Town of Lyndon, Vermont
& Village of Lyndonville, Vermont

2015 Multi-Jurisdiction Hazard Mitigation Plan

September 2015 modified May 2016

2015 Multi-Jurisdiction Hazard Mitigation Plan
Town of Lyndon, Vermont & Village of Lyndonville, Vermont

Town of Lyndon
and Village of Lyndonville, Vermont
P.O. Box 167
Lyndonville, VT 05851

DRAFT September 2015 modified May 2016

Prepared by:

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Record of Changes

This 2015 Multi-Jurisdiction Hazard Mitigation Plan, including Appendices, will be reviewed and approved on an annual basis by the Hazard Mitigation Committee and following any major disasters. All updates and revisions to the plan will be tracked and recorded in the following table. This process will ensure the most recent version of the plan is disseminated and implemented by the Town and Village.

Date of Change	Entered By	Summary of Changes

Certificate of Local Adoption

CERTIFICATE OF ADOPTION

Town of Lyndon and Village of Lyndonville, Vermont
A Resolution Adopting the 2015 Multi-Jurisdiction Hazard Mitigation Plan

WHEREAS, the Town of Lyndon and Village of Lyndonville have historically experienced severe damage from natural haz and it continues to be vulnerable to the effects of the hazards profiled in the **2015 Multi-Jurisdiction Hazard Mitigation Plan,** which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Lyndon and Village of Lyndonville have developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for their **2015 Multi-Jurisdiction Hazard Mitigation Plan, (Plan)** under requirements of 44 CFR 201.6; and

WHEREAS, the **Plan** specifically addresses hazard mitigation strategies, and Plan maintenance procedures for the Town c Lyndon and Village of Lyndonville; and

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

WHEREAS, adoption of this **Plan** will make the Town of Lyndon and Village of Lyndonville eligible for funding to alleviate impacts of future hazards; now therefore be it

RESOLVED by Town of Lyndon Selectboard and the Village of Lyndonville Trustees:

1. The **2015 Multi-Jurisdiction Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of Lynd and Village of Lyndonville;

2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;

3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of thi resolution for a period of five (5) years from the date of this resolution; and

4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Lyndon Selectboard and the Village of Lyndonville this 5th day of July 2016.

6/27/16
Date

Selectboard Chair

Selectboard Member

Selectboard Member

Village Trustee Chair

Village Trustee

Village Trustee

Village Trustee

Village Trustee

ATTEST

Town Clerk

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CHAPTER I

Introduction

The Federal Emergency Management Agency (FEMA) defines mitigation as "the effort to reduce loss of life and property by lessening the impact of disasters. Mitigation is taking actions now – before the next disaster – to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk.)"[1]

"The purpose of mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. Mitigation plans form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. The planning process is as important as the plan itself. It creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters."[2]

"DMA 2000 (Public Law 106-390)[3] provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and Indian Tribal entities to closely coordinate mitigation planning and implementation efforts."[4]

The Town of Lyndon and Village of Lyndonville, Vermont created this plan as part of an ongoing effort to reduce the negative impacts and costs from damages associated with natural hazards, such as nor'easters, floods, and hurricanes. This plan meets the requirements of the Disaster Mitigation Act 2000. More importantly, the plan was created to reduce loss of life, land, and property due to natural hazards that affect the planning area. It is difficult to predict when natural hazards will impact the planning area, but it is accurate to say that they will. By implementing the mitigation actions listed in this plan, the impact of natural hazards will be lessened.

Local Mitigation Plans must be updated at least once every five years in order to continue to be eligible for FEMA hazard mitigation project grant funding. Specifically, the regulation at 44 CFR §201.6(d)(3) reads:

> A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding.

In 2010, the Town of Lyndon developed a draft Hazard Mitigation Plan that identified flood hazard areas, as well as critical facilities that are located in the Town's floodplains. The draft plan was not completed or approved by FEMA. It did include a prioritized number of mitigation actions, which the Planning Team for the development of this 2015 Multi-Jurisdiction Hazard Mitigation Plan reviewed.

1 What is Mitigation? Federal Emergency Management Agency (FEMA). Retrieved January 2014 from http://www.fema.gov/what-mitigation
2 Multi-Hazard Mitigation Planning. Federal Emergency Management Agency (FEMA). Retrieved January 2014 from http://www.fema.gov/multi-hazard-mitigation-planning
3 Disaster Mitigation Act of 2000, Pub. L. 106-390, as amended
4 Disaster Mitigation Act of 2000. Federal Emergency Management Agency (FEMA). Retrieved January 2014 from http://www.fema.gov/media-library/assets/documents/4596?id=1935

Northeastern Vermont Development Association

This 2015 Multi-Jurisdiction Hazard Mitigation Plan was funded by a FEMA Hazard Mitigation Planning Grant, and administered by the Vermont Department of Emergency Management and Homeland Security (DEMHS) through the Northeastern Vermont Development Association (NVDA). NVDA serves the 55 municipalities in Caledonia, Essex, and Orleans Counties as both the Regional Planning Commission and the Regional Economic Development Corporation.

2015 Hazard Mitigation Goals

The purpose of the 2015 Multi-Jurisdiction Hazard Mitigation Plan is to provide the Town of Lyndon and Village of Lyndonville (known throughout the document as the planning area) with a comprehensive examination of all natural hazards affecting the area and to provide a framework for informed decision-making regarding the selection of cost-effective mitigation actions. These mitigation actions, when implemented, will reduce the region's risk and vulnerability to natural hazards.

This plan is a result of a collaborative effort between the NVDA, the Town of Lyndon, and the Village of Lyndonville with support from the public and the surrounding communities. Throughout the development of the plan, the Planning Team consulted with the Hazard Mitigation Committee and the public for input regarding the identified goals, mitigation actions, and risk assessment. They also consulted on the mitigation implementation strategy.

The Jamie Caplan Consulting team and the Planning Team adhered to the following guiding principles in the plan's development:

Guiding Principles for Plan Development[5]

- Focus on the mitigation strategy. The mitigation strategy is the plan's primary purpose. All other sections contribute to and inform the mitigation strategy and specific hazard mitigation actions.
- Process is as important as the plan itself. In mitigation planning, as with most other planning efforts, the plan is only as good as the process and people involved in its development. The plan should also serve as the written record, or documentation, of the planning process.
- This is your community's plan. To have value, the plan must represent the current needs and values of the community and be useful for local officials and stakeholders. Develop the mitigation plan in a way that best serves your community's purpose and people.

The Hazard Mitigation Committee identified the following list of twenty hazards to profile, shown below in the order of risk identified through the combination of risk analysis and community input.

5 Local Mitigation Planning Handbook. (2013). Federal Emergency Management Agency. P.I-2.

Table 1 Hazard Ranking

Ranking	Hazards
High Hazards	Flood and Fluvial Erosion
	Blizzard
	Snow Events
	Nor'easter
Moderate Hazards	Ice Storms
	Wildfire
	Hurricanes
	Hazardous Materials
	Ice Jams
	Extreme Cold
Low Hazards	Microburst
	Hail
	Water Supply Contamination
	Tornadoes
	Drought
	Earthquake
	Lightning
	Extreme Heat and Heat Wave
Very Low Hazards	Invasive Species
	Landslide

The hazard mitigation strategy is the culmination of work presented in the planning area profile, risk assessment, and capability assessment. It is also the result of multiple meetings and public outreach. The Hazard Mitigation Committee developed the five goals listed in Table 2. The goals from the 2010 plan were revised to develop this current list. Information about the goal development process is in Chapter 3 Planning Process. These goals are considered "broad policy-type statements"[6] that represent the long-term vision for mitigating risk from natural hazards in the Town.

6 Local Mitigation Planning Handbook. (2013). Federal Emergency Management Agency. P.6-1.

Table 2 2015 Multi-Jurisdiction Hazard Mitigation Plan Goals

Goal Categories	Mitigation Plan Goals
Save Lives and Property	1. Reduce or eliminate risk to people and property from natural and man-made hazards.
Community Planning	2. Integrate hazard mitigation policies and practices into local planning.
Regional Collaboration	3. Build capacity for hazard mitigation through regional collaboration.
Public Awareness	4. Increase public awareness of hazards by implementing outreach and education programs.
Preservation	5. Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.

2015 Hazard Mitigation Actions

Mitigation actions have been determined to meet the above goals and objectives. The actions are ranked by a number of criteria defined in Chapter 6 Mitigation Strategy. The planning area intends to immediately implement some of the actions and begin seeking funding for others. The Town Planner will oversee the implementation of the mitigation plan and report regularly to the Hazard Mitigation Committee and the Town Administrator.

The following table represents the mitigation actions approved by the Hazard Mitigation Committee for this updated plan. These mitigation actions are listed in order of priority. The Hazard Mitigation Committee recognizes that funding may not come in this order.

Table 3 2015 Mitigation Actions

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Estimated Cost
HIGH PRIORITY MITIGATION ACTIONS				
Stormwater Master Planning	Develop a Stormwater Master Plan.	Lyndon Public Works Director, CCNRCD	ERP	Medium
Rte. 114/5/122 Junction	Intersection study to determine causes of flooding and cost effective mitigation measures. Look specifically at the stormwater drain at the intersection as well as elevating the roadway.	Lyndon DPW, VTrans, CCNRCD, VT RMP	VTrans, FEMA	Medium
Rte. 5 Dry Relief Culverts	Replace the culvert with a dry bridge.	Lyndon DPW, VTrans, CCNRCD, VT RMP	FEMA, Ecosystem Restoration Program	High

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Estimated Cost
Equipment Protection	Pre-position DPW equipment away from high hazard flood areas.	Lyndon DPW, Lyndonville DPW,	Lyndon DPW, Lyndonville DPW	Low
Education for Business Owners and Homeowners.	Implement workshops for business owners and homeowners.	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	Low
Floodproofing Education of Businesses on Broad Street	Implement workshops for business owners and homeowners.	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	Low
Riverview Estates Mobile Home Park Elevation	Raise the lots of each structurally sound mobile home within two-years.	Park Owner	Park Owner	High
Implement Recommendations from the Bridge and Culvert Assessments	Implement the retrofit or replacement of undersized structures.	Lyndon Selectboard, CCNRCD, NVDA, VTrans	Upper Connecticut Mitigation and Enhancement Fund – Current Funding for culvert assessment, V-Trans, FEMA	Low
Buyout repetitive loss structures	Identify list of structures that may be appropriate for buyout and conversion to active floodplain.	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	High
Flooding ordinances and hazard zoning.	Implement stormwater management, erosion prevention, and sediment control ordinances. Implement fluvial erosion hazard zoning. Amend the Town's Flood Hazard Regulations to include restriction of development within River Corridors, and minimize impacts to wetlands and steep slopes.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Estimated Cost
Reconnect the river to existing floodplains upstream from the village by securing easements on private land.	Pursue acquiring river corridor easements to allow the river to reconnect with its natural floodplain, using the locations identified in the River Corridor studies as a guide. In some cases, berms need to be removed to restore connectivity to floodplain.	CCNRCD, DEC	ERP, Easements or fee purchases by PVLT, VRC, VLT, State/Federal Partner Programs	Low
Protect and Retrofit Covered Bridges	Maintain covered bridges in the jurisdiction.	Town of Lyndon and VTrans	Preservation Trust of Vermont, Vermont Division of Historic Preservation	High
Mobile Home Park Community Preparedness and Response Plan	Develop and document strategies for increasing the resilience of the Mobile Home Parks in Lyndon.	Mobile Home Park Owner, LEPC District 9, Vermont Mobile Home Park Research Collaborative (CVOEO & UVM)	CVOEO	Low
MEDIUM PRIORITY MITIGATION ACTIONS				
Implement repairs and continue to track status of stormwater system.	Continue to chart and repair the stormwater system.	Lyndon DPW	Town of Lyndon	Low
Build to the snow load standard.	Lyndon Zoning Administrator will coordinate with the State Building Safety Engineer to evaluate the integrity of all new structures.	Lyndon Zoning Administrator and Lyndon Planning Director, State Fire Marshall's Office	Town of Lyndon	Low

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Estimated Cost
Planned Unit Development Provisions	Encourage property owners seeking to develop their land to utilize the existing Planned Unit Development provisions in the Town's bylaws as a means to minimize impervious coverage and clearing.	DRB	Town of Lyndon	Low
VTrans District 7 Transportation Advisory Meetings	Participate in VTrans Advisory Meetings.	Lyndon Selectboard, TAC	Town of Lyndon	Low
Centre Covered Bridge	Retrofit the bridge span to ease the "pinching" of the river at this location.	Chamber of Commerce, Property Owner, DEC RMP	VTrans	High
Plan for Lyndon Town Garage Site	Remove structures at this site, as it contains hazardous materials that could get into the river, and protect the area as green space.	Lyndon Selectboard, PVLT	FEMA, PVLT, VLT	High
Railroad Flooding Around Broad Street	Coordinate with VTrans about causes and remediation measures of flooding on either side of the railroad tracks.	Lyndon Selectboard, VTrans	Lyndon Selectboard, VTrans	Medium
Elevate transportation corridors at problem locations	Conduct an engineering study of flooding along transportation corridors.	Lyndon Selectboard, VTrans	VTrans, FEMA	Medium
Install Stream Buffers	Implement recommendations for planting and preservation of stream buffers, as outlined in River Corridor Plans	CCNRCD, PVLT, DEC RMP	CCNRCD	Low
Burrington Bridge (AKA Randall Bridge)	Examine bridge structures	Chamber of Commerce, DEC RMP	VTrans	High
Regulate future development along river corridors to prevent erosion and property loss and implement recommendations from the River Corridor Studies	Review studies and implement recommendations related to erosion prevention and property loss along river corridors.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Estimated Cost
Watershed Collaboration for Stormwater Management	Collaborate with upstream towns to address control of stormwater runoff and actions that will allow rivers and streams to regain access to floodplains.	Lyndon Planning Commission, State Floodplain Manager, NVDA	Town of Lyndon	Low
Connect Broad Street residences across Route 5 to stormwater system.	Connect stormwater runoff from residences across Rte. 5 to stormwater system.	Lyndon DPW, VTrans	VTrans	High
Create a Capital Budget	Create a capital budget for funding maintenance and capital improvements.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low
FEMA Flood Maps	Encourage FEMA to update and digitize floodplain maps.	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	Low
LOW PRIORITY MITIGATION ACTIONS				
Maintain data on cost to town related to flooding in repetitive loss areas.	Document costs incurred by Town and Village departments impacted by flooding and flood remediation.	Lyndon Selectboard, Lyndon Municipal Administrator	Town of Lyndon	Low
Vail Dam	Review past engineering study to determine if removal of Vail Dam would decrease flooding upstream. If necessary conduct an updated study.	Lyndon Trustees, Lyndon Selectboard, LED	ERP	Low
Watershed Health and Water Quality	Encourage water quality and watershed health through the implementation of wooded vegetative buffers along rivers and streams.	Lyndon Selectboard, CCRD, Valley Land Trust	Town of Lyndon	Low
Community Rating System Participation	Participate in the NFIP CRS if a regional body shares the responsibility of participation requirements.	Lyndon Zoning Administrator and Lyndon Planning Director, NVDA	Town of Lyndon	Low

Authority and Assurances

Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? 44 CFR 201.6(c)(5)

The Town of Lyndon and Village of Lyndonville will continue to comply with all applicable Federal laws and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 201.6 and will amend its plan whenever necessary to reflect changes in Town, State or Federal laws and regulations as required in 44 CFR 201.6.

The Hazard Mitigation Committee and each of the jurisdictions participating in this 2015 Multi-Jurisdiction Hazard Mitigation Plan recognize FEMA's Local Mitigation Planning Handbook, March 2013, and the Local Mitigation Plan Review Guide, October 2011, as references for this plan.

Plan Adoption

Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement 44 CFR 201.6 (c)(5))

Both the Town of Lyndon and Village of Lyndonville adopted the plan on July 5, 2016 after receiving a "pending adoption" approval from the Federal Emergency Management Agency.

CHAPTER II

Planning Area Profile

The Planning Area consists of the Town of Lyndon and the Village of Lyndonville. "The Town of Lyndon (founded in 1780) is located in Vermont's beautiful rural "Northeast Kingdom" in Caledonia County. The town is six square miles of rolling green hills and valleys on both sides of the Passumpsic River. Caledonia County encompasses 17 towns, including Lyndon, Burke (home of Burke Mountain Ski Area), and St. Johnsbury (the County Seat). Caledonia County was named to honor the Scots who settled here and developed the area. Lyndon is readily accessible from I-91 and is just 3 1/2 hours from Boston, 2 1/2 hours from Montreal, and 6 hours from New York".[1] The Village sits within the borders of the Town and was incorporated by "an act of the legislature dated December 24, 1880."[2]

Governor Thomas Chittenden signed the charter of the town of Lyndon in 1780. Settlement of the town began in 1789. "By the 1790 census, twelve families with 59 residents made their home In Lyndon. These families installed roads, mills, homes, barns, fields, crops, churches, and schools."[3]

The Village of Lyndon Corner was incorporated in 1792 and Lyndonville was incorporated in 1866. "The Village of Lyndon Corner was about 2 miles (3.2 km) south of Lyndonville. Hotel Lyndon was built there in 1807. It became a tavern and burned in 1897. About 1867, the Connecticut & Passumpsic Rivers Railroad bypassed Lyndon Corner, and Lyndon Center. This resulted in business moving to Lyndonville. The bypassed villages became residential and are no longer distinguished as separate villages - they both gave up their incorporated village statuses in 1962."[4]

The planning area lays in the valley of the Passumpsic River in northeastern Vermont. It is located in Caledonia County, within the Northeast Kingdom region. It is bordered by the town of St. Johnsbury to the south, Danville to the southwest, Wheelock to the west, Sutton to the north, Burke to the northeast, and Kirby to the east. According to the United States Census Bureau, the planning area has a total area of 103.1 square kilometres (km or 39.8 sq mi), of which 39.5 square miles (102.2 km2) is land and 0.35 square miles (0.9 km2), or 0.89%, is water. The population in the Town of Lyndon was 5,981 at the 2010 Census. The Village of Lyndonville is located within the Town of Lyndon.[5]

According to Lyndon's Town Plan, "approximately 1% of the planning area's 23,061 acres are being used for agricultural purposes and 16% are forested. Lyndon's citizens live in house sites, which range in size from less than one acre to over l00 acres. From 2005 through 2014, 114 new single-family homes were built, a 5% increase in the number of residences."[6] A large portion of the planning area's population lives in one of its three villages: Lyndon Center, Lyndon Corner and Lyndonville. Lyndonville is the hub of activities for the area. Figure 1 shows a "base map" for the entire planning area with critical facilities identified. Figure 2 shows the state-designated "Village Center" which is the hub of retail and business activity.

1 Our Town. (2015). Lyndon Area: Chamber of Commerce. Retrieved July 27, 2015 from http://www.lyndonvermont.com/our-town.php
2 Official Website of Town of Lyndon. (2007). Town of Lyndon. Retrieved July 27, 2015 from http://www.lyndonvt.org
3 History of the Lyndon Area. (2015). Lyndon Area – Chamber of Commerce. Retrieved August 11, 2015 from http://www.lyndonvermont.com/history.php
4 Ibid.
5 Community Facts. (2010). United States Census Bureau. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml
6 Lyndon. Town Plan. (2015). Town of Lyndon.

