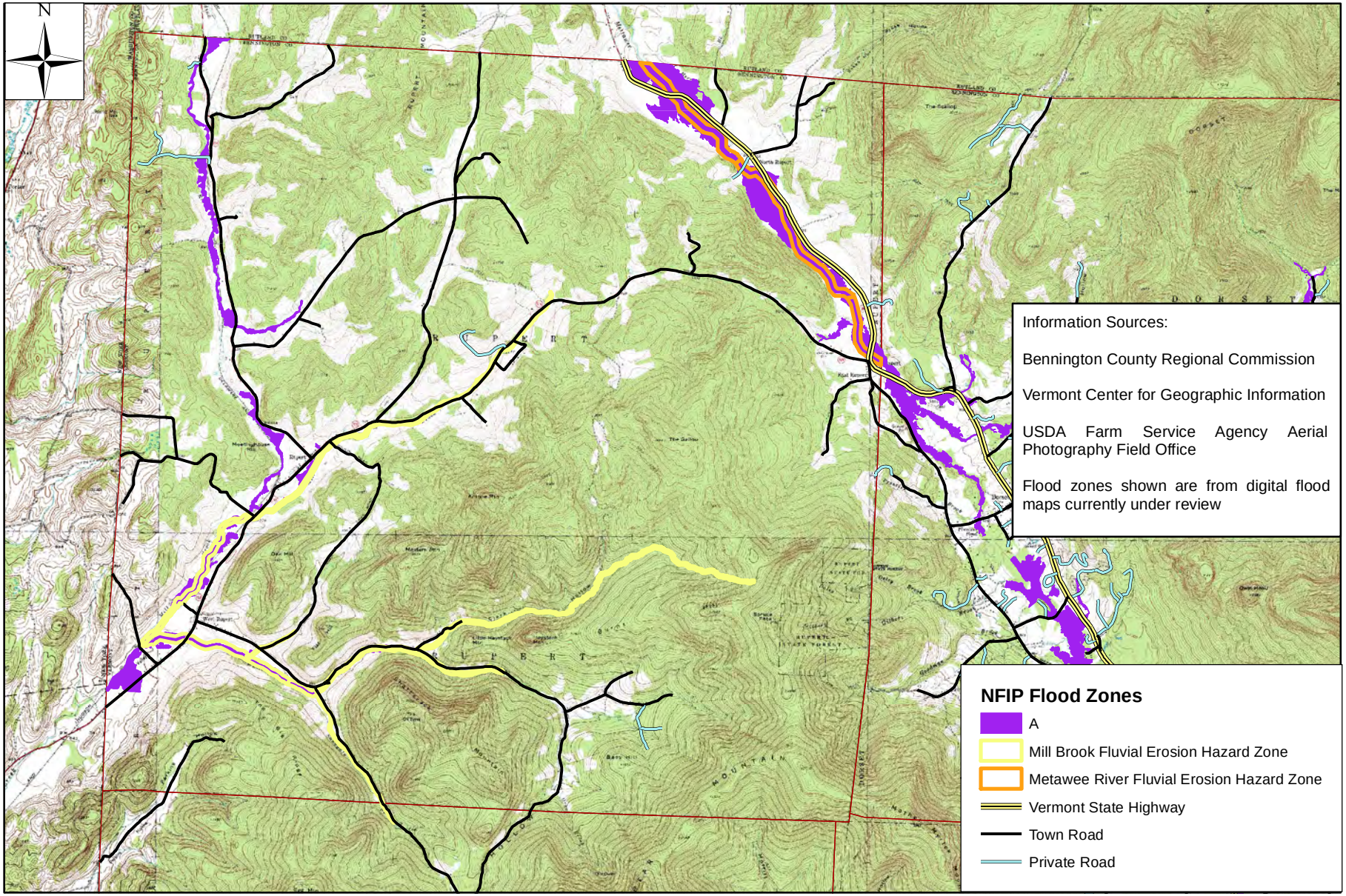
Map 1. Town of Rupert