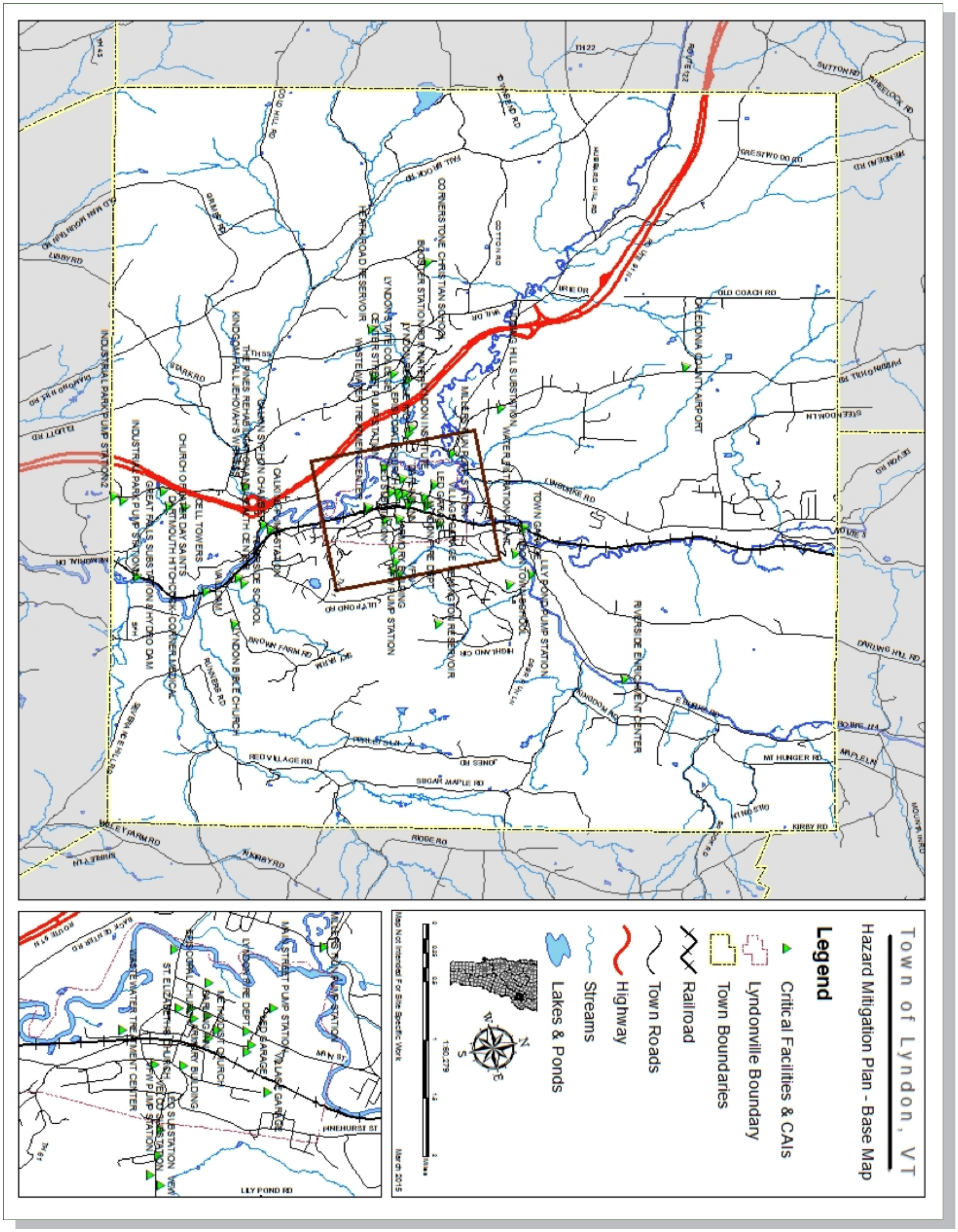

Figure 1 Planning Area Basemap

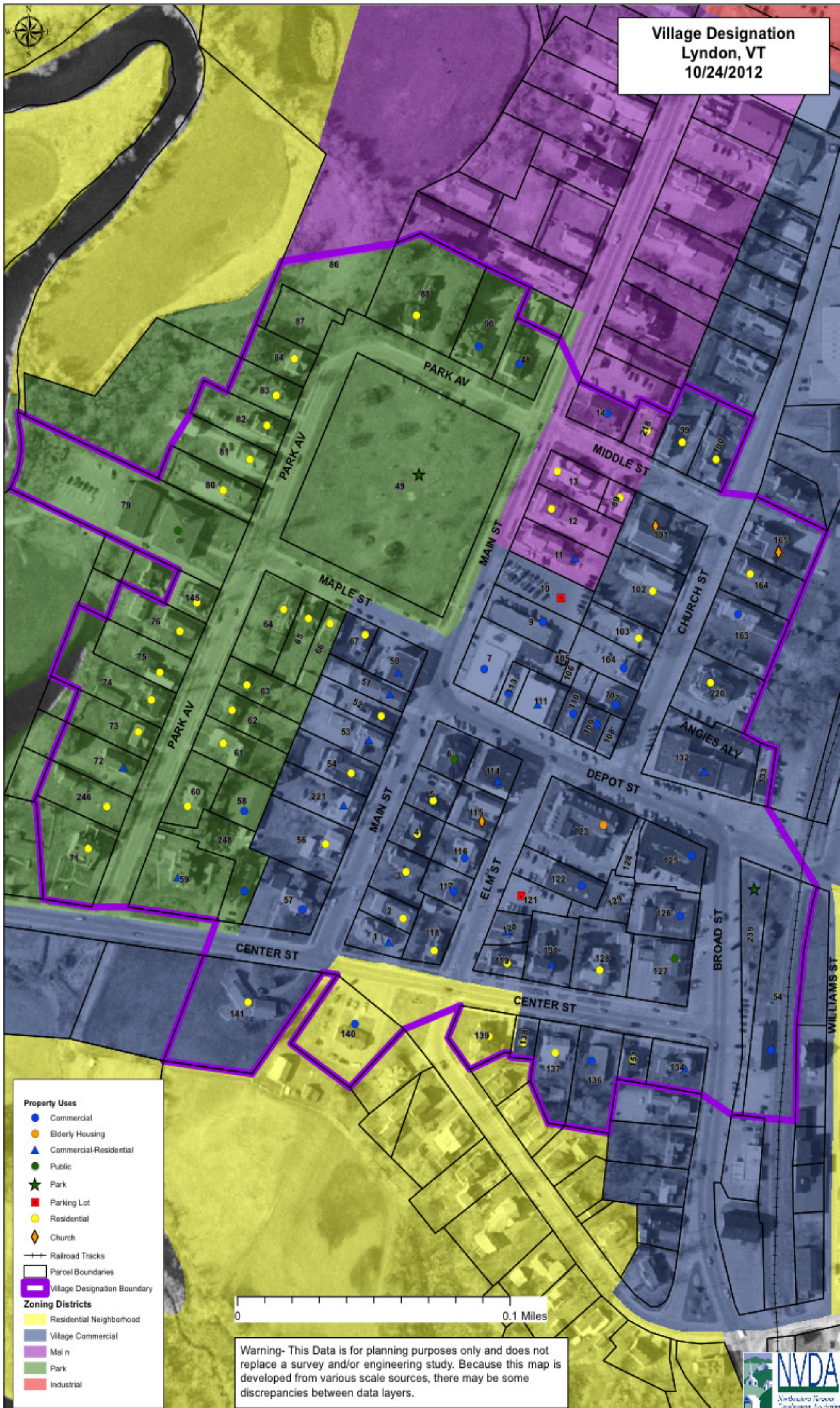

Figure 2 Village of Lyndonville

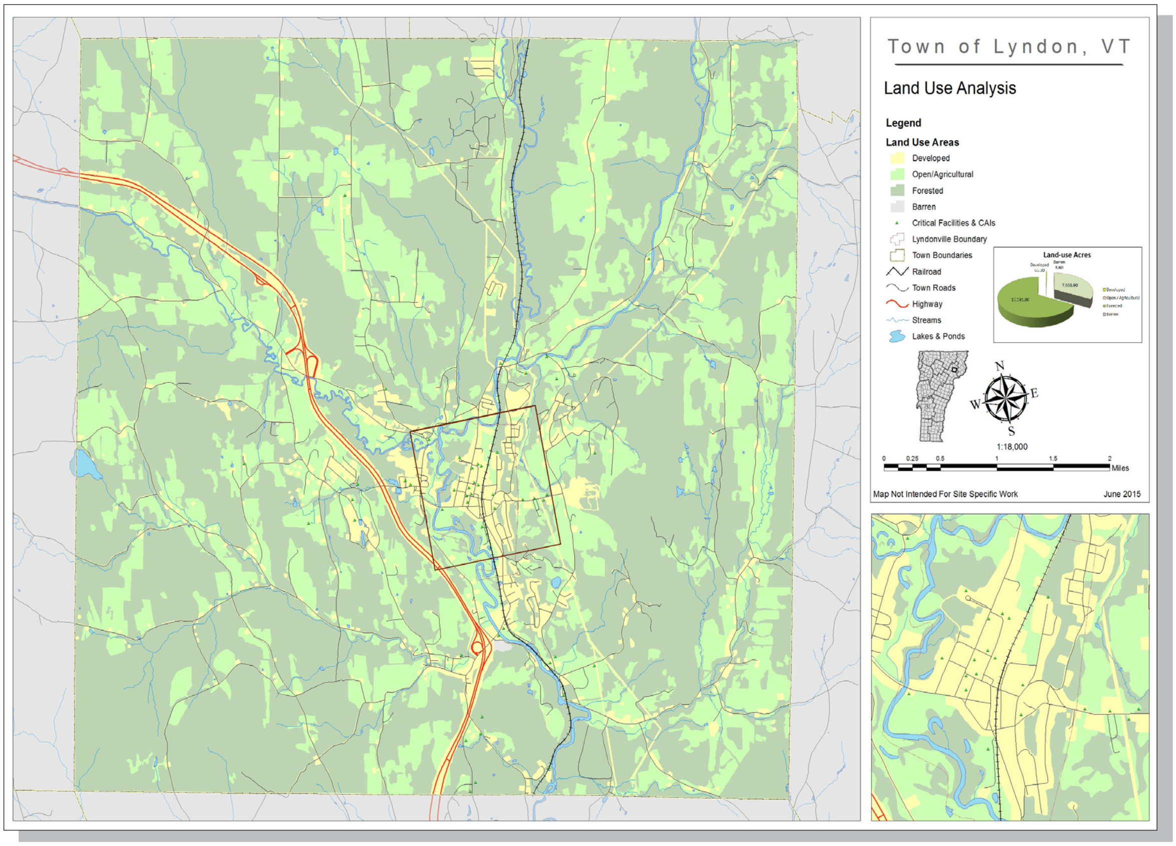

Figure 3 Town of Lyndon Land Use Map

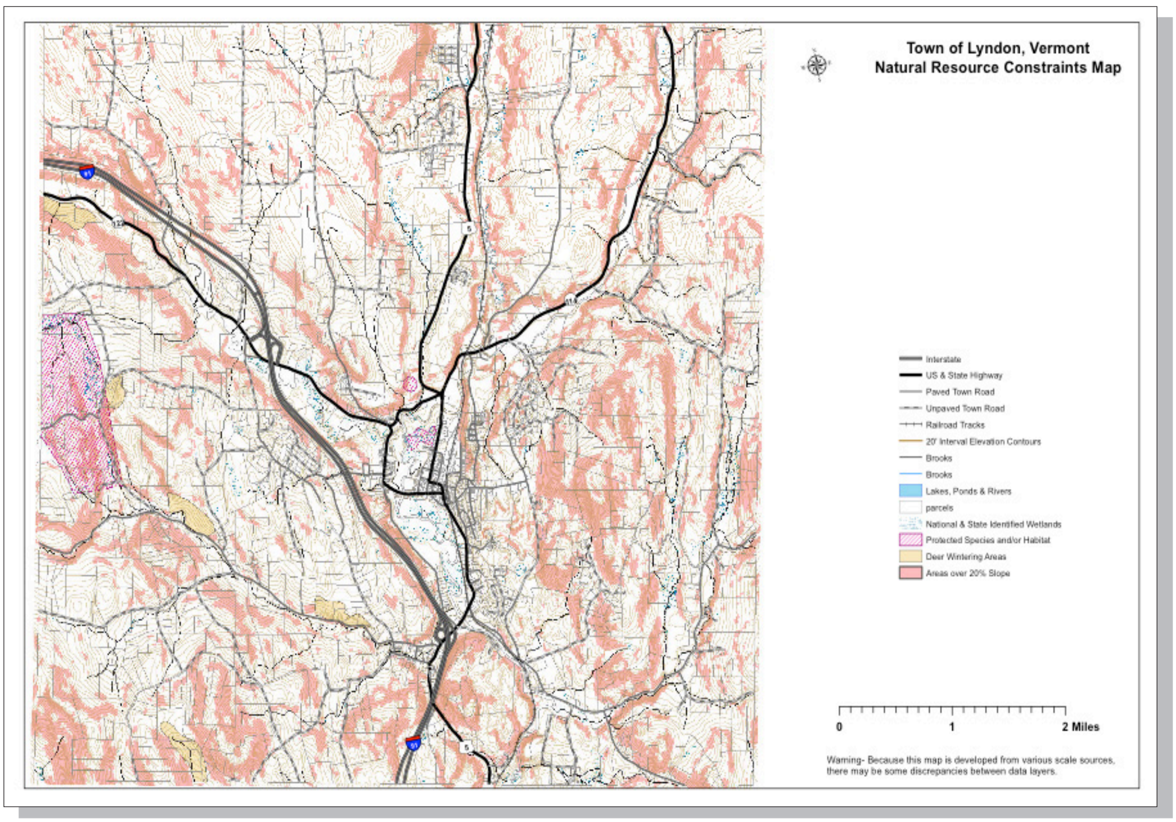

Figure 4 Natural Resource Constraints Map

According to the 2010 US Census Bureau,[7] Lyndon has a population of 5,981. Lyndonville has a population of 1,207 according to City-Data.com.[8] This number is included in the above 2010 US Census figure for Lyndon. Ninety-five percent of the population is white and 62.7% live in owner-occupied houses. Ninety percent of people over age 25 have a high-school diploma or a higher level of education. The planning area includes 39 square miles, and approximately 151 people live in each square mile.

The Lyndon Town Plan addresses several important themes that are relevant with respect to hazards, the Town aims to:[9]

1. **Adjusting to changing demographics and development pressures**
   Background: The town's population is increasing, getting older and more diverse with more foreign-born persons working and living in the area. Development pressure evolves from the plans of turning Burke Mountain located east of Lyndon into an all-season recreation attraction, which will result in considerable growth, in particular along the Route 5, Route 114 and Route 122 corridors.
2. **Controlling flooding**
   Background: Frequent flooding from the Passumpsic River is a known issue as parts of Lyndon sit in a flat river valley (floodplain) surrounded by steep terrain. The town is working on management practices and bylaws to protect owner's properties from flooding.

Government

The Municipal Administrator, Justin Smith, is a board-appointed manager who oversees the operating departments of The Town of Lyndon and The Village of Lyndonville with the exception of the electric department. He is the representative of the Select Board (Town) and Trustees (Village) when dealing with staff, State and Federal government and the public. Responsibilities include highways, water, sewer and police along with management of any capital projects undertaken.

The Lyndonville Electric Department infrastructure is owned and managed by the Village Trustees, which employs an Electric Department manager. The Village Trustees and the Electric Department manager are responsible for repairs to the electric infrastructure, and for cutting trees that are in close proximity to power lines.

Figure 5 Justin Smith, Municipal Administrator

The Village and Town each maintain separate garages for road equipment, although they are in discussions to build a new joint facility. The Village Board of Trustees regulates the use of roads within the Village limits, and a Public Works Supervisor maintains roads and public parks within the Village. A separate Town Road Foreman maintains Town roads and structures (culverts and bridges). Both of these individuals work under the supervision of the Municipal Administrator. The State Department of

7 Quick Facts Beta – Lyndon Town. (2014). United States Census Bureau. Retireved August 14, 2015 from http://www.census.gov/quickfacts/table/PST040213/5000541725

8 Lyndonville, Vermont. (2013). City-Data. Retrieved August 14, 2015 from http://www.city-data.com/city/Lyndonville-Vermont.html

9 Lyndon Town Plan. (2015). Town of Lyndon.

Transportation is responsible for maintenance and repairs to State roads and structures.

The public water system is owned by the Village Trustees, while the public wastewater system is owned by the Town. Ownership of the stormwater infrastructure is dependent on where it is located. If it is on a Village road it is owned by the Village; if it is on a Town road outside the Village, it is owned by the Town.

Table 1 Government Buildings

Facility	Owner	Address	Description	Assessed Value	Year Built	
Cobleigh Public Library	Town	14 Depot Street	Information Center	435,000	1906	No
Lyndonville Electric Department	Village	46 Grove Street	Service office for outage repair	367,400	1957	Yes
Lyndon Rescue Squad	State	114 Vail Drive	Local EMS Service	227,800	not available	Yes
Municipal Building	Town	119 Park Avenue	Town Offices, LED Offices		1900	No
Public Safety Building	Town	316 Main Street	Police & Fire		2004	Yes
Town Garage	Town	433 East Burke Road	Equipment	840,283	1970	Portable
Village Garage	Village	312 East Street	Equipment	538,565	1985	Portable

Cobleigh Public Library
The Cobleigh Public Library first opened in 1907. It serves the planning area as a meeting and information center. It also has a wonderful collection of books and materials and participates in the inter-library loan service in Vermont. The library is a wifi hot spot making it an excellent gathering place during a disaster if power does not go out, the library does not currently have a generator.

Lyndon Electric Department Garage
The Lyndonville Electric Department Garage stores supplies for all electric infrastructure maintenance issues and emergency repairs.

Lyndon Rescue Squad
The Lyndon Rescue Squad is the base for local ambulances and emergency medical first responders including emergency medical technicians (EMT's) and paramedics. The Lyndon Rescue Squad is independent of the Town and Village and is controlled by a separate board of directors. It leases its building on the campus of Lyndon State College from the Vermont State Colleges.

Municipal Building
Each of the Hazard Mitigation Committee meetings was held in the Lyndon Municipal Building. This building serves as the hub for all government activities in the planning area.

Figure 6 Municipal Building Sign

Public Safety Building

"Lyndon is served by a 911 emergency system. Emergency services include the Lyndon Rescue Squad, which has paid professionals, and a volunteer squad of EMT's, the Lyndon Volunteer Fire Department, the Lyndonville Police Department and Calex Ambulance Service in St. Johnsbury. The Town has formulated an Emergency Operations Plan, and Rapid Response Plan.These documents ensure timely coordinated response efforts and also mitigate natural disasters that affect Lyndon.

Figure 7 Lyndon Police and Fire Stations

In addition, regional emergency operations efforts have now developed a system to identify those who may need special assistance in the event of an emergency. This Special Needs Emergency Response Program works with area agencies, such as Caledonia Home Health Care, Area Agency on Aging, Northeast Kingdom Human Services (NKHS), and Umbrella to check on persons who may need immediate assistance depending on the type of emergency. The service provider information is kept confidential by the agencies until an emergency is declared and the information is requested by the Emergency Response Incident Commander. The service providers will only provide information for persons who have given permission to be included the database and permission forms need to be updated annually."[10]

10 Lyndon. Town Plan. (2015). Town of Lyndon. P.74

Town Garage and Village Garage

There are plans for a joint garage at 75 Smiths Road. The Town Garage, pictured below, is vulnerable to being cut-off because of flooding nearby. Parts of the garage are located in the floodplain. The Town and Village garages share resources so it makes sense to combine them in a facility easily accessible and away from flood waters.

Figure 8 Town of Lyndon Garage Barns

Special Populations

Several facilities in the planning area function specifically for the elderly or other special populations. They are each considered critical facilities because of the role they play in supporting citizens in the planning area.

Table 2 Special Population Buildings

Facility	Address	Description	Assessed Value	Year Built	Generator?
Armory Building	73 High Street	Emergency Shelter	657,248	1950	Yes
Darling Inn	78 Depot Street	Elderly Housing, Community Center	1,045,000	1900	
Riverside Enrichment Center	2104 East Burke Road	Elder Day Programming	356,700	1980	No
The Pines	601 Red Village Road	Nursing Home	988,700	1870	Yes
VFW	156 Hill Street	Banquet hall	533,700	1983	No

Figure 9 The Darling Inn Apartments

Schools

The Town of Lyndon has five schools; they are listed in the table below and all considered critical facilities for purposes of this plan. Lyndon Institute is an approved independent high school, governed by a private board of trustees, and includes day and boarding students. Lyndon State College is a public liberal arts college founded in 1911. It has about 1,519 students, 57 full-time faculty, 130 staff and administrators and 115 adjunct faculty members. The Town of Lyndon has three schools for students from grades K-8th grade, the Lyndon Town School, Riverside School and Thaddeus Stevens School. The Lyndon Town School is owned by the Town and is the public elementary school serving students in the Town and Village. It is operated by the locally-elected Lyndon School District board.   The Riverside School and Thaddeus Stevens School are approved independent schools that are privately owned and governed by separate boards of trustees.

Table 3 Lyndon Schools

Facility	Address	Description	Assessed Value	Year Built	Generator?
Lyndon Institute	168 Institute Circle	High School.2 Gyms. Cafeteria	11,846,300	1922	Portable
Lyndon State College	1001 College Road	College	95,140,355	1965	Yes (appx. 6)

Facility	Address	Description	Assessed Value	Year Built	Generator?
Lyndon Town School	2591 Lily Pond Road	K-8 school. Gymnasium. Cafeteria	8,488,700	1991	
Riverside School	30 Lily Pond Road	Small Gym. 80 student school	1,168,400	1860	No
Thaddeus Stevens School	100 King Drive	Pre-school - 8.	249,000	1900	No

Figure 10 Lyndon Institute

Places of Worship

The planning area has eight places of worship listed in Table 4. Each of these places is considered a critical facility because of their capacity to gather people and offer assistance. However, none of the places of worship have generators, they could function as feeding or warming stations if they maintain power.

Table 4 Lyndon Places of Worship

Facility	Address	Description	Assessed Value	Year Built	Generator?
St. Elizabeth's Church	630 Hill Street	Gathering location	557,900	1895	No
Methodist Church	100 Church Street	Gathering location	114,500	1900	No
1st Congregational Church	52 Middle Street	Gathering location	260,700	1970	No

Facility	Address	Description	Assessed Value	Year Built	Generator?
Episcopal Church	43 Elm Street	Gathering location	257,200	1900	No
Church of Latter Day Saints	5521 Memorial Drive	Gathering location	1,126,400	1980	No
Kindgom Hall Jehovah's Witness	88 South Wheelock	Gathering location	294,800	1984	No
Lyndon Center Free Baptist Church	65 College Road	Gathering location	446,400	1875	No
Lyndon Bible Church	250 Brown Farm Road	Gathering location	899,500	2003	No

Infrastructure

Infrastructure in the planning area includes cell service, electric power, water, and waste. Charter communications is the main cable provider and FairPoint Communications is the primary telephone company. Lyndonville Electric Department provides electricity to the majority of the planning area. Some parts of the planning area have wells and others are connected to the town water supply. Garbage is picked-up curbside for a fee and recycling is free at the Northeast Kingdom Recycling Coop as well as curbside. Twenty facilities related to infrastructure in the planning area (listed in Table 5) are considered critical facilities.

Table 5 Lyndon Infrastructure

Facility	Address	Description	Assessed Value	Year Built	Generator?
Communications					
Cell Tower & Radio Repeater	5334 Memorial Drive	Cell Tower & LED Radio Repeater	16,900	not available	No
Electric					
Great Falls Substation & Hydro Dam	76 Great Falls Drive	Hydro Electric Dam & Substation	256,400	1900	No
LED Substation	360 Hill Street	Electric Sub-Station	39,000	not available	No
Pudding Hill Substation	516 Pudding Hill Road	Electric Sub-Station	25,800	not available	No
VELCO Substation	196 Hill Street	Electric Sub-Station	33,000	2010	No
Water					
Booster Station for Water	Snowflake Lane	Water supply	62,366	1974	No
Calkin Pump Station	6554 Memorial Drive	Sewer Pump Station	253,750	1976	No
Center Street Pump Station	670 Center Street	Sewer Pump Station	424,658	1976	No
Heath Road Reservoir	504 Heath Road	Reservoir	538,565	1973	No

Facility	Address	Description	Assessed Value	Year Built	Generator?
Industrial Park Pump Station 1	910 Industrial Parkway	Sewer Pump Station	253,750	1979	No
Industrial Park Pump Station 2	910 Industrial Parkway	Sewer Pump Station	152,250	1979	No
Lily Pond Pump Station	2901 Lily Pond Road	Sewer Pump Station	253,750	2003	No
Main Street Pump Station	Powers Park	Water pump	33,150	1976	No
Millers Run Pump Station	11 Center Street	Sewer Pump Station	253,750	1976	No
Remington Reservoir	139 Remington Road	Reservoir	538,565	1993	No
Vail Dam	166 Light Plant Drive	Hydro Electric Dam	133,800	1950	No
VWF Pump Station	Hill Street	Sewer Pump Station	253,750	1976	No
Wastewater Treatment Center	217 Rose Lane	Wastewater Treatment Center	7,298,791	1976[14]	Yes
Water Filtration Plant	126 Water Road	Water treatment	1,384,090	1993	No
Waste					
Northeast Kingdom Waste Management	224 Church Street	Local Recyling Center	323,500	1900	No

Historical Properties

According to the National Register of Historic Places[11], there are nine historic places in the planning area; five of them are covered bridges. Lyndon is known as the "Covered Bridge Capital of Vermont's Northeast Kingdom."[12] Table 6 describes each of the nine historical properties.

> "Serving the utilitarian purpose of getting people and cargo safely across a river, and roofed to protect the sides and trusses from the temperamental Vermont weather, Vermont's covered bridges are a reminder of past times. Though built for crossing, a covered bridge in the old days has been known to protect a load of hay from a sudden thunder shower, provide a secluded spot for a couple to steal a kiss, or serve unintentionally as a roost for huge flocks of turkeys. The covered bridges in Lyndon have had their shingle roofs replaced by practical metal. However Lyndon is lucky, having five covered bridges remaining. These bridges are often sought out by visitors to photograph and admire, and are appreciated by many "natives" who recognize their value as part of their Vermont Yankee heritage."[13]

11 National Register of Historic Places listings in Caledonia County, Vermont. (2015). Wikipedia. Retrieved August 18, 2015 from https://en.wikipedia.org/wiki/National_Register_of_Historic_Places_listings_in_Caledonia_County,_Vermont

12 Official Website of Town of Lyndon. (2007). Town of Lyndon. Retrieved July 28, 2015 from http://www.lyndonvt.org

13 Covered Bridges. (2015). Lyndon Area – Chamber of Commerce. Retrieved August 14, 2015 from http://www.lyndonvermont.com/covered-bridges.php

The Hazard Mitigation Committee is especially interested in mitigating risk to the covered bridges in the planning area. They have included a couple of mitigation actions directly related to this effort.

Table 6 Historical Properties in the Planning Area

Historical Properties	Description
1. Bradley Covered Bridge (Millers Run Bridge)	The Millers Run Bridge crosses Route 122 at Millers Run, the north edge of Lyndon Center. "In 1995, as a result of irreparable damage due to a storm, the bridge was completely replaced. The new bridge allows for one-way traffic and has a covered walkway for pedestrians. The bridge is noted for being the last covered bridge to be used in the State Highway system."
2. Burrington Covered Bridge (Randall Bridge)	The Burrington Covered Bridge was built in 1865 North of Lyndonville, just off Route 114. "In 1965 a new cement bridge was built at this point across the East Branch Passumpsic River. However, realizing the great loss in the destruction of the covered bridges, the bridge was left to preserve one more example of the craft and beauty inherited from the covered bridge builders. It now serves as a snowmobile crossing." [15]
3. Centre Covered Bridge (Sanborn Run Bridge)	The Sanborn Run Bridge sits behind the LynBurke Motel near the intersection of U.S. Route 5 and State Route 114. The bridge was moved to this location in 1960, it was originally built in 1858 as a way to connect Lyndon Center with farms on the eastern side of the Passumpsic River. The bridge has been considered one of the finest examples of the Paddleford type constructed in the state.
4. Chamberlin Mill Covered Bridge	This bridge was built in 1881 at Lyndon Corner, connecting York Street and South Wheelock Road.
5. Darling Inn	The Darling Inn a three-and-one-half story brick hotel building now functions as senior housing.
6. District 6 School House	This wood frame schoolhouse was built in 1857 in the Greek Revival Style. It still functions as a school building.
7. Mathewson Block	Located on Main Street at the corner of Maple Street. "The Mathewson Block, a 3-story, seven by four bay, flat-roofed, Italianate style, brick commercial building built in 1869, is prominently situated at the head of Depot Street. It is the first commercial building that was built in the village." [16]
8. Old School Bridge	This bridge was built in 1879 at the junction of U.S. Route 5 and South Wheelock Road.
9. Riverside	Historically the building was a single dwelling house and used for agricultural processing. Today it is a school building used for theatre and recreation.

14 Covered Bridges. (2015). Lyndon Area – Chamber of Commerce. Retrieved August 14, 2015 from http://www.lyndon-vermont.com/covered-bridges.php

15 Ibid.

16 National Register of Historic Places Registration Form. (1990). United States Department of the Interior National Park Services. Retrieved August 14, 2015 from http://focus.nps.gov/GetAsset?assetID=db6688a9-cb21-4cdd-8745-eee6118d1c21

(Left) Figure 11 Millers Run Bridge

(Right) Figure 12 Randall Bridge

Figure 13 Sanborn Run Bridge

Transportation

Lyndon is located just off I-91. Burlington Airport is approximately 85 miles west and Manchester, NH is 2 1/2 hours south. Bus service is available locally on the Rural Community Transportation (RCT) Shuttle. RCT has also added commuter routes to Montpelier and Burlington.

Table 7 Lyndon Transportation

Facility	Address	Description	Assessed Value	Year Built	Generator?
Caledonia County Airport	2081 Pudding Hill Road	County Airport	1,218,987	1900	Unreachable

Major Employers

"Major employers in the region include several manufacturers, the largest of which is NSA, followed by Vermont Aerospace and Lyndon Furniture (formerly Lyndon Woodworking). The first two companies are involved in machining and fabrication of metals. Lyndon Furniture designs and manufactures quality wood furniture for the home. The second largest employment sector is education, serving students from the Town, region and the country, from kindergarten through graduate school. In addition to local contractors, Lyndon also has two contracting firms experienced in large state and federal construction projects."[17]

MAJOR EMPLOYERS & EMPLOYMENT 2012

Employers	Employed
Lyndon Furniture, Inc.*	60
Calkins Sand & Gravel, Inc.	25
JBMS	14
Community National Bank (Total)	72
Lyndon Institute	130
Lyndon State College	182
Thaddeus Stevens School	14
Riverside School	Not available
NSA Industries, Inc.*	250
Municipal Government (Town & Village)	28
LED	17
JA MacDonald	40
VT Aerospace*	130
Precision Composites of Vermont, LLC.	12
Northeast Agricultural Sales, Inc	40
NE Home Crafters & Beans Mobile Homes, Inc.	25
Lyndon Town School	103
White's Market	84
The Pines Residential Care Center	82
Northern Gas Transport	44
Winterset, Inc.	85
Total	1437

*Businesses physically located in St. Johnsbury but counted in Industry Information for Lyndon based on Zip Code

Source: Businesses & VT Business Directory 2012-2013

Figure 14 Major Employers Graphic From Lyndon Town Plan [18]

Regional Medical Resources

Lyndon is located 5 miles from Northeast Vermont Regional Hospital, a 110-bed facility. The Hitchcock Clinic is located on Industrial Park Drive in Lyndon Corner.

17 Lyndon Town Plan. (2015). Town of Lyndon. P.25.
18 Ibid.

CHAPTER III

Planning Process

The planning process was developed in full compliance with the current planning requirements of the Federal Emergency Management Agency (FEMA) per the following rules and regulations:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000
- Code of Federal Regulations – Title 44, Chapter 1, Part 201 (§201.6: Local Mitigation Plans)
- Federal Emergency Management Agency (FEMA) Local Mitigation Plan Review Guide (dated October 1, 2011)

In addition, the plan was prepared in a manner that maximizes credit points under the National Flood Insurance Program's Community Rating System (CRS). The Planning Team utilized FEMA's CRS Coordinator's Manual and its own internal planning crosswalk to ensure that the plan is consistent with CRS requirements for floodplain management planning (Activity 510).

Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction 44 CFR 201.6(c)(1) (a-e)

The purpose of the hazard mitigation planning process was to create a 2015 Multi-Jurisdiction Hazard Mitigation Plan that meets all Vermont Emergency Management, Division of Emergency Management and Homeland Security (DEMHS) and FEMA's requirements, including a risk analysis using best-available data and a mitigation strategy.

Planning Team

The Northeaster Vermont Development Association (NVDA) contracted with Jamie Caplan Consulting LLC to create an update to the Town of Lyndon and Village of Lyndonville Hazard Mitigation Plan. Jamie Caplan subcontracted with Clarendon Hill Consulting LLC and Gomez and Sullivan Engineers, P.C. for assistance with the risk assessment portion of the plan.

A Planning Team was formed that included Irene Nagle, NVDA, Jamie Caplan, Jamie Caplan Consulting and Justin Smith, Municipal Administrator, Kaela Gray, Planning Director and Zoning Administrator and Patrick McLaughlin, Planning Commission representative, State Fire Marshall and Lyndon Rescue member, Dan Daley, Selectboard, and Ray Durocher, Trustee. This core group held regular meetings to ensure the project progressed efficiently, Appendix B includes notes from many of these meetings.

The project was divided into nine tasks as illustrated by the Work Plan (shown in Appendix A) and the Work Plan Timeline shown in Figure 1. Jamie Caplan Consulting developed the Work Plan with assistance from the Planning Team.

Town of Lyndon and the Village of Lyndonville:
Multi-Jurisdictional Hazard Mitigation Plan

Project Schedule

Task	Description	Jan/ Feb	Mar	Apr	May	Jun	July	Aug	Sep
1	Assemble planning team and meet with consultant(s) to review the planning process and confirm outreach strategy.	X							
2	Establish work plan with deliverables, timelines for completion and confirmed roles and responsibilities.	X							
3	Review information on natural hazards and on man-made hazards, based on best available data.	X	X						
4	Review Hazard Data Public Meeting #1	X	X						
5	Complete a vulnerability assessment to quantify the extent of each hazard.	X	X	X	X				
6	Identify Mitigation Strategies and complete a cost-benefit review.			X	X	X	X		
7	Review Mitigation Strategies Public Meeting #2				X	X	X		
8	Submit plan to Vermont Emergency Management and Homeland Security and revise accordingly.							X	X
9	Submit revised plan to FEMA; revise if necessary. Town and Village adopt plan.								X
Meetings									
Kick-Off Meeting		X							
Conference Calls Weekly		X	X	X	X	X	X	X	X
Public Meeting #1			X						
Public Meeting #2						X			

February 10, 2015

Figure 1 Work Plan Timeline

The nine tasks were essentially divided into three phases. The first three tasks were part of Phase 1 and focused on developing a public outreach plan and collecting and reviewing data. The consulting team conducted a brief Gap Analysis during this phase, which compared the 2010 Draft Mitigation Plan to the requirements of an updated multi-jurisdiction plan. The data collected was best available and used toward a completely revised risk assessment. The current State mitigation plan, the Town Plan, and many river corridor plans were reviewed, as the first part of making sure the mitigation plan is current with other plans in the region.

The second phase of the mitigation planning process focused on risk analysis and mitigation strategy development. The Planning Team conducted a thorough and completely revised risk assessment for all natural hazards identified in the planning area. They determined the current capabilities of the Town and Village to mitigate risk related to these hazards. Finally, they developed a mitigation strategy and identified multiple mitigation actions. These mitigation actions were ranked by benefit-cost review and mesh with the goals and objectives for mitigation in the Town Plan and State mitigation plan. In addition, funding sources were identified for each of the mitigation actions.

The final phase of the project focused on Plan Maintenance, Adoption and Implementation. Notes from many of the Planning Team meetings are in Appendix B.

Updates Made to 2010 Draft Plan

This 2015 Multi-Jurisdiction Hazard Mitigation Plan is a complete and total revision from the original hazard mitigation plan. The Planning Team used the draft plan started in 2010 as a starting place for updating the plan. Table 1 indicates some basic changes made to the chapter structure of the plan. Each chapter includes details regarding how it was updated and improved from the previous plan. The most significant is an updated risk assessment and revised mitigation actions.

Table 1 Comparison between 2010 and 2015 Mitigation Plan Chapters

2010 Draft Mitigation Plan Chapters	2015 Plan Revisions
1. Planning Process	Chapter 1. Introduction.
2. Risk Assessment and Vulnerability	Chapter 2. Planning Area Profile
3. Mitigation Strategy	Chapter 3. Planning Process
4. Plan Maintenance Process	Chapter 4. Risk Assessment
5. Maps	Chapter 5: Capability Assessment
	Chapter 6: Mitigation Strategy
	Chapter 7: Implementation Plan
	Appendices

Hazard Mitigation Committee

Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development… involved in the planning process? 44 CFR 201.6(b)(2).

The Planning Team identified twenty-one individuals to participate in the Hazard Mitigation Committee. They represent multiple departments in the Town of Lyndon and Village of Lyndonville as well leaders from the surrounding communities. Each of these people was invited to participate, not all of them attended meetings. Some of them participated in separate meetings or conversations with the Planning Team.

Table 2 Hazard Mitigation Committee by Organization, Name, and Position

Organization	**Name**	**Position**
Planning Team		
Town of Lyndon and Village of Lyndonville	Justin Smith	Municipal Administrator (Town and Village)
Town of Lyndon	Kaela Gray	Planning Director/Zoning Administrator
Lyndon Fire Department and Town of Lyndon Planning Commission	Patrick McLaughlin	Planning Commission, Fire Dept., Fire Marshall, Lyndon Rescue
Northeastern Vermont Development Association	Irene Nagle	Senior Planner
Local Leaders		
Town of Lyndon	Ron Aiken	Village Trustee
Town of Lyndon	Dan Daley	Lyndon Selectboard
Town of Lyndon	Joe Dauphin	Public Works Supervisor
Town of Lyndon	Ray Durocher	Village Trustee (former)
Town of Lyndon	Marty Feltus	Town of Lyndon Selectboard
Town of Lyndon	Kermit Fisher	Lyndon Selectboard
Lyndon Town School	Amy Gale	Lyndon Town School Representative
Lyndon Town School	George Gardner	Lyndon Town School Facilities Manager
Lyndon State College	George Hacking	Lyndon State College Representative
Lyndon Police Department	Jack Harris	Police Chief
Lyndon Institute	Rob Heath	Lyndon Institute Representative
Lyndon Fire Department	Greg Hopkins	Fire Chief
Village of Lyndonville	Ken Mason	Lyndonville Electric Manager
Town of Lyndon	Robert Nutting	Town Road Foreman

Organization	Name	Position
Regional Representatives		
Caledonia County Natural Resources Conservation District	Kerry O'Brien	District Manager
VT Agency of Natural Resources (DEC) and Town of St. Johnsbury	Ben Copans	Watershed Coordinator and Town Representative
Adjacent Community Representatives		
Town of Burke	Al Duey	Representative
Town of Danville	Jeffrey Paquet	Representative
Town of Kirby	Brad Libbey	Representative
Town of Sutton	Paul Brouha	Sutton Representative
Town of Sutton	Byron Savoy	Sutton Representative alternate

The Hazard Mitigation Committee met twice during the Planning Process. Details of these meetings are detailed below. Supporting materials are in the Appendix C, including sign-in sheets and PowerPoint presentations.

March 12, 2015 Hazard Mitigation Committee Meeting

On March 12, 2015, seventeen members of the Hazard Mitigation Committee met in the Municipal Building. Irene Nagle, NVDA, opened the meeting by explaining the planning process and the role of NVDA in securing funding and supporting the planning area. Jamie Caplan conducted the meeting, which was designed as a combination of presentation (the PowerPoint presentation is in Appendix C) and workshop.

The purpose of the meeting was to discuss the role of the Hazard Mitigation Committee, to identify hazards that may impact the planning area and to review mitigation actions in the 2010 draft mitigation plan. Fortunately, Kerry O'Brien, Caledonia County NRCD (shown in Figure 2) was present at the meeting. She was the lead author on the 2010 draft plan and provided valuable information to the committee regarding the intent and status of each proposed mitigation action.

Figure 2 Ben Copans, VTDEC Watershed Coordinator and Kerry O'Brien, District Manager, Caledonia County NRCD

The list of hazards to include in the plan was discussed in detail. The PowerPoint presentation included two slides for the purpose of review by the committee. The first shown in Figure 3, shows the hazards included in the 2010 plan, the second shown in Figure 4 is the Planning Team's proposed list of hazards. The committee agreed with the proposed list and seemed to grasp the need to keep climate change as a factor that may exacerbate some of the natural hazards.

Figure 3 2010 Draft Plan Hazard List

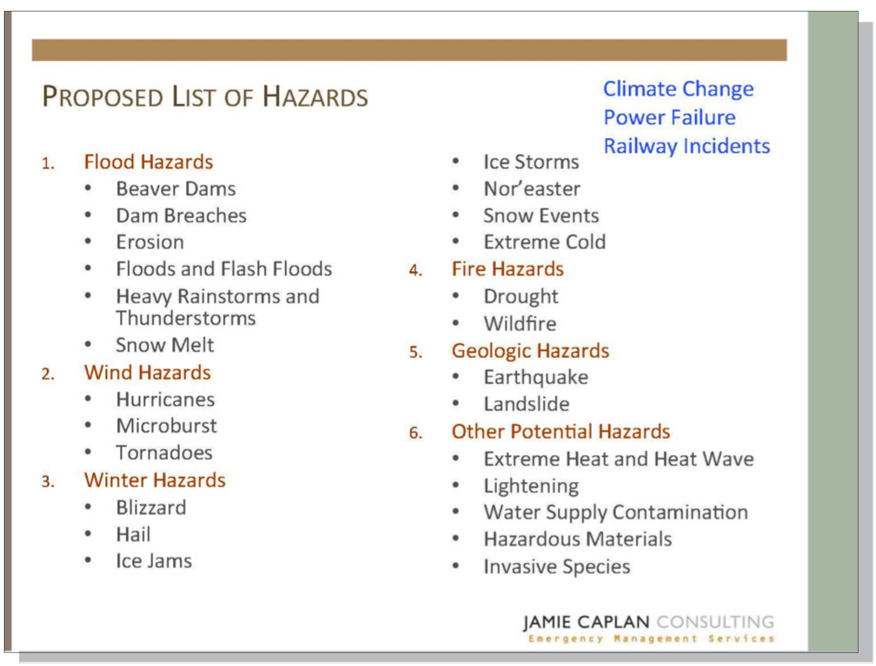

Figure 4 2015 Proposed List of Hazards

After agreeing on the list of hazards for study, the presentation focused on the mitigation strategy. The goal statements from the 2010 plan were discussed and proposed goals suggested. The proposed goals included five categories, listed below, were eventually adopted by the committee:

1. Save lives and protect property,
2. Community planning,
3. Regional collaboration,
4. Public awareness, and
5. Preservation.

The meeting concluded with a discussion of potential mitigation actions. This took place by reviewing each of the mitigation actions in the 2010 draft plan. Many of the mitigation actions had yet to be implemented and committee members considered them still relevant. Following the formal meeting, some committee members stayed for informal discussion (Image of informal group discussion in Figure 5) and to review the location of critical facilities on draft base maps. The consulting team met with Justin Smith, Town Administrator, for a review of the government structure and a better understanding of the relationship between the Town and Village.

Figure 5 Informal Discussions at the Hazard Mitigation Committee Meeting

June 10, 2015 Hazard Mitigation Committee Meeting

Thirteen members of the Hazard Mitigation Committee met on June 10, 2015 to review the results of the public preparedness survey and the risk assessment as well as to further discuss the identified mitigation actions. Irene Nagle from NVDA opened the meeting, followed by a presentation and brief discussion led by Jamie Caplan. Figure 6 shows several members of the committee prior to the start of the meeting.

In reviewing the risk assessment analysis and ranking of the hazards, the committee requested some modification. The draft ranking scale is shown in Table 2. Drought, earthquake, and extreme heat were moved lower on the scale, while ice jams, cold, and lightning were moved up the scale. Committee members mentioned that two mountain bikers had been struck by lightning in the past. The conversation surrounding this proves the absolute need and value to quantifiable and qualitative data collection during a risk assessment.

Table 3 Draft Ranking of Hazards

Ranking	Hazard
High Hazards	Flood and Fluvial Erosion
	Blizzard
	Snow Events
	Nor'easter
Moderate Hazards	Ice Storms
	Wildfire
	Hurricanes
	Hazardous Materials
	Ice Jams
	Extreme Cold
Low Hazards	Microburst
	Hail
	Water Supply Contamination
	Tornadoes
	Drought
	Earthquake
	Lightning
	Extreme Heat and Heat Wave
Very Low Hazards	Invasive Species
	Landslide

The list of mitigation actions was easily received and did not inspire a tremendous amount of conversation. However, it can be an overwhelming amount of material to review on a PowerPoint slide and in a brief workshop. The committee seemed relieved that they would have time to gradually read through the draft plan toward the end of the summer.

Figure 6 Hazard Mitigation Committee Members reviewing the PowerPoint Presentation handout

Public Outreach Strategy

Does the Plan document how the public was involved in the planning process during the drafting stage? 44 CFR 201.6(b)(1) and 201.6(c)(1)

Part of the Work Plan included a Public Outreach Strategy. The strategy, shown in Figures 7 and 8, lists multiple opportunities for the public to participating in the hazard mitigation planning process. The opportunities were offered throughout the planning process that included:

- Public Preparedness Survey
- Town Hall Meetings
- Stakeholder Involvement Meetings
- Reviewing and commenting on the Draft Mitigation Plan

Town of Lyndon and the Village of Lyndonville:
Multi-Jurisdictional Hazard Mitigation Plan

Public Outreach Strategy

Public outreach is an essential component of mitigation planning. The Planning Team firmly believes in the benefit of public outreach. The more engaged the public becomes in the planning process, the more likely they are to support future mitigation strategies. In addition, participation in mitigation planning often serves as a foundation for additional emergency preparedness and response planning, and adds important local knowledge to the mitigation plan.

The Public Outreach Plan will include strategies to:

- Generate public interest in mitigation planning.
- Accommodate special populations such as handicapped or non-English speakers.
- Solicit public input.
- Engage local stakeholders.
- Create opportunities for the public and local stakeholders to be actively involved in the mitigation planning process.

Hazard Mitigation Committee

A Hazard Mitigation Committee will be created to guide the Planning Team and to provide local "ground-truthing" throughout the planning process. This committee will include leaders from the public and private sectors in the Town of Lyndon and Village of Lyndonville. The Hazard Mitigation Committee will meet a minimum of two times throughout the planning process in conjunction with the Public Meetings.

Public Meetings

Two Public Meetings will be held to give the public an opportunity to participate in the planning process. The first meeting will be held in March to identify and review a list of natural and man-made hazards relevant for the plan. This meeting will also include identification of critical facilities. The second meeting will be held in June and focus on the mitigation strategy and specific mitigation actions. The consulting team will prepare PowerPoint presentations for each meeting. The Planning Team will handle all logistics and outreach for the meetings.

The consulting team requests NVDA to ensure the Public Meetings be accessible to disabled populations. If necessary, an interpreter for non-English speakers or the deaf should be provided by NVDA.

Public Preparedness Survey

A Public Preparedness Survey will be drafted to provide an opportunity for individuals in the Town of Lyndon and Village of Lyndonville. This survey allows individuals to share their opinions and participate in the mitigation planning process. The information provided would help the Planning Team to better understand what hazards are of most concern and what mitigation actions are of particular interest. The survey will be posted online (hosted by SurveyMonkey)

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Figure 7 Public Outreach Strategy (Page 1)

Town of Lyndon and the Village of Lyndonville:
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and a link will be provided via the Town of Lyndon Website. Hard copies of the survey will also be distributed at all meetings.

News Media

The consulting team will draft press releases for each public meeting. The first press release will include mention of the Public Preparedness Survey. NVDA and the Town of Lyndon and Village of Lyndonville will send the press releases to all relevant media sources.

Website

The Town of Lyndon webpage will be used to advertise the Public Preparedness Survey, public meetings and for review of the draft mitigation plan.

Draft Plan Review

The consulting team will provide a digital copy of the Draft Plan for review. It is anticipated that each member of the Hazard Mitigation Committee will review the plan. In addition, the public will have the opportunity to review and comment on the plan. A digital version will be placed on the Town of Lyndon webpage.

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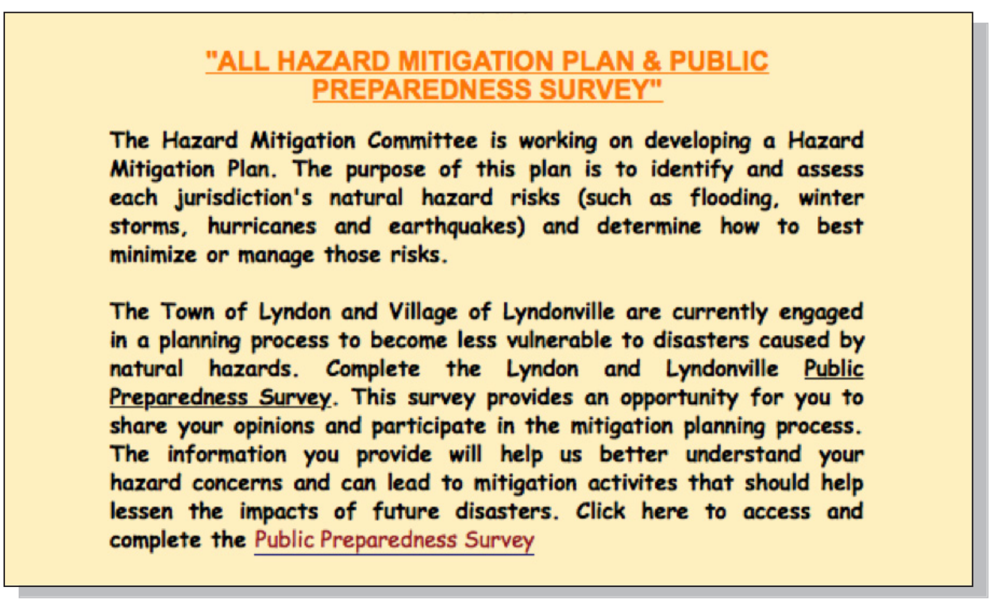
Figure 8 Public Outreach Strategy (Page 2)

Public Preparedness Survey

The Public Preparedness Survey was an integral part of the Public Outreach Strategy. It gave the public an opportunity to comment on their level of interest, knowledge, and readiness toward hazards in their community. The survey was created on www.surveymonkey.com and distributed online and in hard copy. The entire survey is included in Appendix E with results.

The survey was developed within the first month of the planning process. It was announced by Planning Team members at their respective offices and announced publicly as shown in Figure 9 on social media, and Figure 10 on the www.lyndonvt.org webpage. Hard copies of the survey were located in the Cobleigh Public Library, the Laundry Mat and the Cashier's Office for the Town and the Lyndon Electric Department in the Municipal Building.

Figure 9 Social Media Announcement of Public Preparedness Survey



"ALL HAZARD MITIGATION PLAN & PUBLIC PREPAREDNESS SURVEY"

The Hazard Mitigation Committee is working on developing a Hazard Mitigation Plan. The purpose of this plan is to identify and assess each jurisdiction's natural hazard risks (such as flooding, winter storms, hurricanes and earthquakes) and determine how to best minimize or manage those risks.

The Town of Lyndon and Village of Lyndonville are currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards. Complete the Lyndon and Lyndonville Public Preparedness Survey. This survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activites that should help lessen the impacts of future disasters. Click here to access and complete the Public Preparedness Survey

Figure 10 Public Preparedness Survey Announcement on www.lyndonvt.org

Sixty-nine surveys were collected between February 2015 and May 2015. Sixty-five percent of respondents reported never having been impacted physically, financially, or emotionally by a natural disaster. Heavy rainstorms, flood, ice storms, and snowstorms were the experienced by over seventy percent of those who had experienced a natural disaster. Respondents reported being most concerned about Flood, Ice Storms, Heavy Rainstorms and Thunderstorms, Extreme Cold and Nor'easter. Survey results show participants are most interested in protecting fire stations, bridges, electrical distribution system and substations, water treatment plants, police station, wells and gas stations and schools. The Town Hall Building was ranked as "very important" by forty-five percent of respondents. The Hazard Mitigation Committee believes this may be because Town residents are unaware of the role the building plays in emergency management. Considering mitigation actions, in response to "Question 7: In your opinion, what are some actions your community could take to reduce or eliminate the risk of future natural hazard damages in your community?" responses included "dredge the Passumpsic River," "limit future growth and expansion of homes and businesses in floodplains," "work with surrounding community collaboratively," and "preparedness." In terms of preparing for natural hazards, eighty-three percent of respondents have installed smoke detectors, thirty percent have developed a "Household/Family Emergency Plan," and thirty-two percent have a back-up power source kit. Nine percent of respondents have flood insurance.

Stakeholder Meetings

Meeting with stakeholders in the planning area began on March 12, 2015 with a tour of the area; several participants from the tour are shown in Figure 11. We drove and walked throughout the area to examine critical facilities, potential hazard areas, and sites for future mitigation actions. Besides seeing the planning area, spending several hours together enabled the Planning Team to work on the critical facility list, the mitigation action list, and discuss the capabilities of the community pre- and post-disaster.

Figure 11 Hazard Mitigation Committee Members Kaela Gray, Patrick McLaughlin, Irene Nagle and Ben Copans Touring the Planning Area

The Planning Team met individually with Kaela Gray, Patrick McLaughlin, Irene Nagle, Justin Smith, and Joe Dauphin on March 12, 2015 in an effort to gain additional information regarding their areas of expertise. The relationship between the Town and Village is complicated. The Town and Village function as a single unit in many instances and individual entities in some situation. The meeting with Justin Smith was an opportunity for the consulting team to gain a good understanding of how the two remain independent as well as how connected they actually are. One Hazard Mitigation Committee was formed for this multi-jurisdiction plan because of how closely intertwined the Town and Village are.

Planning Team members kept the Planning Commission and Development Review Board on point with the mitigation planning process. They gathered input at these meetings that they shared with the rest of the team during Planning Team meetings.

Public Meetings

The Planning Team with the support of members of the Hazard Mitigation Committee hosted two public meetings during the planning process. Each of these was advertised via press release, flyer, and e-mail. Appendix F includes examples of these outreach materials as well as sign-in sheets and PowerPoint presentations. Figure 12 is a screen capture of the Lyndon Fire Department Facebook page announcing the public meeting on March 12, 2015. Figure 13 presents is a copy of the Caledonia Record article printed on March 9, 2015 in response to the press release sent to the paper.

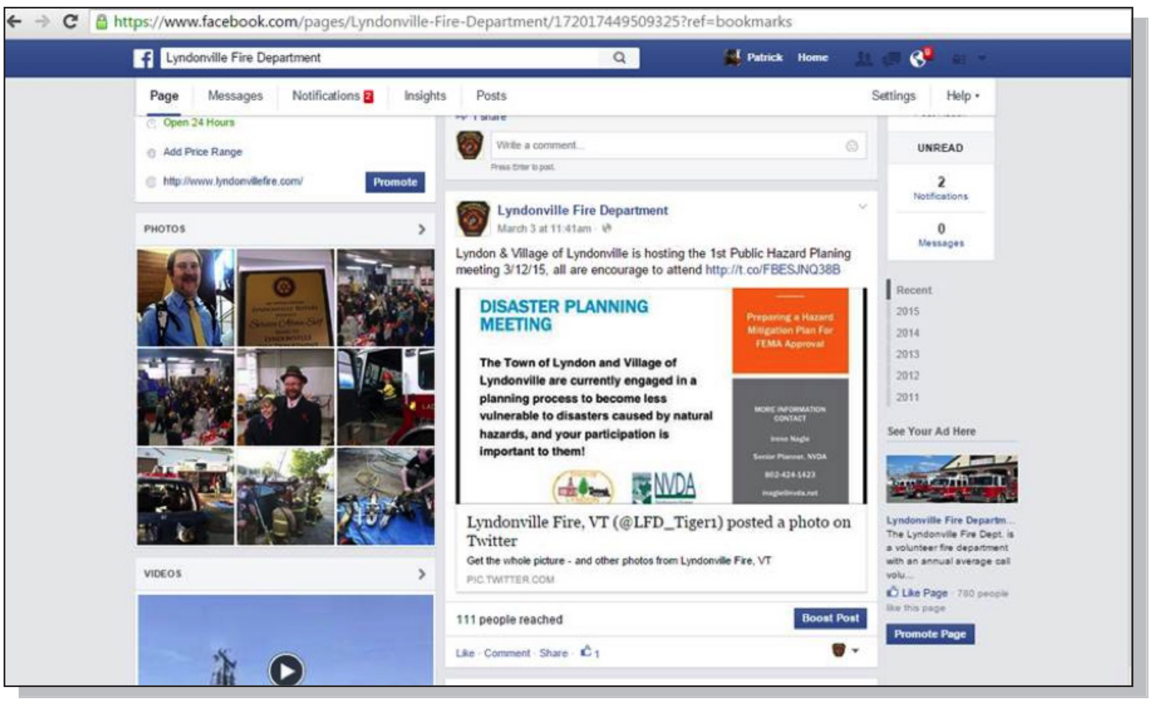


Figure 12
Social Media Announcement

LOCAL

WHEELOCK REMOVES SEVEN WHITE PINES

COURTESY PHOTO

On Thursday, the town of Wheelock hired resident and tree surgeon Tracy St. Louis to cut down seven of the White Pines in the park in front of Town Hall, which is listed on the National Historic Register. Planted in 1829, the trees were nearing the end of their lifespan, and showing signs of sickness and decay. The town plans to use some of the lumber for the Town Hall building project. The remaining three trees are in the Route 122 right-of-way and VTrans is planning to take the worst of those down soon. More pictures and videos may be seen on the Facebook page "Wheelock, Vermont: Then and Now."

LYNDON

Town, Village To Host Disaster Planning Meeting

Lyndon is looking for public participation in planning for natural disasters.

The town of Lyndon and village of Lyndonville are currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards.

The public is encouraged to attend a Hazard Mitigation Committee meeting on March 12 from 6 to 7 p.m. to share ideas for reducing risk and becoming less vulnerable to natural hazards such as floods, hurricanes and winter storms. The meeting will be held at the Public Safety Building, 316 Main Street, Lyndonville.

The public is also encouraged to complete the Public Preparedness Survey. It is online at www.surveymonkey.com/r/LyndonVT. The survey provides an opportunity to share opinions and participate in the mitigation planning process. The information provided will help better understand hazard concerns and can lead to mitigation activities that should help lessen the impacts of future disasters.

The purpose of the Multi-Jurisdiction Hazard Mitigation Plan Update is to identify and assess the community's natural hazard risks and determine how to best minimize and manage those risks. Upon completion, the plan will be presented to the town of Lyndon and village of Lyndonville for adoption and submitted to Vermont Division of Emergency Management and Homeland Security (DEMHS) and Federal Emergency Management Agency (FEMA) for review and approval. A FEMA-approved plan makes these communities eligible for federal and state mitigation grant funding.

The Northeastern Vermont Development Association (NVDA) was awarded a grant from the DEMHS to develop the Multi-Jurisdiction Hazard Mitigation Plan Update; the previous plan was developed in 2005. The NVDA hired Jamie Caplan Consulting LLC to work with them and the Town and Village to develop the Multi-Jurisdiction Hazard Mitigation Plan Update.

For more information, contact Irene Nagle, Senior Planner, Northeastern Vermont Development Association at 424-1423 or inagle@nvda.net.

NEWPORT CITY

Former Republica

BY WILSON RING
Associated Press

MONTPELIER, Vt. — F. Ray Keyser Jr., a three-term lawmaker and former speaker of the Vermont House, took office as governor following the 1960 elections as cracks were beginning to appear in generations of dominance of state politics by a handful of Republican families.

It was two years later that Keyser was defeated by Phil Hoff, the Democrat who broke more than a century's hold on the Vermont governor's office by the GOP, marking the start of state's shift from one of the most conservative in the country to one of the most liberal.

"He was a boy wonder," former Republican Gov. Jim Douglas said of Keyser, who was elected at age 34, making him Vermont's youngest governor.

Keyser died Saturday at age 88 at his daughter's home in Brandon, said Dennis Cilley, director of the Boardway & Cilley Funeral Home. Cilley said Sunday that he didn't know Keyser's cause of death.

Keyser's 1962 defeat was the last time an incumbent Vermont governor was ousted in the general election. It ended 109 years of Republican control of the Vermont governor's office.

Douglas said Keyser also enjoyed the distinction of being the first Vermont governor still living 50 years after his election. Hoff, Keyser's successor, was the second.

"Vermont has lost a faithful public servant who showed his love for this state and its people through his years of service," Democratic Gov. Peter Shumlin said Sunday in a statement. "I know I join all Vermonters in being thankful for Gov. Keyser's

Figure 13 Caledonia Record Article March 9, 2015

March 12, 2015 Public Meeting

The first Public Meeting was held in the Public Safety Building on March 12, 2015 at 6:00 pm and twelve people participated in the meeting plus the consulting team members. Irene Nagle of NVDA introduced the consulting team and described the planning process in general. Subsequently, Jamie Caplan led the group through a PowerPoint presentation and discussion.

The meeting began with a group exercise aimed at helping participants understand the mitigation planning process and the need and value of hazard mitigation. The exercise included four questions shown below:

1. Who lives in Lyndon and Lyndonville?
2. What buildings, organizations and infrastructure do the people rely on?
3. What weather related hazards impact these people and/or the buildings, organizations and infrastructure?
4. What can be done to lessen the impact of these hazards and to protect the people and property?

Discussion throughout the presentation included basic information about the planning process and hazard mitigation in general. Participants spent some time discussing public outreach and education. An idea was mentioned that Lyndonville Electric Department could distribute public information regarding power failures with their invoices. Specific areas in town that are susceptible to flooding were named such as Millers Run Covered Bridge. All participants in the meeting were given a copy of the Public Preparedness Survey.

June 10, 2015 Public Meeting

The second public meeting was held on June 10, 2015 in the Municipal Building with twelve participants. The meeting included a review of Public Preparedness Survey results, risk assessment findings, and identified mitigation actions. Questions from participants including types of projects that can receive funding, how prepared is the planning area, and what are the next steps. Kaela Gray described the Mobile Home Park Community Preparedness and Response Plan mitigation action. This mitigation action is funding through University of Vermont, Department of Community Development and Applied Economics. It is funded through a USDA Rural Development Grant.

Reviewing and Commenting on the Draft Mitigation Plan

Multiple opportunities were provided for the Hazard Mitigation Committee and the public to review the 2015 Multi-Jurisdiction Hazard Mitigation Plan draft. The Planning Team sent a copy of the draft plan to each Hazard Mitigation Committee member for his or her review prior to making the plan available for public review.

The Planning Team then incorporated changes received and posted an updated draft to the Town's website (http://www.lyndonvt.org) for public review. The existence of the draft plan was announced to the public by way of a press release and article in The Record. The press release and corresponding article are included in Appendix K. The Planning Team also announced the opportunity to review the plan at Planning Commission and Development Review Board meetings. The plan was available for review for over two weeks and it was requested that all changes be sent to Irene Nagle (NVDA) for compiling. The public did not contribute comments or changes throughout the three-week time frame that the plan was made available.

CHAPTER IV

Risk Assessment

Introduction

This plan aims to illustrate the natural disaster risks that people are facing in the Town of Lyndon and Village of Lyndonville, VT. This chapter presents a comprehensive natural hazard risk and vulnerability assessment. The risk assessment examines the vulnerability of current and future populations, as well as the vulnerability of structures (critical facilities) to various natural hazards. The risk assessment provides a compilation of available information and data sets to the planning area for comprehensive planning purposes. The risk assessment addresses hazard history, probability, frequency, and impact.

Critical Facilities

Critical facilities or assets are defined broadly to include anything that is important to the character and function of a community, such as people, economic assets, built environment assets, and natural environment assets.

People's livelihoods are the most valuable asset in any community. The Town of Lyndon has a population of approximately 5,981 residents (according to the 2010 census), all of whom could potentially be affected by natural hazards, particularly those with homes, businesses, or in need to access critical facilities located within flood hazard areas.

The following section will explore buildings that are deemed critical to the planning area. Critical facilities are considered structures or institutions necessary for the Town and Village in terms of emergency response and recovery. These facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery. Critical facilities typically include airports, emergency operation centers (EOCs), fire stations, hospitals, police stations, schools, government buildings, and railroad stations.

Table 1 lists the planning area's critical facilities, corresponding with description, the year in which the facility was built, and their assessed value. In conjunction, Figure 1 illustrates the location of each critical facility including community anchor institution (CAI). No data on previous losses to critical facilities were available. There are no known losses to critical facilities, however future losses are possible. These facilities have a combined building exposure value of nearly $145 million.