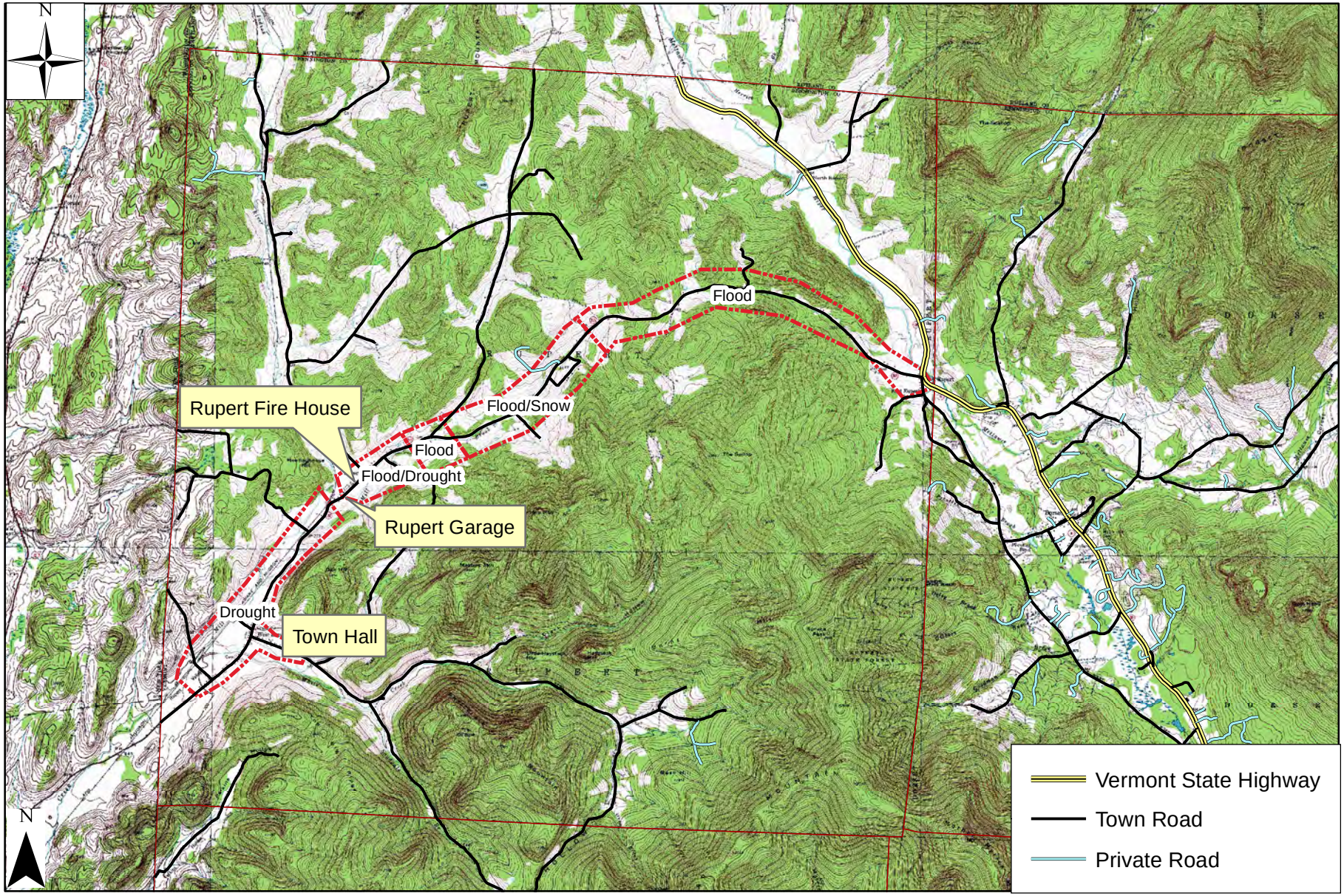
Map 2. Land Cover (2006 MRLC)