Table 1 List of Critical Facilities in the Planning Area

Critical Facility	Description & Justification	Assessed Value	Year Built
Municipal Building (Town & LED Office)	Town Offices, LED Offices	2,941,661	1900
Public Safety Building (Police and Fire Dept.)	These facilities are deemed critical because of their emergency response function	1,487,078	2004
Lyndonville Electric Department (LED) Garage	This structure is a service office for outage repair and identified as critical	367,400	1957
Town Garage (Equipment)	This structure contains town equipment necessary for disaster preparedness, response and recovery	840,283	1970

Critical Facility	Description & Justification	Assessed Value	Year Built
Village Garage (Equipment)	This structure contains town equipment necessary for disaster preparedness, response and recovery	538,565	1985
Lyndon Town School (K8)	Includes vulnerable populations	8,488,700	1991
Lyndon Institute (High School)	Includes vulnerable populations	11,846,300	1922
Lyndon State College	Includes vulnerable populations	95,140,355	1965
Riverside School	Includes vulnerable populations	1,168,400	1860
Thaddeus Stevens School (Pre-School to Grade 8)	Includes vulnerable populations	249,000	1900
Cobleigh Public Library	This structure serves as an information center	435,000	1906
Darling Inn	Elderly Housing, Community Center; Houses vulnerable populations	1,045,000	1900
Riverside Enrichment Center	Elder Day Programming; Houses vulnerable populations	356,700	1980
The Pines	Nursing Home; Houses vulnerable populations	988,700	1870
Armory Building	Identified as critical	657,248	1950
St. Elizabeth's Church	Gathering location and potential resource center	557,900	1895
Methodist Church	Gathering location and potential resource center	114,500	1900
First Congregational Church	Gathering location and potential resource center	260,700	1970
Episcopal Church	Gathering location and potential resource center	257,200	1900
Church of Later Day Saints	Gathering location and potential resource center	1,126,400	1980
Kindgom Hall Jehovah's Witness	Gathering location and potential resource center	294,800	1984
Lyndon Center Free Baptist Church	Gathering location and potential resource center	446,400	1875
Lyndon Bible Church	Gathering location and potential resource center	899,500	2003
VFW	Gathering location and potential resource center	533,700	1983
Cell Towers	Cell Tower & LED Radio Repeater; important for communication and in case of emergency response	16,900	n/a

Critical Facility	Description & Justification	Assessed Value	Year Built
Wastewater Treatment Center	Wastewater Treatment Center; identified as critical for public health.	7,298,791	1976
VELCO Substation	Electric Sub-Station	33,000	2010
LED Substation	Electric Sub-Station	39,000	n/a
Pudding Hill Substation	Electric Sub-Station	25,800	n/a
Great Falls Substation & Hydro Dam	Hydro Electric Dam & Substation	256,400	1900
Vail Dam	Hydro Electric Dam	133,800	1950
Caledonia County Airport	County Airport; critical for transportation	1,218,987	1900
Lyndon Rescue	Local EMS; critical for emergency response	227,800	n/a
Northeast Kingdom Waste Management	Local Recyling Center; identified as critical for public health	323,500	1900
Center Street Pump Station	Sewer Pump Station	424,658	n/a
Calkin Pump Station	Sewer Pump Station	253,750	n/a
Industrial Park Pump Station 1	Sewer Pump Station	253,750	n/a
Industrial Park Pump Station 2	Sewer Pump Station	152,250	n/a
VWF Pump Station	Sewer Pump Station	253,750	n/a
Remington Reservoir	Reservoir	538,565	n/a
Heath Road Reservoir	Reservoir	538,565	n/a
Booster Station for Water	Water Supply	62,366	n/a
Millers Run Pump Station	Sewer Pump Station	253,750	n/a
Lily Pond Pump Station	Sewer Pump Station	253,750	n/a
Main Street Pump Station	Water Pump	33,150	n/a
Water Filtration Plant	Water Treatment Plant	1,384,090	n/a

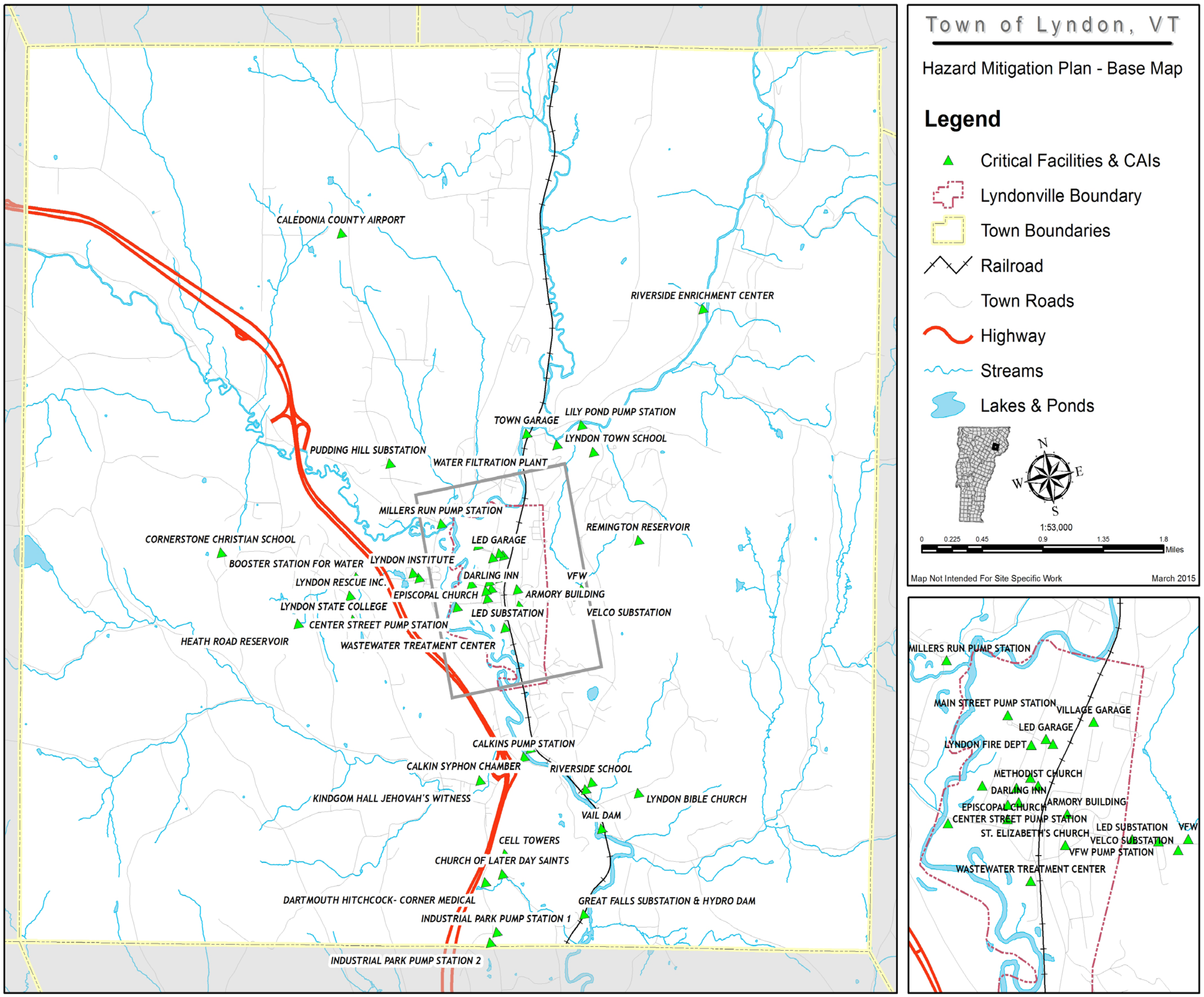


Figure 1 Location of Critical Facilities in the Planning Area

The planning area experiences significant flooding. For this reason, additional information is provided regarding the potential impact of flooding to the planning area. Other assets that are typically severely affected by flood hazards are those within the built environment, including existing structures (e.g., residential and commercial buildings), infrastructure systems (e.g., transportation, water and wastewater systems), and critical facilities (e.g., police and fire stations, emergency operations centers, evacuation shelters, hospitals and medical facilities, schools).

According to data published on the Vermont Flood Ready website[1], approximately 87 structures in the Town of Lyndon and 26 structures in the Village of Lyndonville are located within the FEMA-mapped Special Flood Hazard Area (SFHA), and only 1 critical facility structure is located within either the 1% or 0.2% annual chance exceedance flood inundation areas. However, as part of the planning process, a GIS analysis was conducted. The GIS analysis identified additional structures and critical facilities that are located within or near the SFHA and/or river corridors, and therefore may be vulnerable to flood hazards. These structures and critical facilities are summarized in Table 2 and illustrated on Figures 2 and 3 (Figure 2 and 3 projected in relation to the SFHA and Figures 4 and 5 projected in relation to the river corridor).

Table 2 Structures and Critical Facilities Potentially Located within the SFHA and/or River Corridor

Structure Type	Flood Hazard Area (s)			
	SFHA	River Corridor	Both	Either
Critical Facility	4	9	3	10
Mobile Home	42	69	38	73
Single Family Dwelling	41	72	25	88
Multi-Family Dwelling	6	10	3	13
Commercial	21	12	3	30
Industrial	1	4	1	4
Government	1	5	1	5
Other	7	13	4	16
TOTAL	123	194	78	239

1 Flood Ready Vermont – Community Reports. (2015). Vermont Agency of Natural Resources, Department of Environmental Conservation. Retrieved from http://floodready.vermont.gov/assessment/community_reports

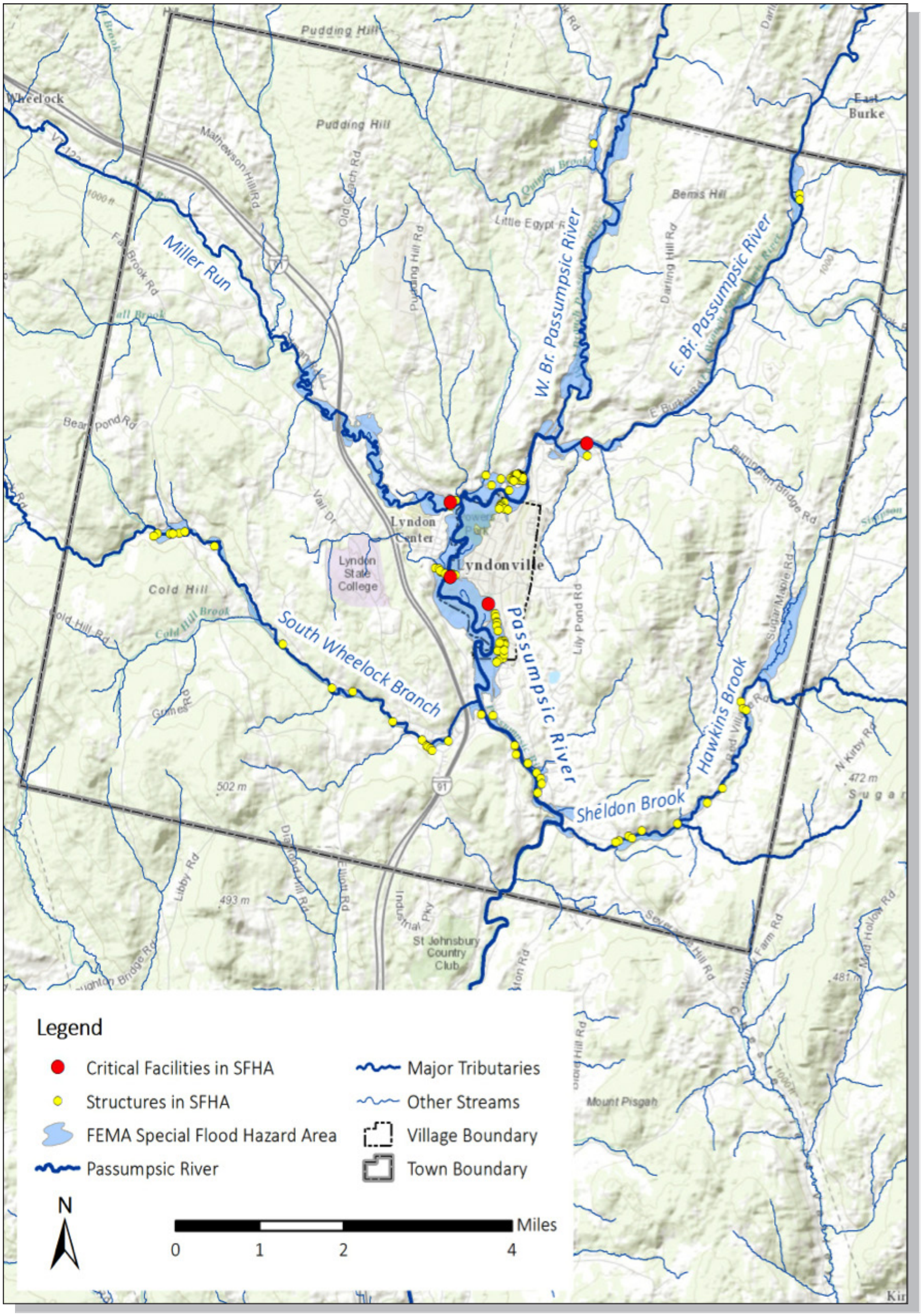


Figure 2 FEMA Special Flood Hazard Area Showing Critical Facilities and Structures

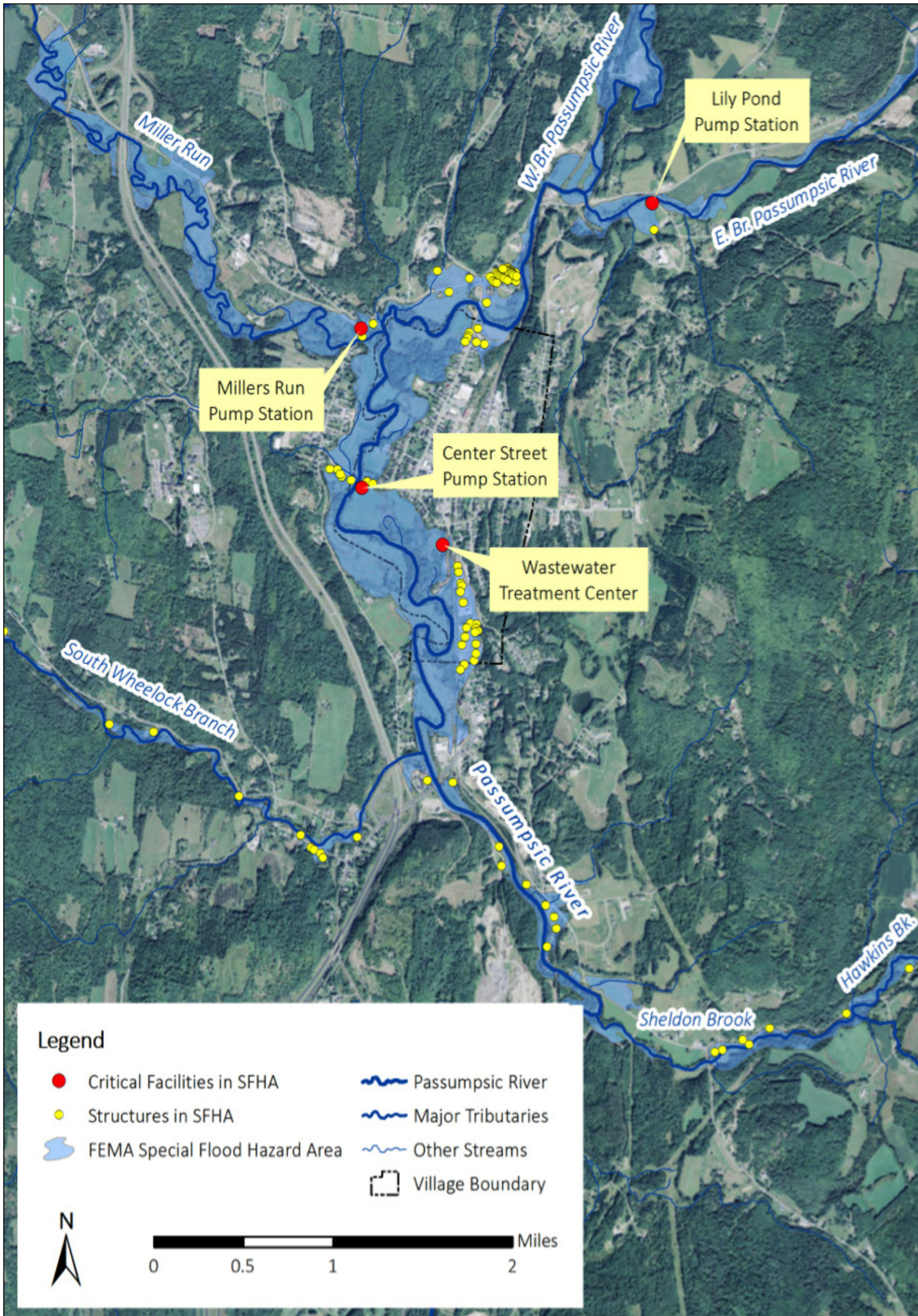


Figure 3 Close-up of FEMA Special Flood Hazard Area Showing Critical Facilities and Structures

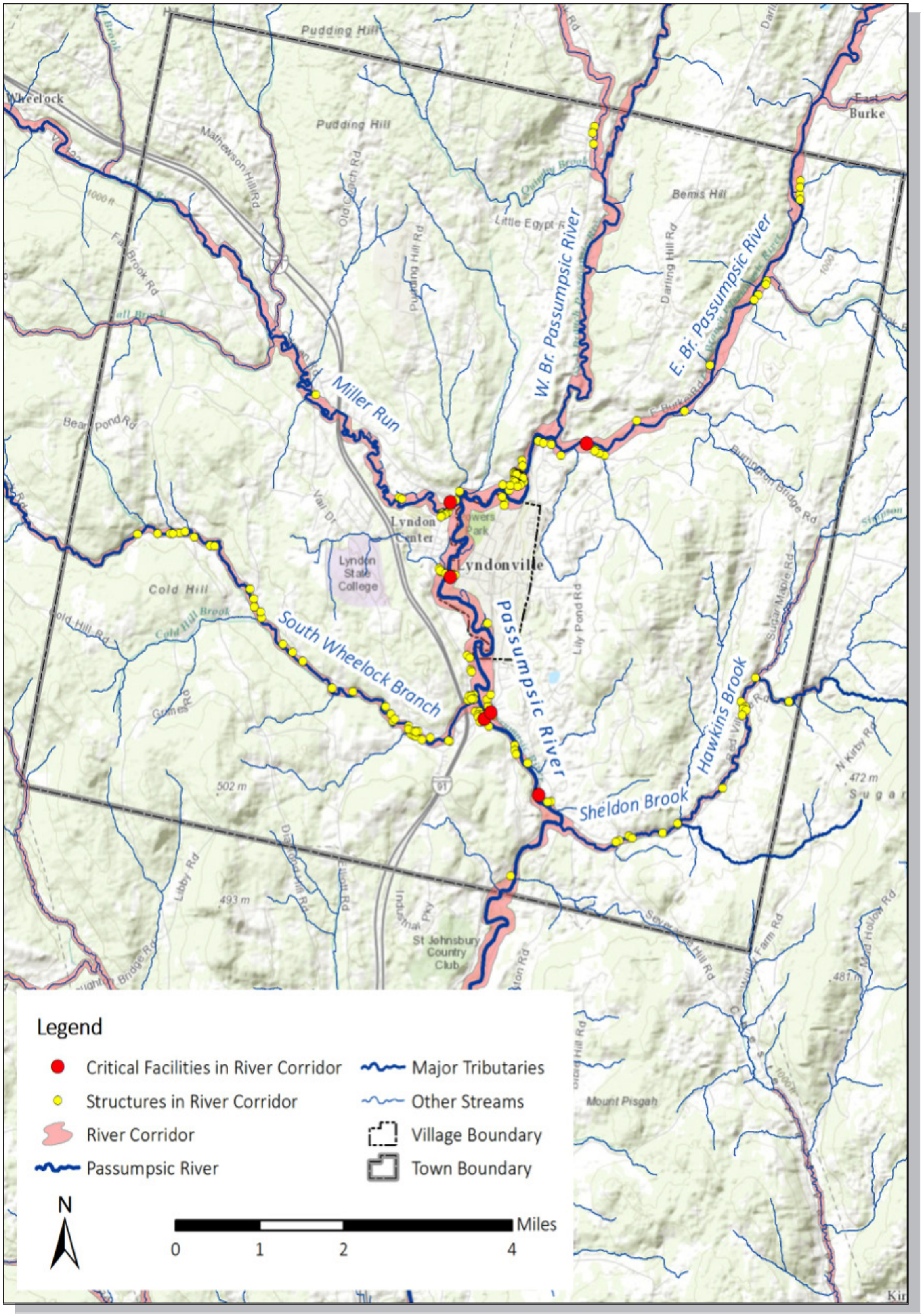


Figure 4 River Corridors Showing Critical Facilities and Structures

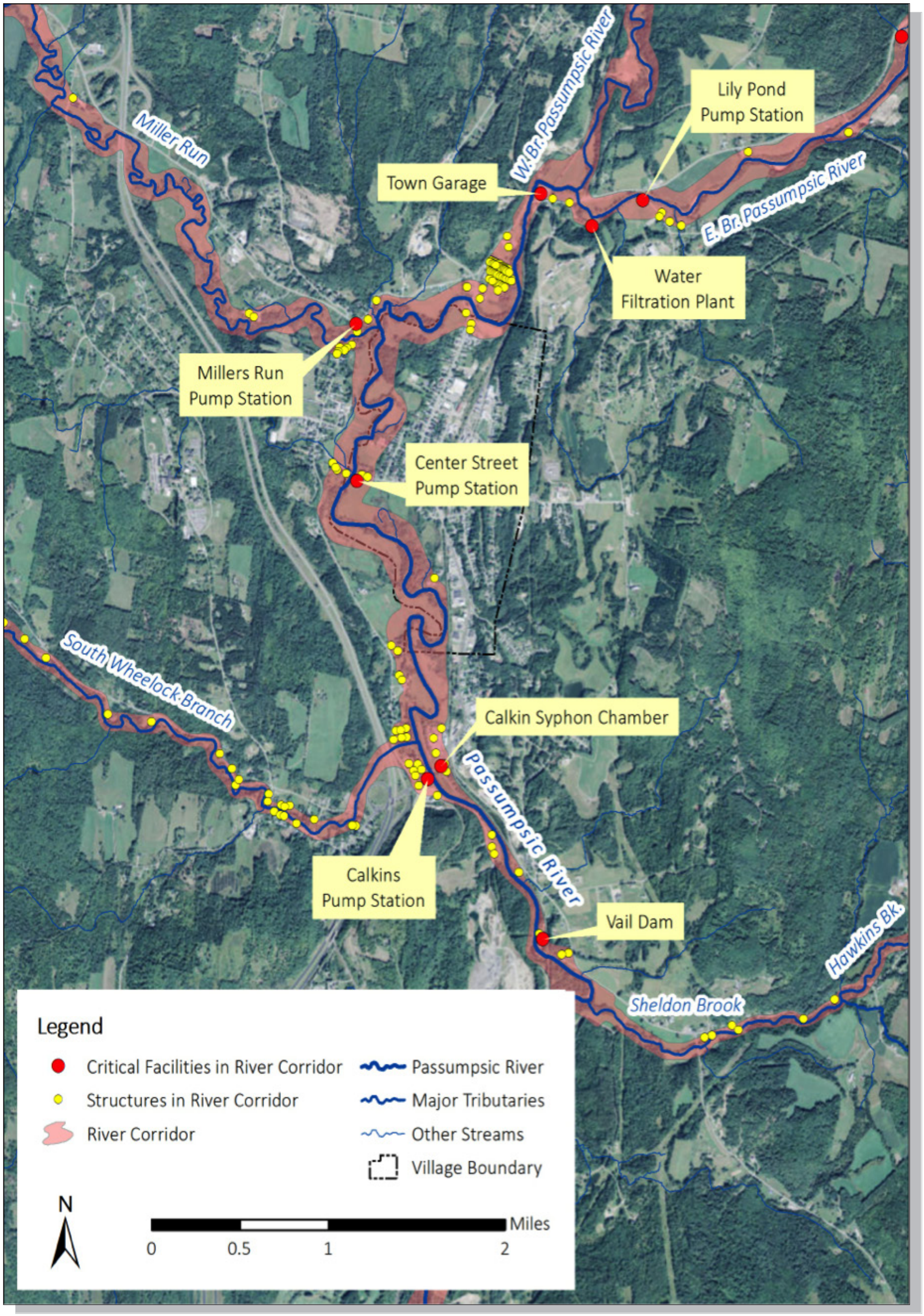


Figure 5 Close-up of River Corridors Showing Critical Facilities and Structures

Infrastructure assets that are often vulnerable to flooding hazards include road-stream crossings such as bridges and culverts. When these structures become partially or fully blocked by debris or ice jams, which has been reported to occur in the planning area, flooding may be exacerbated. In addition to many smaller road-stream crossings throughout the Town and Village, structures crossing the Passumpsic River from the confluence with the East and West Branches of the Passumpsic River to Vail Dam include the following, in upstream to downstream order:

- Canadian Pacific Railroad Bridge
- Route 114 Bridge
- Route 5 Bridge (northern Main Street Bridge)
- Covered Wooden Bridge (Sanborn Bridge)
- Footbridge
- Route 122 Bridge (Center Street Bridge)
- Route 5 Bridge (southern Chapel Street Bridge)

A complete inventory of state- and municipal-owned bridges and culverts is provided in Table 3 below and presented in Figure 6.

Table 3 Bridges and Culverts in the Planning Area

Structure Type	Number of Structures
State & Municipal Bridges (long)	42
State Bridges (short)	14
Municipal Bridges (short)	17
Municipal Culverts	1277
TOTAL	1350

Other infrastructure assets that serve as hydraulic controls are dams. A dam is any artificial barrier that can or does impound or divert water. All dams have the potential to fail, which can lead to downstream flooding due to the sudden release or surge of any impounded water. Causes of dam failure include faulty construction, improper operation, lack of maintenance, blockages, animal activity, earthquakes, vandalism, terrorism, etc.

The State of Vermont classifies dams according to their potential for causing loss of life and property damage in the area downstream of the dam if it were to fail. The Downstream Hazard Classification system is used by the State of Vermont, which is modeled after US Army Corps of Engineers guidelines. Further information relating to the Downstream Hazard Classification of Dams in Vermont provided in Table 4.

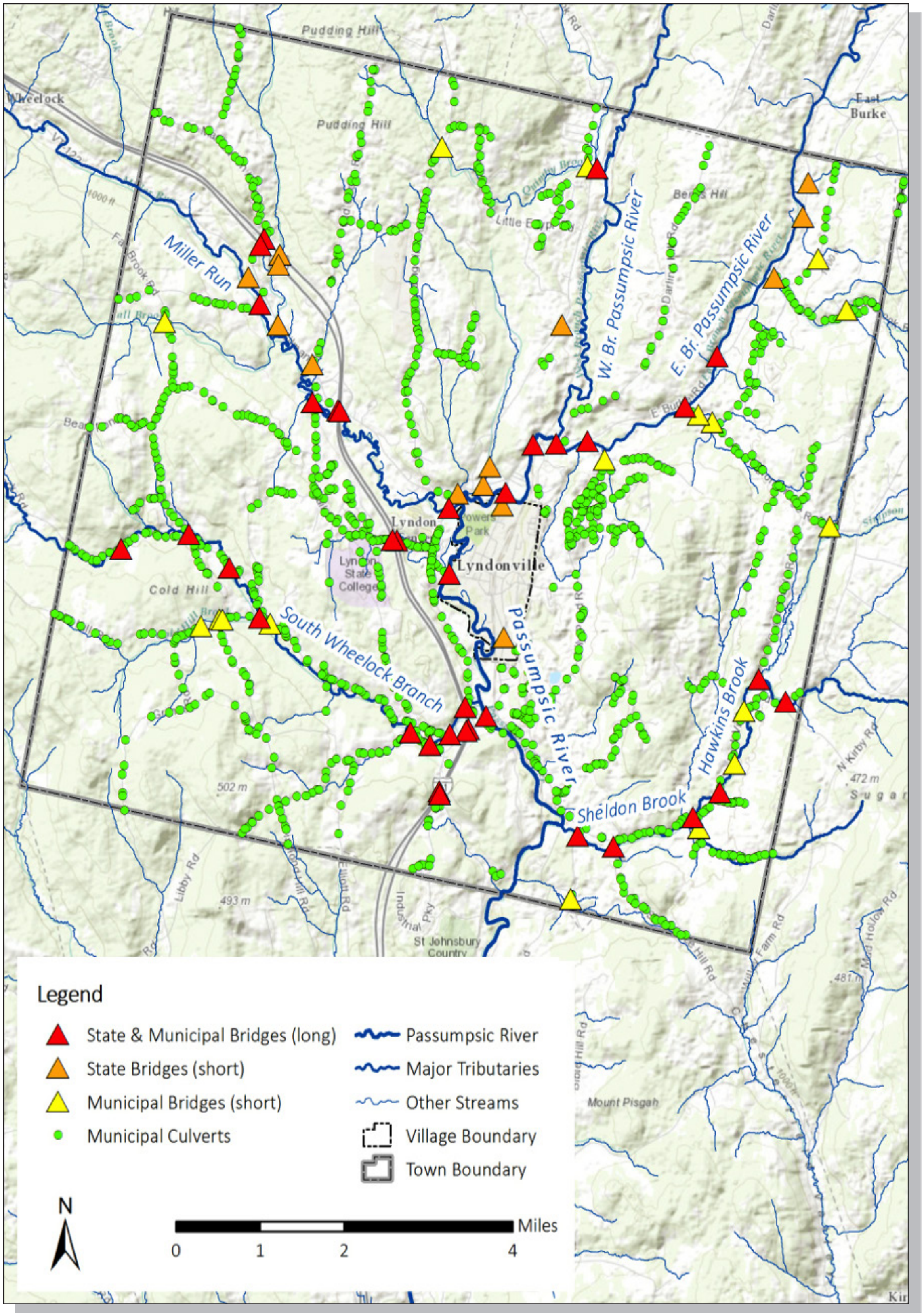


Figure 6 Municipal-Owned Bridges and Culverts

Table 4 Downstream Hazard Classification of Dams in Vermont [2]

Class	Hazard Category	Potential Loss of Life	Potential Economic Loss
3	Low	None expected (no permanent structures for human habitation)	Minimal (undeveloped to occasional structures or agriculture)
2	Significant	Few (no urban developments and no more than a small number of inhabitable structures)	Appreciable (notable agriculture, industry or structures)
1	High	More than few	Excessive (extensive community, industry or agriculture)

The State of Vermont also maintains a Vermont Inventory of Dams. Dams within the planning area listed in the database are provided in Table 5. The location and hazard classification of these dams is shown in Figure 7. The planning area is not located within mapped high-risk dam inundation areas available from the Vermont Center for Geographic Information.[3]

Table 5 Dams within the Planning Area [4]

Name	Stream	Owner	Status	Hazard Category
Fay Young Reservoir	Squabble Hollow Brook	Village of Lyndonville	In Service	Low
Great Falls	Passumpsic River	Lyndonville Elec. Dept.	In Service	Low
Ice Pond (Upper)	Miller Run Trib		In Service	Low
Ice Pond (Lower)	Miller Run Trib		In Service	Low
Institute Pond	Passumpsic River Trib	Lyndon Institute	In Service	High
Lyndon State College (Lower)	Passumpsic River Trib	Lyndon State College	Breached	N/A
Lyndon State College (Middle)	Passumpsic River Trib	Lyndon State College	In Service	Low
Lyndon State College (Upper)	Passumpsic River Trib	Lyndon State College	In Service	Significant
Lyndon-13	S. Wheelock Branch		Breached	N/A
Vail	Passumpsic River	Lyndonville Elec. Dept.	In Service	Low
Whitcomb Mill	S. Wheelock Branch			
Woodworth Reservoir	S. Wheelock Branch Trib		In Service	Low

2 Inspection of Dams. (2014). Vermont Agency of Natural Resources, Dept. of Environmental Conservation, Facilities Engineering Div., Dam Safety Section. Retrieved from http://www.anr.state.vt.us/dec/fed/damsafety/docs/inspectioninfo.pdf

3 High Risk Dam Inundation Areas. (2008). Vermont Center for Geographic Information. Retrieved from http://vcgi.vermont.gov/warehouse/theme_index

4 Vermont Dam Inventory (VDI). (2015). Vermont Center for Geographic Information. Retrieved from http://vcgi.vermont.gov/warehouse/theme_index

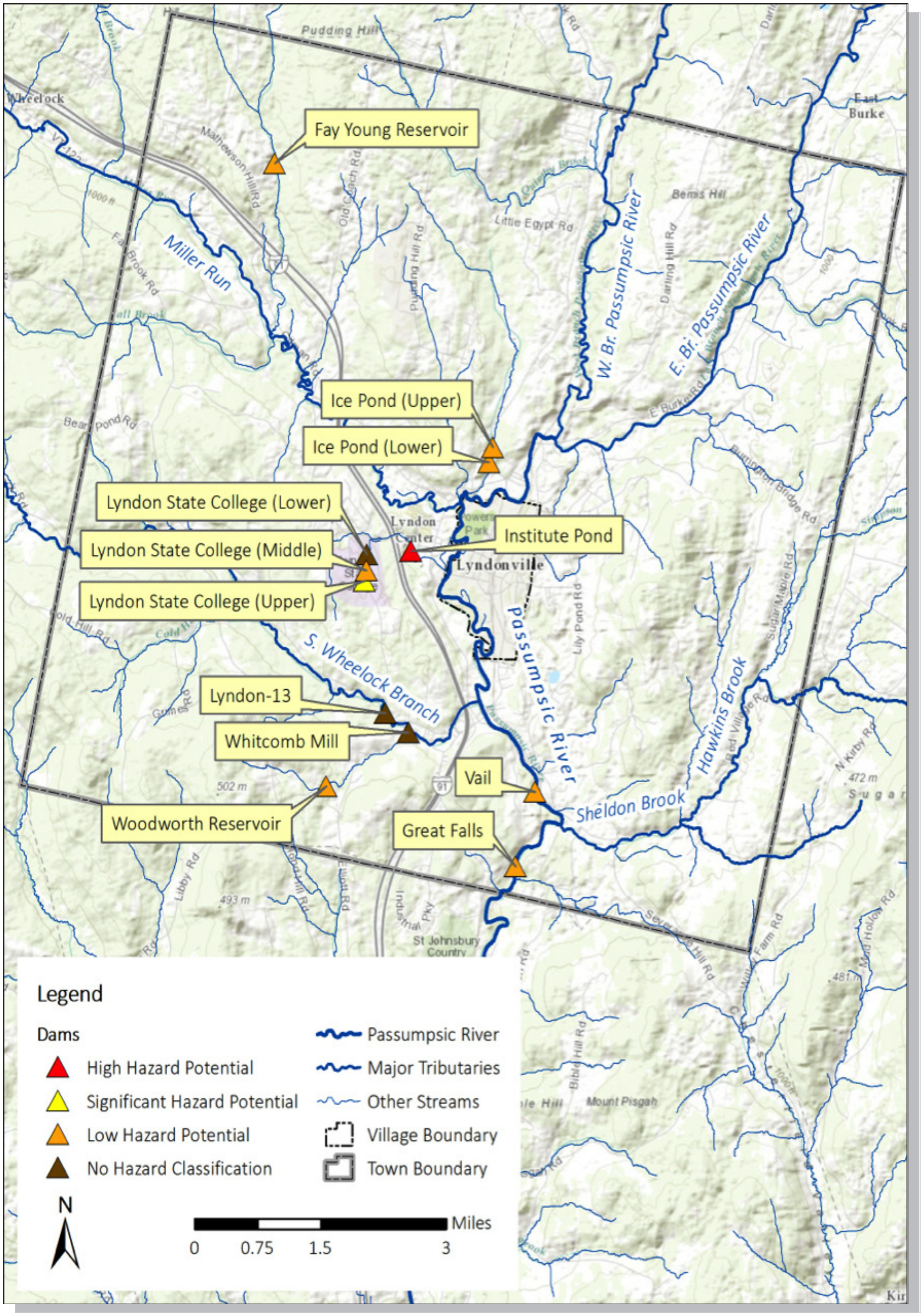


Figure 7 Dams in the Planning Area

Hazard Identification

Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii)

This section identifies the types of hazards that can affect the planning area. Based on the FEMA requirement, the study focuses on natural hazards Additionally, the study includes other secondary hazards such as man-made hazards. FEMA defines a hazard as an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.[5] Without proper mitigation of hazards these could turn into severe disasters. Therefore hazards pose risks to human life and property damage, and have the ability to limit access to electrical power, telecommunication services, potable water, wastewater collection/treatment, and transportation. Downed trees and tree limbs may also limit emergency access and hinder cleanup efforts.

In an effort to identify all of the hazards that may impact the planning area, the Planning Team reviewed the Vermont State Hazard Mitigation Plan (hereafter referred to as the State Plan) and existing town and state plans. The Planning Team also reviewed information related to hazards in the planning area and included the information as applicable. Refer to the resources section for detailed information. In addition, the consulting team worked with town residents and the Hazard Mitigation Committee to identify key stakeholders on their knowledge of past hazard events. Past weather related events were downloaded from the National Climatic Data Center for research and analysis purposes. Newspaper articles and other web sources online were reviewed as well. Table 6 shows a complete list of the Federal Disaster Declarations in Caledonia County.

Table 6 Presidential Disasters that Impacted Caledonia County, VT [6]

Disaster Name (Date of Event)	Date (Disaster Declaration)	Disaster Number (Type of Assistance)	Declared Areas
Tropical Storm Irene	9/1/2011	DR-4022	Addison, Bennington, Caledonia, Chittenden, Essex, Franklin, Lamoille, Orange, Orleans, Rutland, Washington, Windham, Windsor for PA Chittenden, Rutland, Washington, Windsor for IA
Tropical Storm Floyd	11/12/1999	DR-1307	Bennington, Caledonia, Essex, Lamoille, Orange, Orleans, Rutland, Washington, Windham, Windsor
Severe storms, tornado and flooding	8/15/2008	DR-1784	Caledonia, Grand Isle, Lamoille
Severe Storms, High Winds, Flooding	5/4/2007	DR-1698	Bennington, Caledonia, Essex, Orange, Rutland, Windham, Windsor, and Lamoille (added)
Severe storms, Flooding	8/3/2007	DR-1715	Orange, Washington, Windsor, Caledonia, Orleans

5 Local Mitigation Planning Handbook. (2013). Federal Emergency Management Agency.
6 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Disaster Name (Date of Event)	**Date (Disaster Declaration)**	**Disaster Number (Type of Assistance)**	**Declared Areas**
Severe storm, Flooding	7/12/2002	DR-1428	Caledonia, Franklin, Lamoille, Orleans, Essex
Severe storms and Flooding	7/8/11	DR-4001	Essex, Orange, Caledonia, Washington for PA Washington for IA
Severe storms and Flooding	11/08	DR-4043	Caledonia County added for PA and Washington County for IA
Severe storms and Flooding	9/15/08	DR-1790	Addison, Caledonia, Essex, Lamoille, Orange, Washington, Windsor
Severe storms and Flooding	9/23/04	DR-1559	Windham, Addison, Chittenden, Lamoille, Caledonia, Orleans, Franklin
Severe storms, Flooding	8/03/07	DR-1715	Orange, Washington, Windsor, Caledonia, Orleans
Heavy Rain; Flooding	8/16/1995	DR-1063	Caledonia, Chittenden, Essex, Lamoille, Orleans, Washington
Severe Storms	7/1/1998	DR-1228	Addison, Caledonia, Chittenden, Essex, Franklin, Lamoille, Orange, Orleans, Rutland, Washington, Windsor
Excessive Rainfall; High Winds; Flooding	4/25/1997	DR-1184	Caledonia, Franklin, Lamoille, Orleans, Washington
Ice Jams; Flooding	3/18/1992	DR-938	Caledonia, Orange, Washington, Windsor

"Between 1963 and 2012, Vermont experienced 34 federal disaster declarations. This ranks Vermont at 33 out of 59 U.S. states and territories." Among Vermont's counties that have received the most federal disaster declarations, Caledonia County ranks second after Lamoille County to the West of Caledonia County. Between 2003 and 2013, seven disasters have been declared for Caledonia and eight for Lamoille County.[7]

All of the disasters in recent years have been declared as a result of extreme weather conditions. Historically, flooding and flash flooding have caused the most disaster-related damage in Vermont. Most of the declared disasters were the result of suffering caused by flood damage. Table 7 shows the identified hazards in the planning area.

7 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Table 7 Hazard Identification for the Town of Lyndon, VT and the Village of Lyndonville, VT

Hazard	Justification for Inclusion	Included in State Plan?
	FLOOD HAZARDS	
Flooding and Fluvial Erosion	Flooding has historically impacted the planning area. It causes property damage and may cause loss of life. It also impacts infrastructure such as roadways.	Yes
Flash Flooding	A sudden heavy downpour can cause flooding.	Yes – part of flooding
Dam Breach Flooding	Dam breaches have the potential to flood properties in the spillway and endanger lives.	Yes – Dam Failure
	WIND HAZARDS	
Hurricanes	Tropical Storm Irene impacted the planning area in 2011. Hurricanes or tropical storms can result in wind damage, tornadoes, and flooding.	Yes
Microburst	A short-lasting but intense wind event capable of producing tornado-like damage. Microbursts can endanger population and structures.	No
Tornadoes	Tornadoes pose a significant risk because buildings may not be built to withstand severe winds in this part of the country.	Yes
	WINTER HAZARDS	
Blizzard	Blizzards are an expected type of winter storm that pose a risk to the population and structures due to power failure, car accidents, and stranding.	Yes (winter storms)
Hail	Hail is typically associated with thunderstorms and is capable of causing extensive property damage (especially to roofs) and vehicular damage.	Yes
Ice Jams	Ice jams typically occur every 3 years and may result in flooding.	Yes
Ice Storms	Ice storms are an expected type of winter weather that pose a risk to the population and structures due to power failure, car accidents, and stranding. They are also known to produce vegetative debris due to fallen limbs.	Yes (winter storms)
Nor'easter	Nor'easters are an expected type of winter storm that poses a risk to the population and structures due to power failure from strong wind.	No
Snow Events	Snow is a common occurrence in the winter months in New England. It poses a risk to the population and structures due to power failure, car accidents, and stranding.	Yes
Extreme Cold	Extreme cold can become a hazard, particularly for vulnerable populations, if the power is disrupted or the event lasts several days. It may also result in hypothermia or frostbite due to exposure.	Yes
	FIRE HAZARDS	
Drought	Drought typically occurs in the summer months and can result in water restrictions and an increased fire hazard.	Yes
Wildfire	There is no history of natural fire events. However this hazard was investigated since it is listed in the State Plan.	Yes
Lightning	Lightning can result in death and injury. It is frequently associated with thunderstorms.	No

Hazard	Justification for Inclusion	Included in State Plan?
	GEOLOGICAL HAZARDS	
Earthquake	Earthquakes are possible in this area and may cause damage to structure and injury or death to the population.	Yes
Landslide	Landslides have not historically impacted the area but are included in the State Plan and are considered possible.	Yes
	OTHER POTENTIAL HAZARDS	
Extreme Heat and Heat Wave	Extreme heat can become a hazard, particularly for vulnerable populations, if the power is disrupted or the event lasts several days. Heat can result in a variety of health conditions including heat stroke.	Yes
Water Supply Contamination	Pollutants introduced into the ground and/or surface water can cause contamination.	No
Hazardous Materials (HAZMAT)	HAZMAT incidents are a concern given nearby interstate I-91 (within 0.6 mile) just west of the planning area boundary and the freight rail line that runs through the planning area.. HAZMAT incidents from companies in and near the planning area may also pose a threat. HAZMAT may impact the surrounding land, air or water supply. However, it should be noted that non-natural hazards are outside the scope of this plan and typically planned for in a separate planning effort.	No
Invasive Species	Invasive species may destroy crops resulting in economic damage. They may also pose a direct threat to human health.	Yes

Priority Risk Index

The prioritization and categorization of identified hazards for the planning area is based principally on the Priority Risk Index (PRI), which is a tool used to measure the degree of risk for identified hazards in a particular planning area. These hazards were chosen based on a variety of factors including location, extent, impact, probability, warning time, and duration.

The PRI results provide a numerical value for each hazard that allows hazards to be ranked against one another; the higher the PRI value, the greater the hazard risk. PRI values are obtained by assigning varying degrees of risk to five categories for each hazard; 1) probability, 2) impact, 3) spatial extent, 4) warning time, and 5) duration. Each degree of risk has been assigned a value from 1 to 4 and a predetermined weighting factor. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20)
+ (WARNING TIME x .10) + (DURATION x .10)]

The scoring criteria and weighting scheme of the priority risk index are shown in Table 8. According to the applied weighting scheme, the highest possible PRI value is 4.0. Table 8 lists the weighting schemes for each category. By determining a value for each hazard that can be relatively compared to other hazards threatening the planning area, hazards can be ranked with greater ease.

Many of the PRI categories are described within the hazard profiles. The final PRI results, including the calculated values for each natural hazard in Lyndon, are found at the end of this section titled "Summary of Hazard Risk." It should be recognized that not all hazards pose a serious threat to the planning area, and the PRI is helpful in summarizing the potential risk.

Table 8 Priority Risk Index Scoring Criteria

PRI Category	DEGREE OF RISK			Assigned Weighting Factor
	Level	**Criteria**	**Index Value**	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 90% annual probability	3	
	Highly Likely	90%+ annual probability	4	
Impact	Minor	Only minor property damage and minimal disruption to government functions and services. No shutdown of critical facilities.	1	30%
	Limited	Minor injuries are possible. More than 10% of buildings damaged or destroyed. Temporary shutdown of critical facilities (less than one week).	2	
	Critical	Multiple deaths/injuries possible. More than 25% of buildings damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of buildings damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Limited to one specific area of one campus	1	20%
	Small	Small areas affected	2	
	Moderate	Large areas / multiple campuses affected	3	
	Large	All areas / all campuses affected	4	
Warning Time	More than 24hrs	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

Hazard Profiles

Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii)

Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)

Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)

Each hazard mentioned in Table 7 is profiled separately to describe the hazard and its potential impacts on the planning area. The profile for each hazard includes:

- Hazard description: A scientific explanation of the hazard including potential magnitude (or severity) and impacts;
- Location: Geographical extent of the hazard;
- Previous occurrences: The number of previous hazard events occurring in the planning area (or surrounding area). This section also details previous events including past impacts;
- Extent (or magnitude): The severity of the hazard in the past and potentially severity in the future. Measures may include wind speed, wave height, or property damage, for example;
- Probability of future events: The likelihood of future events impacting the planning area. Given that an exact probability is often difficult to quantify, this characteristic is categorized into ranges to be used in hazard profiles in accordance with the PRI described above:
  - o Unlikely: Less than 1% annual probability
  - o Possible: Between 1% and 10% annual probability
  - o Likely: Between 10+% and 90% annual probability
  - o Highly Likely: Greater than 90% annual probability
- Vulnerability Assessment: The vulnerability assessment will address conditions that may increase or decrease vulnerability such as topography, soil type, land use, and development trends will also be included.
- Potential Losses: Estimated losses will be calculated using available data and resources. Methods utilized include GIS analysis and hazard modeling where tools are available. Information such as number of structures at risk and critical facilities at risk will be analyzed.

In addition, each hazard addresses the impacts of climate change. In most cases, this trend is expected to exacerbate existing hazards.

The next section provides hazard profiles for each identified hazard for the planning area of Lyndon and Village of Lyndonville. Hazards are presented in six overarching categories:

1. Flood hazards
2. Wind hazards
3. Winter hazards
4. Fire Hazards
5. Geologic Hazards
6. Other Potential Hazards

Flood Hazards

Hazard Description

The National Oceanic and Atmospheric Administration (NOAA) and National Weather Service (NWS) defines a flood as the inundation of a normally dry area caused by rising water in an existing waterway, such as a river or stream, and notes that flooding is a longer term event that may last days or weeks.[8]

A flash flood is defined as a flood caused by heavy or excessive rainfall in a short period of time, generally within a time period of less than six hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through river beds, urban streets, or mountain valleys. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam.

Flooding is the most common recurring hazard event in the State of Vermont and one of the most common natural hazards in the US. There are three main types of flooding that occur in Vermont: flooding from rain or snowmelt, flash flooding, and urban flooding. The effects of all types of flooding events can be worsened by ice or debris jams or the failure of infrastructure including bridges, culverts, and dams as well as beaver dams.[9]

Flood damages are associated with both inundation and fluvial erosion hazards (FEH). Fluvial erosion refers to streambed and streambank erosion, often associated with catastrophic physical adjustment of stream channel dimensions (width and depth) and location that can occur during flooding. More than 75 percent of monetary flood damages in Vermont are associated with fluvial erosion. These events may result in widespread damage in river floodplains or localized flash flooding caused by unusually large rainstorms over a small area.2

Primary causes of flooding within the planning area include the following[10]:

- Precipitation and the associated volume of runoff from the watershed area that drains into the rivers and streams
- Historic human disturbances, including channel dredging, berming, straightening, and encroachment, which have led to changes in river channel morphology in upstream tributaries and associated sediment deposition, fluvial erosion, and flooding impacts downstream
- Land use development along river corridors, particularly the conversion of forest and wetlands to urban development
- Hydraulic controls such as bridges, culverts, dams, and natural grade controls (e.g., bedrock outcrops), particularly when blocked by debris or ice jams

8 National Weather Service Glossary. (2015). National Oceanic and Atmospheric Administration, National Weather Service. Retrieved from http://w1.weather.gov/glossary/index.php

9 State of Vermont Hazard Mitigation Plan. (2013). Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. Retrieved from http://vem.vermont.gov/sites/vem/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP_scrubbed_cleanedMCB.pdf

10 Passumpsic River Flood Mitigation Study. (2006). Weare, NH: Gomez and Sullivan Engineers. Retrieved from http://caledoniadistrict.org/wp-content/uploads/2014/08/Vol-1-Final-Report.pdf

Location

The Town of Lyndon and Village of Lyndonville are located in the Passumpsic and Upper Connecticut River Tactical Basin, within the subwatersheds of Millers Run, West Branch Passumpsic River, East Branch Passumpsic River, Passumpsic River, and the Sleepers River. The Village of Lyndonville lies in the flat valley floor adjacent to the Passumpsic River just downstream of where its three major tributaries (Millers Run, the West Branch of the Passumpsic River, and the East Branch of the Passumpsic River) empty into the main stem, resulting in an increased vulnerability for flooding.[11]

The Federal Emergency Management Agency (FEMA) conducts Flood Insurance Studies (FIS) and develops accompanying Flood Insurance Rate Maps (FIRMs) to determine the extents of the flood inundation area for the 1% annual chance exceedance flood (also referred to as the 100-year flood or base flood), which is estimated to have a 1% chance of occurring in any given year. The flood inundation area, or floodplain, corresponding to the base flood and depicted on the FIRM is known as the Special Flood Hazard Area (SFHA). The 0.2% annual chance exceedance (500-year) flood is also typically mapped on the FIRM.

The Town of Lyndon's FIS was originally published in 1977 and updated in 1988. Although map amendments have been made over the years to incorporate specific development projects, a comprehensive re-mapping of the flood hazard area has not yet been conducted. Areas within the FEMA-mapped SFHA are shown in Figures 2 and 3[12] and include a large portion of the Village of Lyndonville, where the main stem of the Passumpsic flows. This includes most of the land between Route 5 on the east, Back Center and Center Streets on the west, and Route 122 on the north. Areas adjacent to Millers Run, the East and West Branches of the Passumpsic River, Wheelock Brook, and Sheldon Brook/Hawkins Brook are also mapped as SFHAs by FEMA.

It is important to note that not all flood hazard areas within the Town of Lyndon are identified on the FIRM. Identified flood hazard areas vary in the level of accuracy with which they've been delineated, and flood hazards change over time. Consequently, all development and infrastructure located in floodplains and other areas where water may accumulate within the Town are potentially vulnerable to the flood hazard, regardless of inclusion on the FIRM.

Additionally, while flood inundation area, as depicted on the FIRMs, is a significant component of flood disasters, the predominant mode of flood damage in Vermont is due to fluvial erosion hazards. The FIRMs published by FEMA do not consider FEH. The Vermont Agency of Natural Resources[13] has been working with towns to identify and map river corridors and implement protection strategies designed to mitigate FEH. The river corridor map shows the area a river needs to accommodate equilibrium conditions, specifically the meanders (stream length) and slope requirements of a stable stream channel. It also shows the land most vulnerable to erosion from flooding. Preventing further encroachment into the river corridor will minimize fluvial erosion hazards and property loss from flooding, enhance public safety, maximize channel stability, and maintain or improve water quality and habitat function).[14] VANR recently posted a base map of statewide river

11 Lyndon Town Plan. (2015). Lyndon, VT. Available from http://www.lyndonvt.org/LyndonTownPlan_Adopted02_09_2015.pdf

12 Figures are provided on pages 60 and 61.

13 Mitigating Flood-Related Fluvial Erosion Hazards (FEH) Using River Corridor Protection Factsheet. Vermont Agency of Natural Resources, Department of Environmental Conservation, River Management Program. Retrieved from http://www.watershedmanagement.vt.gov/rivers/docs/nfip/rv_Mitigating_Flood_Related_FEH_Using_CP_Fact_Sheet.pdf

14 Mitigating Flood-Related Fluvial Erosion Hazards (FEH) Using River Corridor Protection Factsheet. Vermont Agency of Natural Resources, Department. of Environmental Conservation, River Management Program. Retrieved from http://www.watershedmanagement.vt.gov/rivers/docs/nfip/rv_Mitigating_Flood_Related_FEH_Using_CP_Fact_Sheet.pdf

corridors online at the Flood Ready Atlas. A map of delineated river corridors within the Town of Lyndon is shown in Figures 4 and 5.[15]

Streets in the Town of Lyndon that are susceptible to flooding include portions of Broad Street, South Wheelock Road, Red Village Road, Center Street, Calendar Brook Road, Severance Hill Road, Mathewson Hill Road, Back Center Road, Fall Brook Road, Hubbard Hill Road, Vail Drive, Urie Drive, Lily Pond Road, Burrington Bridge Road, Sugar Maple Road, Cold Hill Road, York Street, Elliott Street, Boston Street, Brown Farm Road, New Boston Road, and Sheldon Brook Road.[16] A map highlighting portions of these streets within either the SFHA or the river corridor (described below) is provided in Figure 8.

Extent

The geographic extent of flood hazards within the Town of Lyndonville includes areas adjacent to the Passumpsic River and its major tributaries, including a large portion of the Village of Lyndonville. In addition to mapped inundation areas, the depth of flow in rivers and streams can provide information about the extent of flood hazards. The US Geological Survey (USGS) maintains river gages that measure streamflow and stage height (water depth), which are used in forecasting river conditions and flood hazards. The NWS defines the following flood categories for each gage location that describe the expected severity and extents of flood impacts in nearby streams.[17]

- **Action Stage** – The stage at which some type of mitigation action should be taken in preparation for possible significant hydrologic activity.
- **Flood Stage** – The established gage height for a given location above, which a rise in water surface level begins to create a hazard to lives, property, or commerce. The issuance of flood advisories or warnings is linked to flood stage.
- **Minor Flooding** – The stage at which minimal or no property damage, but possibly some public threat is expected. A Flood Advisory is issued to advise the public of flood events that are expected not to exceed the minor flood category.
- **Moderate Flooding** – The stage at which some inundation of structures and roads near the stream may occur, and some evacuations of people and/or transfer of property to higher elevations may be necessary. A Flood Warning is issued if moderate flooding is expected during the event.
- **Major Flooding** – The stage at which extensive inundation of structures and roads will occur. Significant evacuations of people and/or transfer of property to higher elevations are necessary. A Flood Warning is issued if major flooding is expected during the event.

The closest gage for the planning area is Gage No. 01133000 on the East Branch of the Passumpsic River near East Haven, VT, with a drainage area of 53.8 square miles, which has been operating intermittently since 1928. Although this gage does not include flow from the two other major tributaries of the Passumpsic River (the West Branch of the Passumpsic River and Miller Run), it provides the best available data for predicting flood hazards in the planning area.