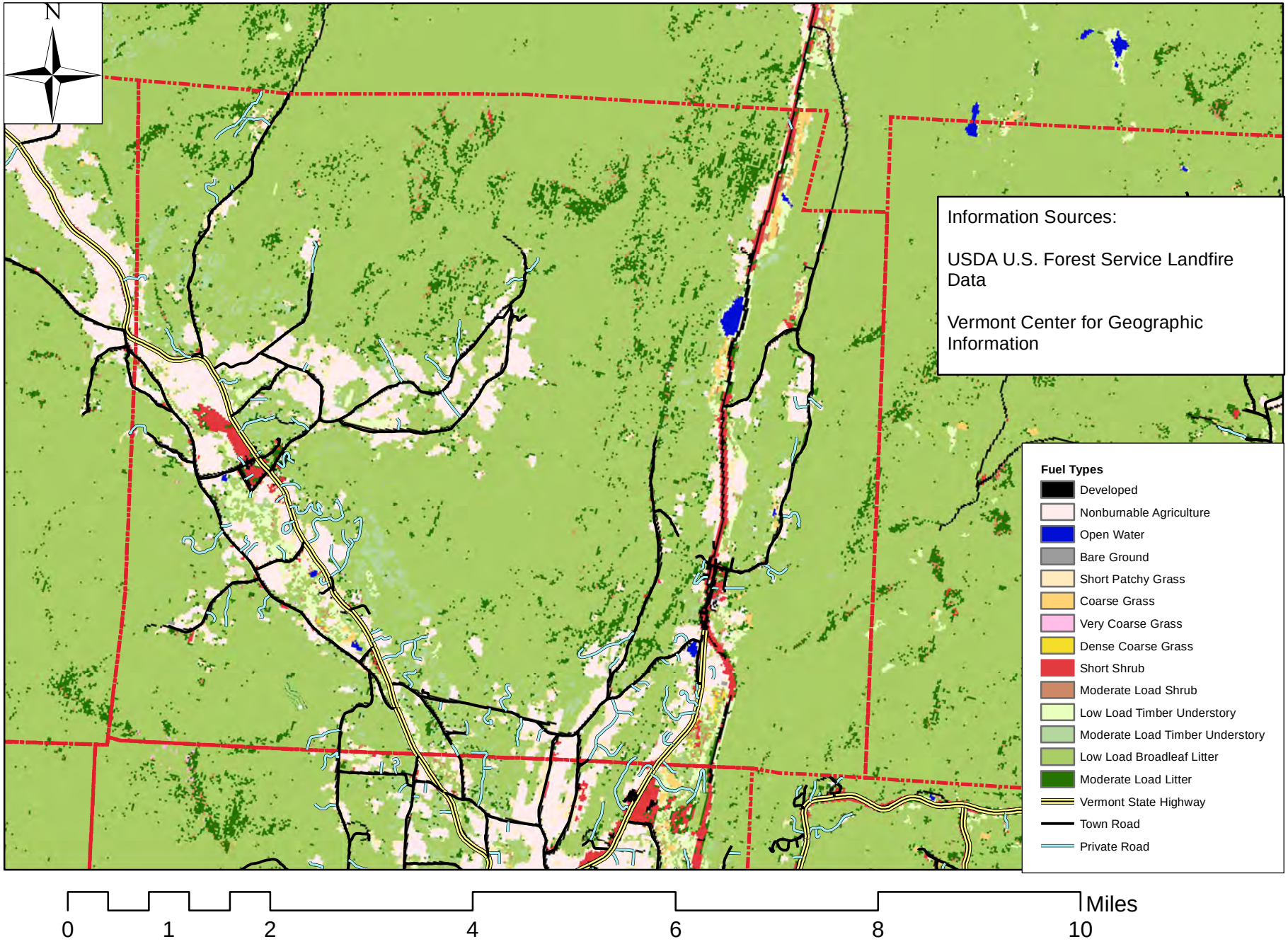
Map 3. Flood Zones and Fluvial Erosion Hazard Zones



Map 4. Rupert Hazard Zones



Map 5. Wildland Fuel Types



Map 6. Rupert Hazard Areas and Critical Facilities