Gage No. 01135500 is located well downstream on the Passumpsic River near Passumpsic, VT, but several

15 Vermont Flood Ready Atlas. (2015). Vermont Agency of Natural Resources, Department of Environmental Conservation. Retrieved from http://floodready.vermont.gov/assessment/vt_floodready_atlas

16 Lyndon Town Plan. (2015). Lyndon, Vermont. Retrieved from http://www.lyndonvt.org/LyndonTownPlan_Adopted02_09_2015.pdf

17 National Weather Service Glossary. (2015). National Oceanic and Atmospheric Administration, National Weather Service. Retrieved from http://w1.weather.gov/glossary/index.php

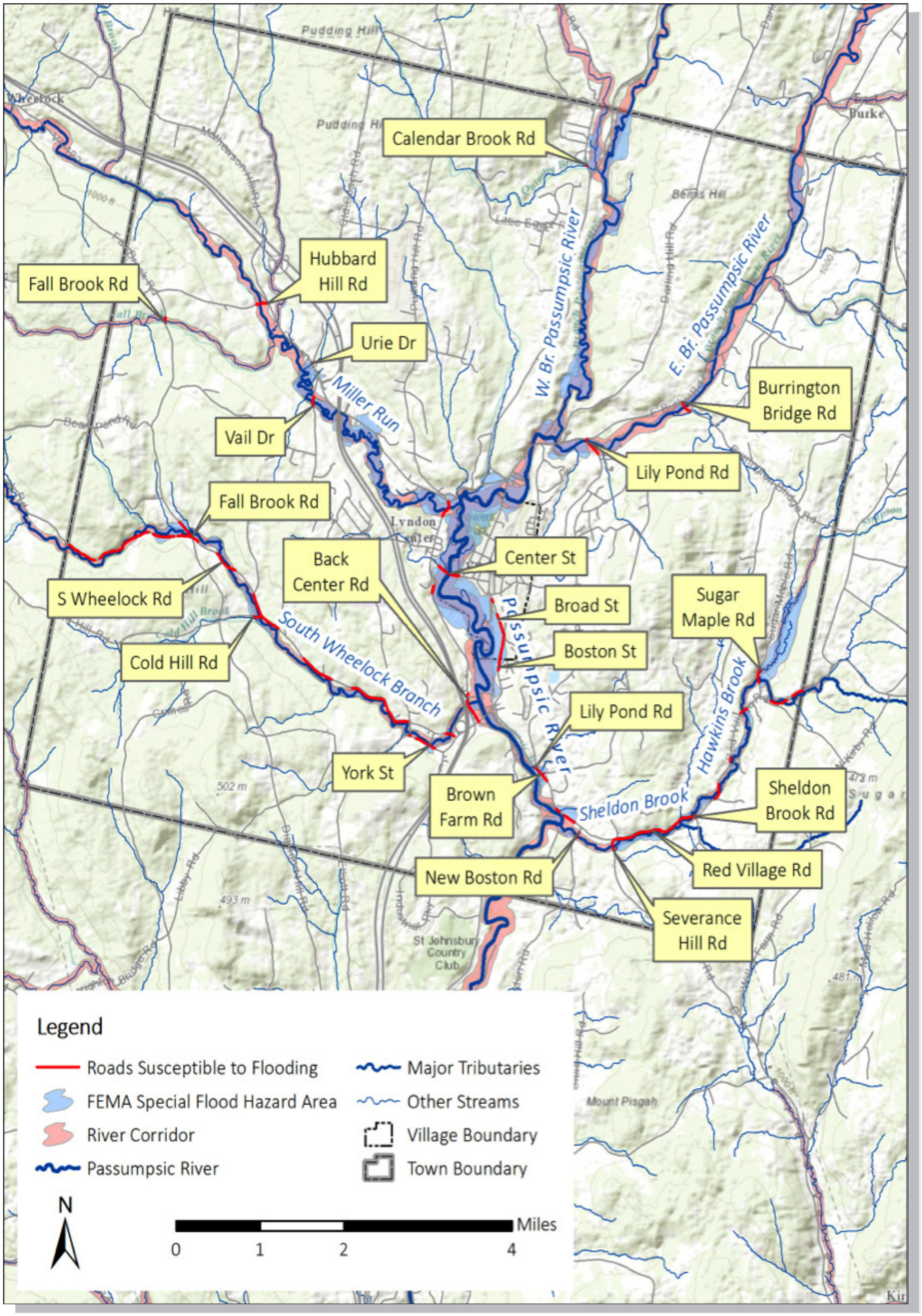


Figure 8 Streets Susceptible to Flooding

hydropower dams located between Vail Dam and the gage can impact the timing and magnitude of flows recorded at the gage, so it is not as useful in predicting flood hazards.

The NWS Advanced Hydrological Prediction Service provides the following information on the extents of flooding downstream of the East Branch of the Passumpsic River gage in the Town of Lyndon based on various stage heights observed at the gage[18]:

- **Action Stage (6 feet)** – At 6 feet, field flooding will occur north of the Village of Lyndonville near the confluence of the East and West Branches of the Passumpsic River and Miller Run. Water flowing out of the ungaged Miller Run or West Branch of the Passumpsic River may cause minor road flooding on the north side of the Village of Lyndonville where none is indicated by the East Branch gage, especially if Miller Run and West Branch basins receive more rainfall.
- **Flood Stage (6.5 feet)** – At 6.5 feet, flooding will begin downstream on the north side of the Village of Lyndonville. Low lying fields will flood, and water will begin to threaten the Northeast Kingdom Mobile Home Park on Route 114 north of the Village of Lyndonville. However, a berm has been built to protect the trailer park at minor flood stage. Water may approach low lying areas of Routes 5, 114, and 122 and Stevens Loop Road at the confluences of Miller Run and the East and West Branches of the Passumpsic River north of the Village of Lyndonville.
- **7.5 feet** – At 7.5 feet, water will cover Routes 114, 122, and 5 and Stevens Loop Road. Widespread field flooding will occur. Water may threaten the Northeast Kingdom Mobile Home Park, but the flood control berm near the trailer park may still protect it. At this stage, Route 5 between the Village of Lyndonville and Saint Johnsbury Center usually will not flood.
- **Moderate Flood Stage (8.5 feet)** – At 8.5 feet, the Northeast Kingdom Mobile Home Park will flood and evacuations may be necessary. Flooding will occur on roads and bridges, including Routes 122, 114, and 5 and Stevens Loop Rood. Portions of Route 5 downstream between the Village of Lyndonville and Saint Johnsbury Center may flood at this stage.
- **Major Flood Stage (10 feet)** – At 10 feet, widespread flooding will occur downstream in the Village of Lyndonville. Homes and businesses on Route 5 along the Passumpsic River from the Village of Lyndonville to Saint Johnsbury will be inundated. Flooding will be similar to Tropical Storm Irene in August 2011 and events occurring on June 12, 2002 and July 1, 1973. Although measurements of Tropical Storm Irene are not available within Lyndon, measurements taken in nearby towns range from 3.55 inches in less than 36 hours at East Haven, VT to 4.92 inches in less than 24 hours at Saint Johnsbury, VT.

Previous Occurrences

Various sources were consulted to collect data on previous occurrences of flooding, including:

- Lyndon Town Plan – FEMA Public Assistance to Lyndon 2002-2014[19]
- Vermont Hazard Mitigation Plan – Significant Flood Events in Caledonia County 2002-2012[20]
- FEMA Disaster Declarations for Caledonia County 2002-2015[21]

18 River Forecast Data for East Branch of the Passumpsic River at East Haven (EHVV1). (2015). National Oceanic and Atmospheric Administration, National Weather Service, Advanced Hydrological Prediction Service. Retrieved from http://www.water.weather.gov/ahps2/hydrograph.php?wfo=btv&gage=ehvv1

19 Lyndon Town Plan. (2015) Lyndon, VT. Retrieved from http://www.lyndonvt.org/LyndonTownPlan_Adopted02_09_2015.pdf

20 State of Vermont Hazard Mitigation Plan. (2013). Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. Retrieved from http://vem.vermont.gov/sites/vem/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP_scrubbed_cleanedMCB.pdf

21 Disaster Declarations. (2015). Federal Emergency Management Agency. Retrieved from https://www.fema.gov/disasters

- NOAA National Climatic Data Center (NCDC) Storm Events Database 1950-2015[22]
- NOAA NWS Historic Crests for East Branch of the Passumpsic River at East Haven 1927-2015[23]
- US Army Corps of Engineers (USACE) Cold Regions Research and Engineering Laboratory (CRREL) Ice Jam Database[24]

Summary tables of previous flooding events compiled from each source are provided below.

Table 9 FEMA Public Assistance to the Town of Lyndon or Village of Lyndonville, VT (2002-2014)[25]

Disaster Declaration Date	Incident Type	Applicant Name	Number of Projects	Federal Share Obligated
7/12/2002	Severe Storm(s)	Lyndon (Town)	10	$217,043
7/12/2002	Severe Storm(s)	Lyndonville (Village)	7	$16,810
5/4/2007	Severe Storm(s)	Lyndon (Town)	1	$10,341
5/4/2007	Severe Storm(s)	Lyndonville Electric Dept.	2	$80,148
7/8/2011	Severe Storm(s)	Lyndon (Town)	13	$62,785
9/1/2011	Hurricane	Lyndon (Town)	10	$33,963

Table 10 Significant Flood Events in Caledonia County, VT (2002-2012)[26]

Begin Date	End Date	Remarks	Property Damage*
4/13/2002	4/14/2002		$25,060
6/12/2002	6/13/2002		$29,759
10/27/2003	10/28/2003		$6,190
4/3/2005	4/3/2005	Flood	$5,778
1/18/2006	1/19/2006	Flood	$28,261
5/16/2007	5/16/2007	Flood	$21,895
7/11/2007	7/11/2007	Flash Flood	$273,684
4/29/2008	4/30/2008	Flood	$26,263
8/6/2008	8/6/2008	Flash Flood	$52,525
7/24/2008	7/24/2008	Flood	$10,505
3/8/2008	3/9/2008	Flash Flood	$210,101
10/1/2010	10/1/2010		$104,000
3/23/2010	3/23/2010		$2,080

*Adjusted for inflation to 2013.

22 Storm Events Database. (2015). National Oceanic and Atmospheric Administration, National Climatic Data Center. Retrieved from http://www.ncdc.noaa.gov/stormevents/

23 River Forecast Data for East Branch of the Passumpsic River at East Haven (EHVV1). (2015). National Oceanic and Atmospheric Administration, National Weather Service, Advanced Hydrological Prediction Service. Retrieved from http://www.water.weather.gov/ahps2/hydrograph.php?wfo=btv&gage=ehvv1

24 Ice Jam Database. (2015). Hanover, NH: US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Ice Engineering Research Group. Retrieved from https://rsgisias.crrel.usace.army.mil/apex/f?p=524:1:

25 Lyndon Town Plan. (2015). Lyndon, VT. Retrieved from http://www.lyndonvt.org/LyndonTownPlan_Adopted02_09_2015.pdf

26 State of Vermont Hazard Mitigation Plan. (2013). Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. Retrieved from http://vem.vermont.gov/sites/vem/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP_scrubbed_cleanedMCB.pdf

Table 11 FEMA Disaster Declarations for Flooding in Caledonia County, VT (2002-2015) [27]

ID	Begin Date	End Date	Disaster Type	Total Public Assistance (Statewide)
DR-4178	4/15/2015	4/18/2015	Severe Storms and Flooding	$1,689,907
DR-4140	6/25/2013	7/11/2013	Severe Storms and Flooding	$5,419,702
DR-4022	8/27/2011	9/2/2011	Tropical Storm Irene	$209,977,294
DR-4001	5/26/2011	5/27/2011	Severe Storms and Flooding	$10,593,641
DR-1790	7/21/2008	8/12/2008	Severe Storms and Flooding	$4,570,892
DR-1784	7/18/2008	7/18/2008	Severe Storms, Tornado, and Flooding	$449,483
DR-1715	7/9/2007	7/11/2007	Severe Storms and Flooding	$4,905,985
DR-1698	4/15/2007	4/21/2007	Severe Storms and Flooding	$3,563,487
DR-1559	8/12/2004	9/12/2004	Severe Storms and Flooding	$2,348,738
DR-1428	6/5/2002	6/13/2002	Severe Storms and Flooding	$1,788,584

*Older disaster declarations are listed for Vermont going back to 1964, but county-specific information is not available.

Table 12 Storm Events in Caledonia County (1950-2015) [28]

Begin Location	End Location	Begin Date	Event Type	Property Damage	Flooding Cause
South Peacham	Wheelock	4/15/2014	Flood	$350,000	Heavy Rain / Snow Melt
Lyndonville	Brown Arpt	1/12/2014	Flood	$2,000	Ice Jam
East Hardwick	East Hardwick	1/11/2014	Flood	$1,000	Ice Jam
Lyndonville Arpt	Lyndon	12/22/2013	Flash Flood	$15,000	Ice Jam
East Burke	East Ryegate	8/28/2011	Flood	$4,000,000	Heavy Rain
Danville	East Peacham	5/30/2011	Flash Flood	$75,000	Heavy Rain
Ricker Mills	East Ryegate	5/26/2011	Flash Flood	$2,500,000	Heavy Rain
Sheffield	Passumpsic	4/27/2011	Flood	$750,000	Heavy Rain / Snow Melt
Egypt	East Lyndon	4/11/2011	Flood	$5,000	Heavy Rain / Snow Melt
St Johnsbury	St Johnsbury	3/13/2011	Flood	$10,000	Ice Jam
South Wheelock	St Johnsbury Ctr	3/6/2011	Flood	$0	Ice Jam
Lyndon Center	Lyndon	10/1/2010	Flood	$100,000	Heavy Rain
Lyndon Center	Lyndonville	3/23/2010	Flood	$2,000	Heavy Rain / Snow Melt

27 Disaster Declarations. (2015). Federal Emergency Management Agency. Retrieved from https://www.fema.gov/disasters
28 Storm Events Database. (2015). National Oceanic and Atmospheric Administration, National Climatic Data Center. Retrieved from http://www.ncdc.noaa.gov/stormevents/

Begin Location	End Location	Begin Date	Event Type	Property Damage	Flooding Cause
Barnet Center	St Johnsbury	8/6/2008	Flash Flood	$50,000	Heavy Rain
Lyndon Center	Lyndon Center	7/24/2008	Flood	$10,000	Heavy Rain
Lyndon Center	Lyndonville	4/29/2008	Flood	$25,000	Heavy Rain / Snow Melt
East Burke	East Burke	3/8/2008	Flash Flood	$200,000	Ice Jam
Hardwick	Hardwick	7/11/2007	Flash Flood	$250,000	Heavy Rain
Stannard	Stannard	5/16/2007	Flood	$20,000	Heavy Rain
		1/18/2006	Flood	$25,000	
		4/3/2005	Flood	$5,000	
		10/27/2003	Flood	$5,000	
		3/29/2003	Flood	$0	
		6/12/2002	Flood	$50,000	ASOS*
		4/13/2002	Flood	$20,000	
		4/24/2001	Flood	$1,000	
		12/18/2000	Flood	$5,000	
Countywide	Countywide	12/17/2000	Flash Flood	$100,000	
Lyndonville	Lyndonville	5/11/2000	Flash Flood	$5,000	
South Portion	South Portion	4/4/2000	Flash Flood	$1,000	
South Portion	South Portion	8/11/1998	Flash Flood	$1,000,000	
Ricker Mills	Ricker Mills	6/29/1998	Flash Flood	$5,000	
Countywide	Countywide	4/1/1998	Flash Flood	$5,000	
Countywide	Countywide	3/31/1998	Flash Flood	$10,000	
Countywide	Countywide	1/8/1998	Flash Flood	$5,000	
Countywide	Countywide	7/15/1997	Flash Flood	$500,000	
		7/3/1996	Flood	$15,000	
		4/27/1996	Flood	$5,000	
		1/19/1996	Flood	$25,000	

*ASOS: Automated Surface Observing System

Table 13 Historical Crests for East Branch Passumpsic River Gate (1927-2014) [29]

Crest Date	Crest Stage (ft)	Flood Category
11/4/1927	12.6	Major Flood
6/30/1973	11.45	Major Flood
6/12/2002	10.65	Major Flood
8/29/2011	9.76	Moderate Flood
4/27/2011	9.09	Moderate Flood
4/16/2014	8.93	Moderate Flood

29 River Forecast Data for East Branch of the Passumpsic River at East Haven (EHVV1). (2015). National Oceanic and Atmospheric Administration, National Weather Service, Advanced Hydrological Prediction Service. Retrieved from http://www.water.weather.gov/ahps2/hydrograph.php?wfo=btv&gage=ehvv1

Crest Date	Crest Stage (ft)	Flood Category
12/18/2000	8.47	Moderate Flood
5/11/2000	8.36	Moderate Flood
8/4/2010	8.31	Moderate Flood
12/21/1973	8.18	Moderate Flood
10/1/2010	7.9	Moderate Flood
4/1/1976	7.62	Moderate Flood
4/24/2001	7.49	Minor Flood
3/31/1998	7.38	Minor Flood
8/17/1977	7.36	Minor Flood
9/17/1999	7.28	Minor Flood
4/20/2013	7.24	Minor Flood
5/25/2013	7.23	Minor Flood
4/23/1954	7.2	Minor Flood
10/17/2005	7.17	Minor Flood
3/29/2003	6.85	Minor Flood
4/12/2011	6.58	Minor Flood
10/28/2003	6.43	Action Stage
4/24/2007	6.38	Action Stage
4/18/1960	6.28	Action Stage
5/4/1972	6.25	Action Stage
5/28/1940	6.2	Action Stage
9/1/2005	6.14	Action Stage
4/4/2000	6.07	Action Stage

Table 14 Historical Ice Jam Data for the Planning Area [30]

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
1/12/2014	Lyndonville	Passumpsic River	44.54408888	-72.00068333		A jam caused flooding on Rt 122 at the junction of Rts 5 and 114. The AOT list noted that there was also a jam in Lyndon on the East Branch of the Passumpsic near the covered bridge.	2014011 6081941

30 Ice Jam Database. (2015). Hanover, NH: US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Ice Engineering Research Group. Available from https://rsgisias.crrel.usace.army.mil/apex/f?p=524:1:

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
12/22/2013	Lyndonville	East Branch Passumpsic River	44.54888888	-71.99555555		A breakup ice jam in Lyndonville resulted in a rapid rise of water levels on the East Branch of the Passumpsic River in Lyndonville. The Lyndonville Fire Station served as a temporary shelter for residents who were evacuated from a mobile home park on Rt 114. The hydrographs upstream and downstream of Lyndonville 12/26/13 were well below flood stage. In addition, there were no other sites flooding in the state at that time.	2013122 3173509
1/31/2013	Lyndonville	Passumpsic River	44.53333333	-72.00361111		A midwinter thaw with record-breaking temperatures and rain across central and northeastern states January 29-31, 2013 resulted in numerous breakup jams across the region. Ice jams continued along the Passumpsic River through Lyndonville and on the East Branch of the Passumpsic from Lyndonville upstream along Rt 114. Spotters noted that the river was flowing through the jams.	2013021 5120632
3/6/2011	East Burke	Passumpsic River	44.57463888	-71.95045833		Heavy rain the previous day resulted in a breakup ice jam along the Passumpsic River between East Burke and Lyndonville. The jam caused water to back up behind the jam flooding Rt 114, resulting in its closure.	2011030 9142733

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
12/31/2004	Lyndonville	Passumpsic River	44.53361111	-72.00361111		An ice jam was located near Rts 114 and 5 at the confluence of Millers Run and the East Branch Passumpsic to form the Passumpsic River, an area that has flooded due to ice jams in the past.	2005010 1132746
2/24/1996	Lyndonville	Passumpsic River	44.53361111	-72.00361111	Lowland flodding	An ice jam was located on the Passumpsic River at the junction of Rts 5 and 114 just north of Lyndonville and only caused lowland flooding.	1227
1/19/1996	Lyndon	Passumpsic River	44.51416666	-72.01138888	Road and homes (incl. trailer park) flooded	An ice jam first formed on 1/19/96, following the rapid thaw and rainfall event that resulted in very high water. There were at least two, and possibly three, distinct high water events since jam formation, including on the 19th and the morning of the 28th. Flooding in Lyndon included the Northeast Kingdom Trailer Park, Rts 114, 5, and State Aid 3, Forrest Field, and the Lynburke Motel. Rt 5 was closed downstream on 1/20/96 after huge ice chunks washed up from the river in St. Johnsbury Center. Jams also formed here in 1993 and 1974.	1225

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
3/30/1993	St. Johnsbury	Passumpsic River	44.37555555	-72.02611111	Road flooding	Ice jams caused flooding of Rt 5 in St. Johnsbury Center and the intersection of Rts 5 and 114 in Lyndonville. High water continued until the following afternoon when a flood warning reported that the water levels on Rts 5 and 114 went down, but the southbound lane of Rt 5 in St. Johnsbury remained under water. By that evening, the ice jam had partially failed and flood waters receded from Rt 5.	1235
2/1/1976	Lyndon	Sheldon Brook	44.83916666	-71.99083333		An ice jam formed at the confluence of Sheldon Brook with the Passumpsic River. Ice jams that form at this location usually melt out or are pushed out by upstream ice and water. December 1973 and February 1976 were the most significant ice events during the period 1969 to 1980, although ice jams occurred 7 years during that period.	1429
2/1/1976	Lyndon	West Branch Passumpsic River	44.55027777	-71.99194444	Road flooded and closed	Ice jam formed at the Rt 5 bridge, causing water to back up into Quimley Brook, but was not considered serious. December 1973 and February 1976 were the most significant ice events during the period 1969 to 1980, although ice jams occurred 7 years during that period.	1660

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
2/1/1976	Lyndon	Branch Brook	44.54333333	-72.0075	None	Ice jam formed at the State Aid Road #1 Bridge, flooded 6 homes and the road, closed York Street bridge, and damaged the covered bridge. In 1976, the Corps used a dragline to clear channel. Dynamite had been used in previous years. Since 1976, the town cleared gravel deposits from the reach upstream of the bridge allowing water to move more freely. Only minor jams occurred between 1976 and 1980; no more recent information available.	117
2/1/1976	Lyndon	Miller Run	44.54194444	-72.00888888	$70k Replace bridge, erosion	Ice jams occurred at the State Aid Road #26 Bridge 7 years during the period 1969-1980. Only December 1973 and February 1976 posed a serious threat.	942
2/1/1976	Lyndon	Passumpsic River	44.55055555	-71.99194444	Threatened to overtop sewage treatment plant	The most serious ice jam location of the 1976 event was just upstream of Miller Run to above the Rt 114 bridge. The 1976 event was similar to the 1973 event and caused about the same damages. The Northeast Kingdom Mobile Home Park dike built after the 1973 event was not tied into high ground and had no interior drainage, therefore about same damage occurred in 1976 (50 mobile homes flooded). Some windows were broken by the blasting of the jam.	1224

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
12/1/1973	Lyndon	Branch Brook	44.54333333	-72.00750000	None	Ice jam formed at the State Aid Road #1 Bridge, flooded 6 homes and the road, closed York Street bridge, and damaged the covered bridge. The town had used dynamite in some years to clear the jam.	116
12/1/1973	Lyndon	Miller Run	44.54194444	-72.00888888	Bridge threatened	Ice jams occurred at the State Aid Road #26 Bridge 7 years during the period 1969-1980. Only December 1973 and February 1976 posed a serious threat.	941
12/1/1973	Lyndon	Passumpsic River	44.55055555	-71.99194444		The most serious ice jam location of the 1973 event was the ice jam toe upstream of Miller Run. Sandbars and debris contributed to ice jamming. The jam extended upstream past the Rt 114 bridge. Rts 114 and 5, 7 homes, 3 commercial buildings, and 50 mobile homes were flooded. Another ice jam was reported at the Rt 122 bridge between Lyndonville and Lyndon Center. Geography may have been changed by construction of I91. Remedial efforts included a dike, sandbagging, blasting, and draglining.	1223

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
12/1/1973	Lyndon	Sheldon Brook	44.83916666	-71.99083333	$150k town $10k state	An ice jam formed at the confluence of Sheldon Brook with the Passumpsic River. Ice jams that form at this location usually melt out or are pushed out by upstream ice and water. December 1973 and February 1976 were the most significant ice events during the period 1969 to 1980, although ice jams occurred 7 years during that period.	1428
12/1/1973	Lyndon	West Branch Passumpsic River	44.55027777	-71.99194444	Road/ house flooding	Ice jam formed at the Rt 5 bridge, causing water to back up into Quimley Brook, but was not considered serious. December 1973 and February 1976 were the most significant ice events during the period 1969 to 1980, although ice jams occurred 7 years during that period.	1659
1/10/1935	Passumpsic	Passumpsic River	44.36555555	-72.03944444	Plant closed	A maximum annual gage height of 17.74 feet, affected by backwater from ice, was reported at the USGS gage on the Passumpsic River at Passumpsic on January 10, 1935. The recorded discharge was about 8,500 cfs.	3065

Date	Town/ Village	River	Latitude	Longitude	Damages	Description	Index No.
1/9/1935	Lyndonville	Passumpsic River	44.51611111	-72.00055555	Houses, mill flooded	As reported in The Burlington Free Press And Times on Friday, January 11, 1935, "The ice over a foot thick on the three rivers centering here [St. Johnsbury] broke up at 4 o'clock this morning after a three days rain, causing ice jams and flooded highways and cellars, recalling the more serious flood of 1927. . . . an ice jam in the Center village swept large cakes of ice from the Passumpsic river uon the highway and sent much water into the basements of nearly a dozen homes and the Grange hall." Picture Caption in the Hartford Daily Courant on Saturday, January 12, 1935, "St. Johnsbury, Vt, Jan. 11- State highway crews were faced with a big job today in clearing away tons of ice hurled up from nearby streams at the flood stage near here. At one point the ice was carried 800 feet to the highway."	1226

Figure 9 presents a map of the historical ice jam locations listed in Table 14 that are within the planning area.

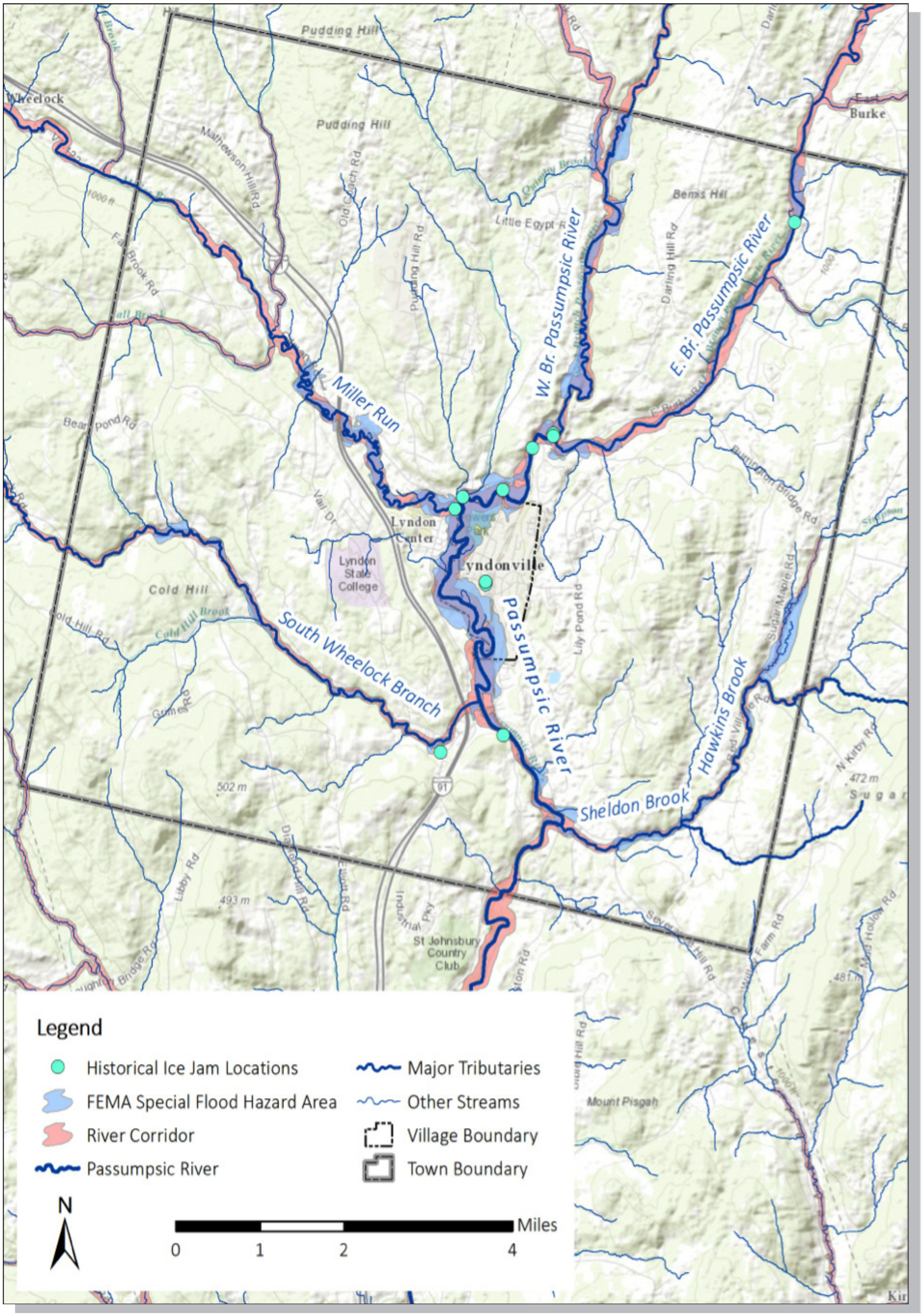


Figure 9 Historical Ice Jams

Representative photographs of past events are shown below.

Ice jam at a covered bridge during a December 2013 flooding event.

Flooding of the Northeast Kingdom Mobile Home Park due to Tropical Storm Irene in August 2011, Photo courtesy of Heinz Fischer

The 2010 All Hazards Pre-Disaster Mitigation Plan for the Town of Lyndon and Village of Lyndonville[31] provided an assessment of community vulnerability for floods and flash floods. Based on the findings of the updated risk analysis, the vulnerability for flood hazards was determined to be consistent with the 2010 assessment, which is provided in Table 15 below.

Table 15 Summary of Community Vulnerability Assessment

Hazard Type	Likelihood	Impact	Community Vulnerability	Most Vulnerable Assets
Flood	High	High	High	Infrastructure, village
Flash Flood	Low	Low	Medium	Infrastructure

Probability of Future Events

In recent years, flood intensity and severity in Vermont appear to be increasing. It is highly likely that flooding will continue in both the short- and long-term.[32] Given the frequency of previous major occurrences shown in Table 15, and considering that it is likely that less severe events will continue to impact the planning area even

31 Draft Town of Lyndon and Village of Lyndonville All Hazards Pre-Disaster Mitigation Plan. (2010). Lyndon, VT.

32 State of Vermont Hazard Mitigation Plan. (2013). Vermont Deartment of Public Safety, Division of Emergency Management and Homeland Security. Retrieved from http://vem.vermont.gov/sites/vem/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP_scrubbed_cleanedMCB.pdf

more frequently, an estimated probability of "likely" was assigned for flood hazards.

Climate change may exacerbate flood hazards over time. Research suggests that the frequency and intensity of related hazards such as rain, snow, and severe storms may increase with climate change, which could lead to an increased risk of flooding.

Wind Hazards

Wind hazards include hurricane, microburst, and tornado events.

Hurricane

Description

A hurricane is a type of tropical cyclone, which is a generic term for a low-pressure system that generally forms in the tropics. Thunderstorms in the Northern Hemisphere is a counterclockwise circulation of winds near the earth's surface accompany the cyclone. Tropical cyclones are classified as follows: a tropical depression is an organized system of clouds and thunderstorms, with a defined surface circulation, and maximum sustained winds of 38 miles per hour or less: a tropical storm is an organized system of strong thunderstorms, with a defined surface circulation, and maximum sustained winds of 39 to 73 miles per hour; a hurricane is an intense tropical weather system of strong thunderstorms, with a well-defined surface circulation, and maximum sustained winds of 74 miles per hour or higher.

Atlantic hurricanes form off the coast of Africa or in the southern Atlantic Ocean, Caribbean Sea, or Gulf of Mexico. Hurricanes require warm tropical oceans, moisture, and light winds above them to form. A hurricane can produce violent winds, tornadoes (primarily on the leading and trailing edges of the hurricane), powerful waves and storm surge, and torrential rains and floods.

Atlantic hurricane season lasts from June to November, averaging 11 tropical storms each year, six of which turn into hurricanes. Vermont is at high risk between the months of August and October when water temperatures in the Northern Atlantic are most likely to reach a temperature warm enough to develop and sustain a hurricane. According to the National Hurricane Center, the Atlantic hurricane season is currently in a period of heightened activity that started around 1995 and could last at least another decade.[33]

Table 16 below shows the scale for describing hurricane intensity (Saffir-Simpson Scale) and Table 17 describes the damage that could be expected for each hurricane category

33 National Hurricane Center. (2012). National Oceanic and Atmospheric Administration. Retrievedon April 20 from www.nhc.noaa.gov/

Table 16 Saffir-Simpson Scale (hurricane intensity)[34]

Category	Maximum sustained wind speed (MPH)
1	74-95
2	96-110
3	111-129
4	130-156
5	157+

Table 17 Hurricane Damage Classification[35]

Storm Category (Saffir-Simpson Scale)	Damage level	Description of Damages
1	MINIMAL Very dangerous winds will produce some damage	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. An example of a Category 1 hurricane is Hurricane Dolly (2008).
2	MODERATE Extremely dangerous winds will cause extensive damage	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. An example of a Category 2 hurricane is Hurricane Francis in 2004.
3	EXTENSIVE Devastating damage will occur	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland. An example of a Category 3 hurricane is Hurricane Ivan (2004).
4	EXTREME Catastrophic damage will occur	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. An example of a Category 4 hurricane is Hurricane Charley (2004).
5	CATASTROPHIC Catastrophic damage will occur	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. An example of a Category 5 hurricane is Hurricane Andrew (1992).

34 National Hurricane Center (2012). National Oceanic and Atmospheric Administration. . Retrieved May 4th, 2015 from http://www.nhc.noaa.gov/

35 National Hurricane Center (2012). National Oceanic and Atmospheric Administration. . Retrieved May 4th, 2015 from http://www.nhc.noaa.gov/

Location
Hurricanes rarely reach as far inland as Vermont. Vermont often receive tropical storms or depressions. Hurricanes and tropical storms potentially impact the entire planning area.

Previous Occurrences and Extent
From 1950 to 2014 no events with wind speeds above 74 MPH (Hurricane category 1) were reported in Caledonia County. However, one event with wind speeds above 69 MPH was reported on April 16, 2007 in Caledonia County.

As shown in Table 17, there were major disaster declarations as a result of tropical storm Irene (2011) and Floyd (1999) in Caledonia County. The most severe non-winter storm to hit Vermont was the disastrous hurricane of 1938. Figure 10 shows the rainfall amounts from Tropical Storm Irene 2011. Table 17 lists major disaster declarations due to Hurricane and Tropical Storms in Caledonia County.

Examples of tropical storms and hurricanes, which impacted Vermont:

> The Hurricane of 1938: On September 21, 1938, a very fast-moving hurricane made landfall in Suffolk County, Long Island (known as the "Long Island Express") and hit Vermont in the early evening causing wind damage. There was also severe flooding as a result of more than four inches of rain that accompanied the storm. Buildings were lost, power lines downed, and many trees felled.[36]
>
> Tropical Storm Floyd: Tropical Storm Floyd hit Vermont in September 1999 and caused flooding and wind damage in parts of Vermont. Floyd is responsible for one fatality and resulted in a federal disaster declaration.[37]
>
> Tropical Storm Irene: In August 2011, Tropical Storm Irene moved up the Eastern Coast of the United States, gradually turning into a tropical storm as it made landfall in New York and Connecticut. The tropical storm moved into Vermont, dropping as much as 11 inches of rain on the state, causing nearly every river and stream to flood and experience catastrophic fluvial erosion. This resulted in extensive transportation damage with nearly every state highway being affected and many local roads been washed away. Statewide, three people died and many were injured from the floods.[38]

In general, severe hurricanes are not considered likely nor do they pose a recurring threat in Vermont. Figure 10 depicts the amounts of rainfall from tropical storm Irene. Table 18 shows major disaster declarations in Caledonia County due to Hurricane and Tropical Storms.

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36 The Great Hurricane of 1938. (2014). National Weather Service. Retrieved May 2, 2015 from http://www.weather.gov/box/1938hurricane
37 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
38 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

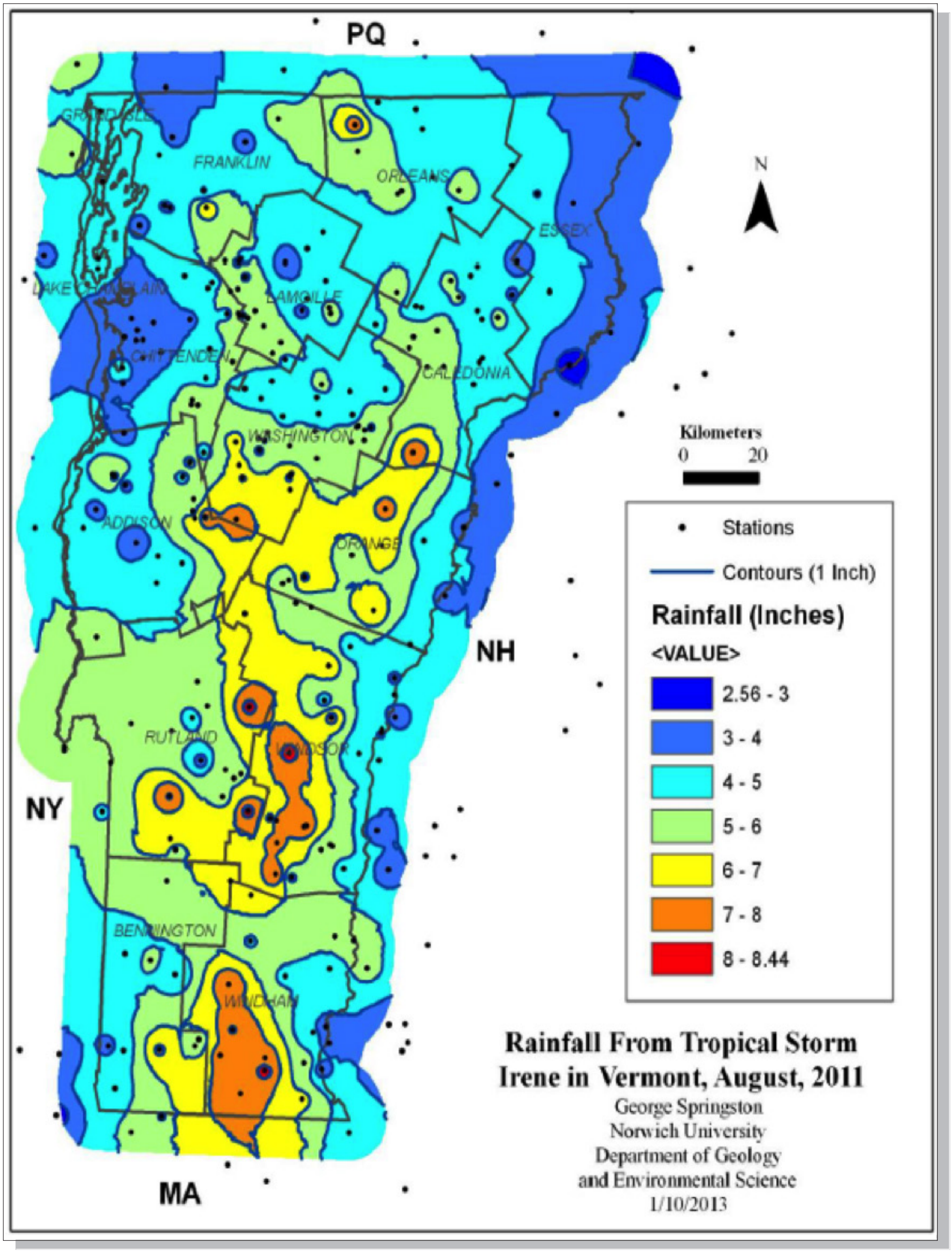

Figure 10 Rainfall amounts from Tropical Storm Irene in Vermont [39]

39 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Table 18 Major Disaster Declarations in Caledonia County due to Hurricane and Tropical Storms 40

Disaster Name (Date of Event)	Disaster Number (Type of Assistance)	Declared Areas
Tropical Storm Irene, 2011	DR-4022	Addison, Bennington, Caledonia, Chittenden, Essex, Franklin, Lamoille, Orange, Orleans, Rutland, Washington, Windham, Windsor for PA Chittenden, Rutland, Washington, Windsor for IA
Tropical Storm Floyd, 1999	DR-1307	Bennington, Caledonia, Essex, Lamoille, Orange, Orleans, Rutland, Washington, Windham, Windsor

Probability of Future Events

The planning area is situated in a very low risk hurricane zone. Based on past hurricane and tropical storm events, the frequency of hurricanes in Vermont is an average of once every 18 years. In addition, GIS analysis was used to determine that 13 tropical storms and hurricanes have passed within 75 miles of the planning area between 1866 and 2011. This means that on average once every eleven years a hurricane had an indirect impact on the planning area. This results in an annual probability of 9%. Based on this, a probability of possible was assigned. Figure 11 shows the results from the GIS analysis of hurricane and tropical storm paths within 75 miles from the planning area.

Vulnerability Assessment and Estimated Losses

Hurricane and tropical storms had varying impacts on the planning area. The 1938 storm caused great wind damage and some flooding, while tropical storm Floyd caused flooding and wind damage in parts of Vermont. Tropical Storm Irene, however, had the most devastating impacts due to its immense amounts of flooding. Since storms are atmospheric in nature, all existing and future buildings, populations, and critical facilities are at risk to the hurricane and tropical storm hazard. Hurricanes and wind events have a large spatial extent and would affect many buildings. In a typical storm event, there is adequate warning with this hazard allowing time for evacuation, which reduces the impact on the population. The event itself would likely last less than 24 hours. Flooding is a major concern as shown before since low moving hurricanes (or ones that stall over an area) can dump tremendous amounts of rain. Additional impacts include water damage in buildings from building envelope failure, business interruption, loss of communications, and power failure. Utility disruption is a serious threat for areas with above ground electrical wiring.

Climate change impacts are difficult to predict but likely will affect hurricane behavior in the northeast. Rising sea temperature could lengthen the hurricane season and fuel stronger hurricane events. The National Climate Assessment report (2014) notes that hurricane "intensity, frequency, and duration have all increased since the early 1980s". This source predicts continuing intensity and associated rainfall with raising temperatures. This would result in greater losses due to increased flooding, associated building damages, and business interruption impacts.[41]

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40 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

41 Walsh and Wuebbles (2014). Changes in Hurricanes. National Climate Assessment – U.S. Global Change Research Program.

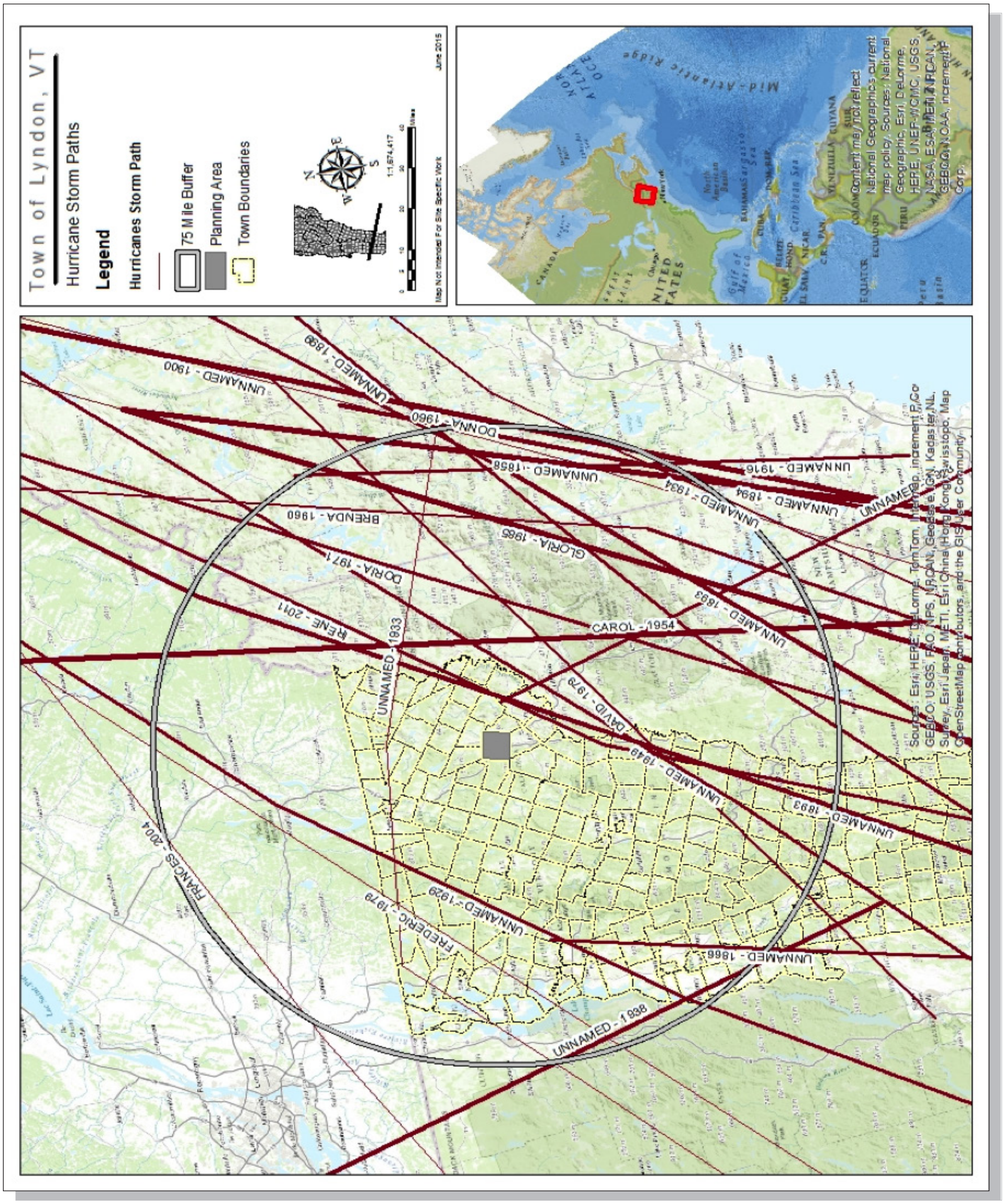

Figure 11 Hurricane and Tropical Storm Paths within 75 Miles from the Planning Area

HAZUS-MH

"HAZUS is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. HAZUS uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. It graphically illustrates the limits of identified high-risk locations due to earthquake, hurricane, and floods. Users can then visualize the spatial relationships between populations and other more permanently fixed geographic assets or resources for the specific hazard being modeled, a crucial function in the pre-disaster planning process."[42] The current software HAZUS-MH-2.2 was used to assess potential losses from hurricanes in the planning area.

Results from HAZUS-MH- 2.2 Hurricane Wind Analysis

HAZUS-MH- 2.2 was used to estimate losses. Three scenarios were run. The first was a historic scenario based on Hurricane Gloria, the second a historic scenario based on the 1938 hurricane; the third was a probabilistic scenario based on Hurricane Gloria to determine annualized losses. (Data sets from Hurricane Irene were not available in HAZUS-MH.) Town based information on critical facilities and parcel data was integrated into the HAZUS-MH data inventory. However, it has to be noted that the HAZUS results are aggregated based on Caledonia county census data.

Background information on Hurricane Gloria:

Hurricane Gloria formed on September 18, 1985. The hurricane topped out at 145 miles per hour (Category 4) near the Bahamas. Gloria made landfall three times including the Outer Banks, North Carolina (on September 26th, 1985), Long Island, New York, and Connecticut. The storm caused impacts from South Carolina to Maine including 14 fatalities (six related to fallen trees) and extensive power outages.[43]

Probabilistic Scenario: Annualized Losses

The probabilistic scenario runs a variety of scenarios, both catastrophic and minor, to determine potential losses on an annual basis. Scenarios are modeled for the 10-, 20-, 50-, 100-, 200-, 500- and 1,000-year scenarios to estimate annualized loss.

Findings from the HAZUS-MH probabilistic analysis

According to the HAZUS-MH results, if hurricane Gloria were to impact the planning area today, it would result in approximately $9 million in total damage at the most catastrophic scenario (a 1000 year return period). The annualized cost however would be considered limited with $ 43,000 in total damage. Table 19 shows the economic losses for various scenarios.

Important findings

Based on the HAZUS-MH scenarios (Gloria model), minor hurricane events would not have any impact on Lyndon. Starting with a recurrence of 100 years, some minor impacts would be noted. Only major events with a recurrence of 500 or 1000 years would have a more significant impact on Lyndon: At a 1000-year event 136 structures would receive minor and merely 5 buildings would receive moderate damage (see Table 18). Appendix J contains the HAZUS output for the scenarios run for the planning area.

42 Hazus - Methodology. Federal Emergency Management Agency. Retrieved on July 20, 2015 from https://www.fema.gov/hazus

43 Collins, Chris. (2014). Hurricane Gloria September 27, 1985. National Weather Service. Retrieved June 1, 2015 from http://www.weather.gov/mhx/Sep271985EventReview

Table 19 Economic Loss Scenarios (Hurricane Gloria Probabilistic Model)

Return Period	Property Damage Losses		Business Interruption
	Residential	Total	(Income) Losses
10	0	0	0
20	0	0	0
50	0	0	0
100	426	0	0
200	1380	1392	0
500	4,548	4631	16
1000	9266	9433	11
Annualized	41	43	1

Economic loss: x1000

According to the HAZUS-MH probabilistic model run for Hurricane Gloria (compare HAZUS output in Appendix J), the fire and police station, and schools would not be affected even in the probabilistic event of a 1000-year Hurricane.

Microburst

Description

"A microburst is a downdraft (sinking air) in a thunderstorm that is less than 2.5 miles in scale. Some microbursts can pose a threat to life and property, but all microbursts pose a significant threat to aviation. Although microbursts are not as widely recognized as tornadoes, they can cause comparable, and in some cases, worse damage than some tornadoes. Wind speeds as high as 150 mph are possible in extreme microburst cases."[44]

Several factors can cause microbursts to develop, including mid-level dry air entrainment, cooling beneath the thunderstorm cloud base, sublimation (occurs when the cloud base is above the freezing level), and the existence of rain and/or hail within the thunderstorm (i.e. precipitation loading). Microbursts can be a combination of these factors while others may only be driven by one factor. "Due to this, microbursts can be subdivided into three primary types - wet, dry, and hybrid. Cooling beneath the thunderstorm cloud base and sublimation are the primary forcing mechanisms with dry microbursts. Dry microbursts typically occur with very little precipitation at the surface or aloft, hence the dry type. Wet microbursts, on the other hand, are primarily driven by entrainment of mid-level dry air and precipitation loading. Hybrid microbursts possess characteristics of both wet and dry microbursts. They are forced in the mid-levels by dry air entrainment and/or precipitation loading and in the low-levels by cooling beneath the cloud base and/or sublimation."[45]

44 Microburst. National Oceanic and Atmospheric Administration. Retrieved May 16th, 2015 from http://www.srh.noaa.gov/ama/?n=microbursts
45 Microburst. National Oceanic and Atmospheric Administration. Retrieved May 16th, 2015 from http://www.srh.noaa.gov/ama/?n=microbursts

Location
Microburst generally impact very localized areas. They are possible anywhere in the planning area.

Previous Occurrences and Extent
News articles were investigated to locate previous occurrences of microburst in the planning area, noting the following:

- May 17, 2014[46]: a small-localized microburst (65 kts) was reported in Craftsbury, VT (Orleans County, approximately 25 miles from Lyndon, VT). Nearly a dozen trees were uprooted, a few greenhouses damaged, roof blown off a barn and a house minor damaged. No injuries were reported.

Thunderstorm wind events were also investigated for possible microburst activity in the area. The National Climatic Data Center reported the following thunderstorm events between 1950 and 2014[47]:

- 70 days with thunderstorm wind events and property damage throughout Caledonia County,
    - o Of which 53 showed property damage and
    - o Two resulted in death or injury.
- 13 thunderstorm wind events in Lyndon and Lyndonville,
    - o Seven with thunderstorm wind of ~50 knots
    - o With a total property damage of $ 122,000
    - o One event of these 13 events resulted in a damage of $25,000 (most costly)
- Seven events in East and West Burke (neighboring towns of Lyndon)

Table 20 lists the thunderstorm wind events in the planning area between 1950 and 2014. It should be noted that these thunderstorm events are not confirmed as microbursts but were included for reference. Microbursts can have a wind speed of up to 168 miles per hour, which aligns them with an EF4 tornado (see Table 14). However, as the Craftsbury event in 2014 has shown, smaller microbursts with less magnitude can occur as well. Damage may not be as extensive due to the shorter duration and smaller scale of the microburst event.

Table 20 Thunderstorm Wind Events in the Planning Area between 1950-2014[48]

Date	Wind Magnitude	Death/ Injuries	Property Damage	Details
8/31/1993	n/a	0/0	5K	n/a
7/26/1994	n/a	0/0	5K	n/a
06/26/1997	n/a	0/0	5K	A severe thunderstorm moved through the Lyndon Center, VT area with trees and power lines blown down and small hail. In addition, between 200 and 300 residents were without power.

46 NOAA Storm Events Database. National Oceanic and Atmospheric Administration. Retrieved on May 8th, 2015 from http://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=242662)
47 NOAA Storm Events Database. National Climatic Data Center. Retrieved on May 8th, 2015 from http://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=242662)
48 NOAA Storm Events Database. National Climatic Data Center. Retrieved on May 8th, 2015 from http://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=242662)
49 This event shows similarities to a small microburst event.

Date	Wind Magnitude	Death/ Injuries	Property Damage	Details
7/5/1999	n/a	0/0	5K	Across the northern half of the county the following towns were greatly impacted with numerous reports of trees and power lines blown down: East and West Burke, Sutton, Sheffield, Lyndon. Over 1000 were without power. In addition, in the town of Sheffield, a pickup truck was destroyed when a tree was blown on top of it.
6/26/2002	n/a	0/0	5 K	Scattered thunderstorms developed during the afternoon of June 26th, and a few of them reached severe criteria. Thunderstorms in Caledonia county resulted in numerous downed trees and power lines in the Vermont towns Lyndonville and East Burke.
5/31/2006	50 kts	0/0	10 K	The thunderstorms intensified as they moved into Caledonia county during the mid-afternoon with several reports of numerous trees down in the towns of Lyndon, Wheelock and Lower Waterford. Slightly over 5000 customers lost power in northern Caledonia and Essex counties.
08/16/2007	50 kts	0/0	20 K	One thunderstorm developed in a favorable, highly sheared wind environment which eventually intensified into a supercell thunderstorm in Clinton county, NY. This supercell then proceeded to travel into Vermont affecting numerous communities between Grand Isle (Grand Isle county) and Concord (Essex county). Significant straight-line wind damage (estimated between 60 and 80 mph) in the form of snapped, uprooted and downed trees, downed power lines and some structural damage occurred in Grand Isle, Georgia (Franklin county), Westford (Chittenden county) and Hardwick (Caledonia county).[49]
8/25/2007	50 kts	0/0	25 K	Numerous trees and power lines down across Lyndonville and Lyndon.
7/9/2008	50 kts	0/0	20 K	A severe thunderstorm produced localized damaging winds that knocked down several trees throughout Lyndonville. Several downed and snapped trees in Lyndonville, including Lyndon State College, East Burke Road and Center Road.

Date	Wind Magnitude	Death/ Injuries	Property Damage	Details
6/5/2010	50 kts	0/0	5 K	Scattered thunderstorms developed across Vermont during the afternoon and tapped into an unseasonably strong mid-atmospheric disturbance and wind field, which eventually resulted into a supercell that formed across southeast Franklin county, Vermont. Spruce tree approximately two feet in diameter snapped, as well as other branches and limbs.
5/27/2011	50 kts	0/0	2 K	This supercell produced a brief EF1 tornado in Craftsbury (Orleans county) and resulted in numerous reports of wind damage and large hail, up to golf ball size, downstream in Caledonia and Essex counties.
6/2/2013	50 kts	0/0	5K	A strong mid-atmospheric disturbance, ahead of a cold front, moved across portions of Vermont and triggered widespread thunderstorms with pockets of damaging winds and large hail. Some of the damage occurred in the Rutland vicinity as well as the Route 2 corridor between Montpelier and Lunenburg. At the peak of the event, roughly 20,000 customers had lost power.
7/19/2013	55kts	0/0	15 K	Widespread wind damage in the form of downed trees and power lines that fell on vehicles and structures across the region. More than 15,000 customers were without power across the state.

*K stands for x1000

There haven't been any major disaster declarations related to microbursts in Caledonia County.

Probability of Future Events

Limited information was available on previous microburst events in the planning area; therefore thunderstorm events were investigated as well. One microburst was reported near the planning area and at least one thunderstorm event showed similar patterns to a small microburst within Caledonia County (see description for the event on 08/16/2007 in Table 20). It is certain that microburst events are possible in the planning area but they may not occur annually. Therefore a probability of possible was assigned.

Vulnerability Assessment and Estimated Losses

All current and future buildings and populations should be considered at risk to microbursts. Estimating accurate losses is difficult since it is impossible to predict where a microburst will occur and limited information is available on past occurrences. Microbursts are capable of causing tornado-like damages. Such events are capable of causing catastrophic damage, injuries, and deaths. Additional impacts may include power failure, class disruption or campus shutdown, loss of communications, research disruption, and downed trees and debris.

Climate change impacts could lead to increased frequency of microbursts and more severe occurrences.

Tornado

Description

"A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground"[50]. Tornadoes are most often generated by thunderstorm activity when cool and dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. However, tornadoes can also be form from hurricanes and other tropical storms. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 miles per hour to more than 300 miles per hour.[51] "The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction" and turning harmless ordinary objects into deadly missiles.[52]

Tornado season in Vermont runs ordinarily from March through August; however, tornadoes can strike at any time of the year if the essential conditions are present. Tornadoes are most likely to form in the late afternoon and early evening. The average forward speed is 30 miles per hour, but may vary from nearly stationary to 70 miles per hour. Most tornadoes are a few dozen yards wide and touchdown briefly, but even small short-lived tornadoes can inflict tremendous damage. Damage paths can be in excess of 1 mile wide and 50 miles long. The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings (particularly mobile homes).[53] Figure 12 shows the tornado activity in the United States.

50 Meteorology Glossary. (2000). American Meteorological Society.
51 The Online Tornado FAQ. (2015). Storm Prediction Center. Retrieved from http://www.spc.noaa.gov/faq/tornado/
52 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
53 The Online Tornado FAQ. (2015). Storm Prediction Center. Retrieved from http://www.spc.noaa.gov/faq/tornado/
54 Severe Weather 101. (2015). Tornado Basics. National Severe Storms Laboratory. Retrieved on May 20, 2015 from http://www.nssl.noaa.gov/education/svrwx101/tornadoes/

As shown on Figure 12, the highest concentration of tornadoes in the US has been in Oklahoma, Texas, Kansas, and Florida respectively. Each year, an average of 1,200 tornadoes is reported nationwide.[55]

Tornado magnitude is reported according to the Fujita and, since 2007 to the Enhanced Fujita Scales. A comparison of these two scales along with a description of the typical damage caused by tornado wind forces is presented in Table 21.

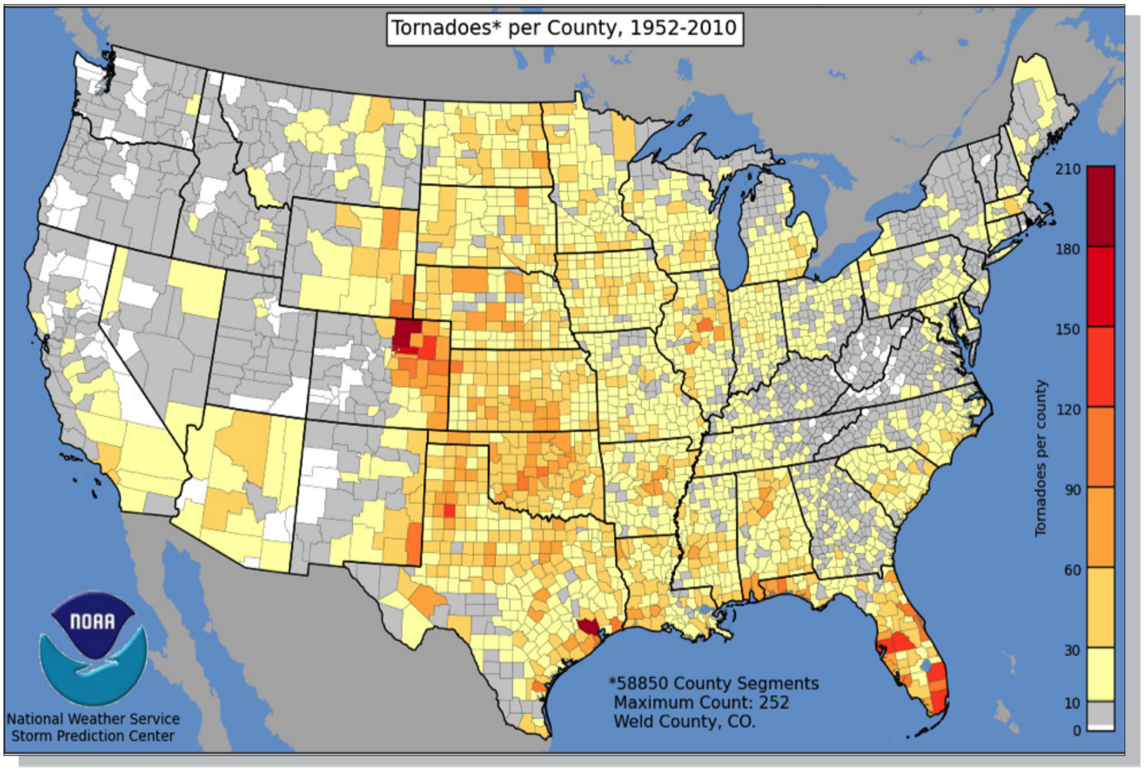

Figure 12 Tornado Activity in the US Per County, 1952-2010 (NOAA)[55]

55 Severe Weather 101. (2015). Tornado Basics. National Severe Storms Laboratory. Retrieved on May 20, 2015 from http://www.nssl.noaa.gov/education/svrwx101/tornadoes/

Table 21 Fujita and Enhanced Fujita Scale (Tornado Wind Force) [56]

Enhanced Fujita Scale	Fujita Scale	Typical Damage
EF-0 (65-85 mph)	F0 (45-73 mph)	**Light damage.** Some damage to chimneys, gutters or siding; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards
EF-1 (86-110 mph)	F1 (73-112 mph)	**Moderate damage.** Roofs severely stripped; mobile homes pushed off foundations or overturned; moving cars pushed off the roads; loss of exterior doors; windows and or glass broken; attached garages may be destroyed.
EF-2 (111-135 mph)	F2 (113-157 mph)	**Considerable damage.** Roofs torn off well-constructed houses; mobile homes demolished; cars lifted off ground; large trees snapped or uprooted; light object missiles generated.
FE-3 (136-165 mph)	F3 (158-206 mph)	**Severe damage.** Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF-4 (166-200 mph)	F4 (207-260 mph)	**Devastating damage.** Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF-5 (>200 mph)	F5 (261-318 mph)	**Incredible damage.** Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.
EF No rating	F6-F12 (319 - 379 mph)	**Inconceivable damage.** These winds are very unlikely. Should a tornado with the maximum wind speed in excess of EF-5 occur, the extent and types of damage may not be conceived. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage.

Location

Tornadoes can strike anywhere and at any hour of the day. All areas in the planning area are at risk.

Previous Occurrences and Extent

Several sources were investigated to determine past occurrences of tornados in the planning area including the National Climatic Data Center, web searches, news articles, and the State of Vermont Hazard Mitigation Plan.

More than 40 tornadoes, 14 of magnitude F2 (significant) and 16 of magnitude F1 (moderate) on the Fujita Scale have been reported statewide. Damage from tornadoes has ranged from a few downed trees to seven injuries during a 1970's tornado in Franklin County (located near Lake Champlain at the border to New York State).[57] Property damage has totaled over $8.4 million overall in the State of Vermont due to tornado damage. There have been no deaths as a result of a tornado in Vermont since 1950.[58]

56 The Tornado Scale. (2015). Tornado Facts. Retrieved on May 20, 2015 from http://tornado-facts.com/the-tornado-scale/

57 These injuries occurred when a waterspout, a tornado that originates over water instead of land, moved from Lake Champlain to the south part of Swanton, where it struck a cabin.

58 NOAA Storm Events Database. (2015). National Climate Data Center.

One major disaster declaration related to severe storms, tornados, and flooding has occurred in Caledonia County in 2008; Table 22 provides more information on the pertaining disaster declaration. The tornado referenced in this disaster declaration touched base twice in Cambridge, VT (about 65 miles east of Lyndon). This event of a magnitude EF0 and EF1 resulted in a damage of $100,000.[59]

Table 22 Disaster Declaration Related to a Tornado in Caledonia County [60]

Disaster Name (Date of Event)	**Disaster Number (Type of Assistance)**	**Declared Areas**
Severe Storms, a Tornado and Flooding (July 18, 2008)	DR-1784	Caledonia, Grand Isle, Lamoille

NCDC reported one tornado event within Caledonia County. Table 23 provides more background information on this tornado event.

Table 23 Tornado Event in Caledonia County [61]

Date	**Location**	**Wind Magnitude (Scale)**	**Length**	**Width**	**Death/ Injuries**	**Property Damage**	**Details**
8/3/2010	Peacham, VT	EF0	0.14 miles	50 yards	0/0	25 K	Significant wind damage in the form of trees downed, uprooted and some snapped occurred with a convergence debris field pattern indicative of a tornado.

According to a website that lists tornado events near searchable locations, ten tornado events occurred in the proximity of the planning area. The largest tornado of these ten was an F1 (Gale Tornado, wind speed 40 -72 mph) in 1989 that caused no injuries or deaths.[62] Table 24 lists the reported tornado events and their distance from Lyndon, Vermont.

Table 24 Reported Tornadoes Near Lyndon, VT [63]

DATE	Force	Death(s)	Injured	Distance to Lyndon, VT
5/29/2012	0	0	0	16
8/3/2010*	0	0	0	18
6/5/2010	1	0	0	19
8/13/1999	1	0	0	6
9/3/1993	1	0	0	19
8/6/1989	1	0	0	15

59 NOAA Storm Events Database. (2015). National Climate Data Center.
60 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
61 NOAA Storm Events Database. (2015). National Climate Data Center.
62 Tornado Information for Lyndon, Vermont. (2015). Homefacts. Retrieved on May 8th, 2015 from http://www.homefacts.com/tornadoes/Vermont/Caledonia-County/Lyndon.html
63 Tornado Information for Lyndon, Vermont. (2015). Homefacts. Retrieved on May 8th, 2015 from http://www.homefacts.com/tornadoes/Vermont/Caledonia-County/Lyndon.html

DATE	Force	Death(s)	Injured	Distance to Lyndon, VT
8/28/1988	0	0	0	15
5/19/1982	1	0	0	22
6/27/1964	0	0	0	26
5/20/1962	1	0	1	22

*The event on 8/3/2010 is referenced in Table 23

Probability of Future Events

The tornado index was consulted to investigate probability. The tornado index indicates that the planning area has an index of 12.29. In comparison, the tornado index indicates an index of 27.21 for the state of Vermont and an index of 136 for the nation. The tornado index value is calculated based on historical tornado events data using USA.com algorithms.[64] The tornado index value is an indicator of the tornado level in a region. A higher tornado index value means a higher chance of tornado events. According to the State Plan, Vermont has averaged less than one tornado per year since 1950.[65]

While no tornado was reported in the planning area, 10 events with F0 or F1 were reported within a distance of six to 26 miles of the planning area over 53 years (see Table 13). Based on this information, a tornado would have occurred approximately every 5 years resulting in an annual probability of about 19%. However according to the NCDC database, only one event was noted over the past 65 years within the County, which results in an annual probability of about 1.5%. Taken into consideration the results from Table 24, probability is likely lower for the planning area, given a smaller study area. Thus, a probability of possible was assigned.

Vulnerability Assessment and Estimated Losses

NCDC Databases covering 64 years (from 1950 to 2015) have been consulted. The tornado with the worst impact near the planning area (approximately 65 miles distance from Lyndon, VT) was an EF1 tornado (Cambridge, VT in Lamoille County in 2008) causing $100,000 in property damage and no deaths or injuries. One other event was reported with $25,000 damage. An annualized loss with a range of $390 - $1562 from tornado events has been conducted. The impact is considered minor.

Climate change could impact the frequency and severity of tornadoes. Tornadoes occur due to unstable air. With that said, warmer and moister air due to climate change could increase the frequency of favorable conditions for tornadoes to occur. Research from Florida State University (using NOAA Storm Prediction Center data) does predict more frequent tornadoes. The data indicates that larger numbers of tornadoes are occurring in a single day. Since 2001, there has been at least one day per year when 32 or more tornadoes occurred on a single day[66]. However, the development of a tornado will also depend on local weather patterns. It is assumed that the likelihood for tornadoes to develop in Vermont will remain low.

All current and future buildings and populations should be considered at risk to tornadoes. Tornadoes are capable of causing catastrophic damage, injuries, and deaths. Additional impacts may include power failure, class disruption or campus shutdown, loss of communications, research disruption, and downed trees and debris.

64 Tornado Index. (2015). USA.com. Accessed on May 9th, 2015 from http://www.usa.com/rank/us--tornado-index--state-rank.htm
65 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
66 Haughney. (2014).

Winter hazards

Winter hazards include blizzard, hail, ice jams, ice storms, nor'easter, snow events, and extreme cold. Many of these hazards overlap, for instance, blizzard is a type of snow event. Severe winter storms bring the threat of heavy accumulations of snow, cold/wind chills, strong winds, and power outages that result in high rates of damage and even higher rates of expenditures. Severe winter storms develop through the combination of multiple meteorological factors. In Vermont and the northeastern United States, these factors include the moisture content of the air, direction of airflow, collision of warm air masses coming up from the Gulf Coast, and cold air moving southward from the Arctic. Table 25 lists terminology related to snowfall events.

Table 25 Terminology Related to Snowfall Events[67]

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

The Northeast Snowfall Impact Scale (NESIS) categorizes the severity of a snowstorm based on the amount of snowfall and the population at risk. NESIS provides a numerical measurement of the snowstorm's potential socioeconomic impact compared with past storms and assigns each large storm into one of five categories.[68] Table 26 shows the NESIS categories, values, and descriptions. The scale takes into account the size of area that is affected, amount of snow, and population.

Table 26 NESIS Definition of Snowstorms[69]

Category	NESIS Value	Description
1	1 – 2.499	Notable
2	2.5 – 3.99	Significant
3	4 – 5.99	Major
4	6 – 9.99	Crippling
5	10.0 +	Extreme

67 Glossary. (2015). National Oceanic and Atmospheric Administration's National Weather Service. Retrieved from http://w1.weather.gov/glossary/index.php?letter=b
68 Regional Snowfall Index. (2015). National Climate Data Center – National Oceanic and Atmospheric Administration. Retrieved from https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis
69 Regional Snowfall Index. (2015). National Climate Data Center – National Oceanic and Atmospheric Administration. Retrieved from https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis

Blizzard

Description

Blizzards are dangerous winter storms that are a combination of low temperatures, blowing snow, and winds of 35 miles per hour or more resulting in very low visibilities. Officially, the National Weather Service defines a blizzard as a storm, which contains large amounts of snow or blowing snow, with winds in excess of 35 mph and visibilities of less than 1/4 mile for an extended period of time (at least 3 hours). Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, or difference in pressure between two locations, which in turn results in very strong winds. These strong winds pick up available snow from the ground, or blow any snow that is falling, creating very low visibilities and the potential for significant drifting of snow.[70]

Location

A blizzard will impact the entire planning area.

Previous Occurrences and Extent

The State Plan and National Climatic Data Center (NCDC) database were researched for blizzard events. As blizzards can be associated with a heavy snow event and/or high wind events, we investigated the NCDC database for events of heavy snow and for winter storms events.

a) Heavy snow events

The NCDC reported 8 heavy snow events throughout Caledonia County between 1950 and 2014 resulting in a total property damage of $261,000. One singular heavy snow event in February 2007 known as the Valentine's Day Blizzard resulted in a damage of $200,000. Table 27 lists all heavy snow events in Caledonia County between 1950 and 2014. The Valentine's Day Blizzard event is described in more detail in the following section.

Table 27 Heavy Snow Events in Caledonia County from 1950-2015 (NCDC)[71]

Date	Death/Injuries	Property Damage	Further Details
12/1/1997	0/0	10 K	10" in Caledonia County
12/25/1997	0/0	15 K	7" in Burke (Caledonia County)
3/14/1998	0/0	5 K	9" in Sutton (Caledonia County)
3/21/1998	0/0	5 K	Storm system; 15-20" (average)
2/27/2002	0/0	1 K	< 7" of snow (in average)
2/14/2007	0/0	200 K	"Valentine's Blizzard"; Lyndon: 20"
2/5/2014	0/0	10 K	5-12 inches of snow
2/13/2014	0/0	15 K	Winter storm; 12" in Lyndonville

70 Blizzards. (2015). National Weather Service Forecast Office. Retrieved from http://www.wrh.noaa.gov/fgz/science/blizzard.php?wfo=fgz

71 Storm Events Database. (2015). National Climatic Data Center – National Oceanic and Atmospheric Administration.

February 2007 ("Valentine's Day") Blizzard Event Details[72][73]:
The February 2007 North America Winter Storm (also referred to as the Valentine's Day Blizzard) was a massive winter storm that affected most of the eastern half of North America, that began on February 12, 2007 and peaked on February 14, 2007 (Valentine's Day). Snowfall rates of 2 to 4 inches per hour and brisk winds of 15 to 25 mph caused near whiteout conditions at times, along with considerable blowing and drifting of the snow, making roads nearly impassable in Vermont. Temperatures in the single digits above zero combined with brisk winds resulted in wind chill values of 10 degrees below zero or colder. While some areas of Vermont received from 28–36 inches of snow in a 24–48 hour period, Lyndon received on average 20 inches of snow.

The deep snow fall and snow drift caused numerous problems including the blocking of numerous heat vents that resulted in the build-up of carbon monoxide and sent dozens of people seeking treatment at area hospitals. There were additional indirect injuries resulting from this storm, including vehicle accidents and cardiac arrests due to overexertion during snow removal. Snow removal operations took several days and up to a week in some urban communities. In addition, the weight of the heavy snowfall on some weaker roofs, resulted in the partial or total collapse of 20 or more barn roofs and the deaths of more than 100 cattle. As indicated above, this event resulted in a property damage of $200,000 for Caledonia County. Overall, the Valentine's Day Blizzard resulted in $2,625 million of property damage in the six affected Vermont counties.

b) Winter storm events
Between 1950 and 2014, 101 winter storms and 126 winter weather events were noted throughout Caledonia County that resulted in total property damage of 1,500 million from winter storms and of $624,500 from winter weather (compare ice storm section).

Major disaster declarations related to blizzards (i.e. December 1969) occurred on the State level but did not include Caledonia County. The impacts from blizzards were indicated as critical to catastrophic. Some blizzards have resulted in shut down of facilities for several weeks and a high number of deaths. The Valentine's Day blizzard resulted in serious property damage throughout the State.

Probability of Future Events

Only one specific blizzard was noted for Caledonia County. Blizzards are a common winter hazard in the northeast and typically occur during the winter months. The State Plan lists 57 heavy snow events within the State of Vermont and five winter storm events in Caledonia County over a 5-year time span. It can be assumed that some of the heavy snow events (12.5 % annual probability for County) and winter storms (160% annual probability for the county) are related to blizzards. With at least one winter storm and about 11 snow events per year, blizzards are very likely. An annual probability of highly likely for blizzards has been assigned.

Vulnerability Assessment and Estimated Losses

All current and future buildings and populations are at risk to this hazard. It has a variety of potential impacts. Heavy snow loads may cause roofs and trees to collapse leading to structural damage. Deaths and injury are also possible. Additional impacts may include road closures, power outages, business interruption, business losses (i.e. loss of cow milk due to road closures), hazardous driving conditions, frozen pipes, fires due to

72 Valentine's Day Blizzard. (2015). Retrieved from http://en.wikipedia.org/wiki/February_2007_North_America_blizzard
73 Storm Events Database. (2015). National Climatic Data Center – National Oceanic and Atmospheric Administration.

improper heating, and second health impacts caused by shoveling (such as a heart attack).
Only 10 of the 33 critical facilities, in the planning area have generators. Based on this statistic, 30.3% of the critical facilities could accommodate power outages.

Annualized loss from heavy snow in Caledonia County is only $4,000. However, should a severe blizzard such as the “Valentine’s Day Blizzard” occur, damages of $200,000 per county could reoccur. In comparison, statewide-annualized property damage from heavy snow is $442 million (with a total property damage of 2,650 million resulting from 57 heavy snow events over 6 years). Annualized damage from winter storms in Caledonia County is calculated with $23 million and from winter weather with approximately $9,758. This evidence suggests that losses from blizzards in the planning area would likely be higher than the existing data shows.

Research indicates that climate change will result in more precipitation in the Northeast. This trend may result in more frequent and/or more severe blizzards.

Hail

Description

“Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into balls of ice. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people. Hailstones grow by colliding with super-cooled water drops. Super-cooled water will freeze on contact with ice crystals, frozen raindrops, dust or some other nuclei. Thunderstorms that have a strong updraft keep lifting the hailstones up to the top of the cloud where they encounter more super-cooled water and continue to grow. The hail falls when the thunderstorm’s updraft can no longer support the weight of the ice or the updraft weakens. The stronger the updraft the larger the hailstone can grow.”[74]

Hailstones can range in size from 5 millimeters (mm, approximately pea-sized) to greater than 100 mm (approximately melon-sized). In Table 28, derived from the website of the Tornado and Storm Research Organization (TORRO), shows the typical damage associated with different hail sizes.

74 Severe Weather 101 – Hail Basics. National Sever Storms Laboratory. Retrieved on May 9, 2015 from http://www.nssl.noaa.gov/education/svrwx101/hail/

Table 28 TORRO Hailstorm Intensity [75]

	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, J-m2	Typical Damage Impacts
H0	Hard Hail	5	0-20	No damage
H1	Potentially Damaging	5-15	>20	Slight general damage to plants, crops
H2	Significant	10-20	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	>500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60		Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75		Severe roof damage, risk of serious injuries
H8	Destructive	60-90		Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Location

Hail is atmospheric in nature and therefore can affect the entire planning area. Further, it typically coincides with thunderstorm events.

Previous Occurrences and Extent

The National Climatic Data Center reported 33 days with hailstones up to 1.75” in size throughout Caledonia County between 1950 and 2015. Six 1.50” to 1.75” hail events resulted in property damage and in crop damage. To date, one event caused crop damage. The reported property damage was mostly related to thunderstorms that caused flooding and power outages from damaging winds. However, one hail event in the neighboring town East Burke on 06/05/2010 with 1.75” size hails caused damage to several vehicles and roof shingles (totaling $15,000 in damage). Additional damage to outdoor furniture and siding was reported in similar cases. Total damage from hail events over the past 64 years in the county resulted in $87,000 in damage. Hail events tend to be highly localized and are limited to a relatively small area.[76]

As shown in Table 29, nine events took place in the planning area over the last 64 years; no damage was reported. Hailstones ranged in size from 0.88” to 1.75”. The adjacent Town of Burke (East, West and Burke Hollow) reported 12 hail events during the same timeframe.

75 Hail Scale. (2015). The Tornado and Storm Research Organisation. Accessed on May 9, 2015 from www.torro.org.uk/site/hscale.php

76 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Table 29 Hail Events in the Planning area from 1950-2014

Date	Magnitude	Death/Injuries	Property Damage	Description
9/21/1998	1.75"	0/0	0	Golf ball size hail
7/15/2000		0/0	0	Pea to marble size hail
7/10/2001	1.5"	0/0	0	
7/3/2002	0.75"	0/0	0	
6/9/2005	1"	0/0	0	
7/1/2006	0.88"	0/0	0	Nickel size hail
6/27/2007	1"	0/0	0	
5/16/2012	0.75"	0/0	0	Penny size hail
7/8/2014	0.88"	0/0	0	Nickel size hail and small limbs down due to thunderstorms

There have been no major disaster declarations related to hail in Caledonia County.

An additional online investigation produced the following recorded hail event:

> "On June 23, 2013, doppler radar detected half dollar size hail near Lyndonville, VT, Pittsford, VT and Wallingford, VT. This hail storm was traveling ESE at 22.94 mph and produced hail for roughly 4 hour(s). Spotters reported a max hail size of 1.25" and an average hail size of 1.25". There were two spotter report(s) and the volume of hail detected was significant. Based on this information, you can expect to see minor damage to vehicles, tile roofs and crops in isolated areas (Impact Rating 2)."[77]

According to the State Plan, 282 hail events took place in the State between 1955 and 2005. These hail events typically occurred during the summer months. Most of these events had hail measuring 0.75 inches, but many had hail at least 1.5 inches in size. The largest hail during the period was 3-inch hail that fell in Chittenden County in 1968. Tennis ball-sized hail was reported in the Town of Chittenden during a storm in the summer of 2001.[78]

Probability of Future Events

According to the State Plan, hail is relatively infrequent. However, based on the information above, 10 hail events were noted over the last 65 years in Lyndonville, which equates to an annual probability of 22%. The probability of likely has been assigned for hail events in the planning area. This is supported by a similar pattern of approximately 12 hail events in the neighboring Town of Burke.

Vulnerability Assessment and Estimated Losses

All current and future buildings and populations are at risk to the hail hazard. Hail is capable of causing damage, particularly to roofs, vehicles, crops, and exposed metal and glass.

The reported hail events in the planning area and within the county showed hail events with hailstones up to 1.75" (44 mm) in size. According to the TORRO scale (refer to Table 18), hailstones of 1.5" to 1.75" (38-44 mm) would be classified as H4 or H5 with an associated severe or destructive intensity that can cause wholesale destruction of glass, damage to tiled roofs up to dents in grounded aircraft. While impacts of this extent have not been reported within the planning area or the county, they are possible. According to the Town Plan, 8% of

77 1.25 Inch Hail Near Lyndonville, VT 06-23-2013. (2014). Hailstrike. Retrieved on May 9th, 2015 from http://maps.hailstrike.com/vermont/1-25-inch-hail-near-lyndonville-vt-06-23-2013/

78 NOAA Storm Events Database. (2015). National Climate Data Center.

the area is used for agriculture. Due to this, the risk for damage from hail is minor. Areas with large amounts of farmland are more vulnerable to hailstorms; there have been reports of hailstorms destroying entire hay fields and cornfields.

Based on previous hail events throughout the county, the annualized cost from hail events is approximately $1,360. The losses in the planning area are likely lower.[79]

Climate change impacts can potentially affect this hazard as it might increase the frequency of hailstorms. Consequently, this may increase associated damages.

Ice Jams

Description

Ice jams form frequently on northern rivers in the winter and spring. When temperatures rise and river ice begins to break up, it is common for big chunks to block the river channel and form massive "jams." Pieces of floating ice carried with a stream's current can accumulate behind any obstruction to the stream flow. Obstructions include river bends, mouths of tributaries, points where the river slope decreases, as well as dams and bridges. The water held back can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur downstream. Ice jams are most severe when combined with melting snowpack or heavy rainfall.

There are two main types of ice jams: freeze-up ice jams and break-up ice jams. Freeze-up jams happen when extremely cold air temperatures occur over open water. This results in the rapid production of large amounts of river ice that can jam downstream. Break-up jams account for about 2/3 of local ice jams, and occur when rapid thaw and/or runoff entering the river system break the existing ice cover and cause jamming downstream.[80]

According to the State Plan, ice jams are ranked as a moderate risk for the jurisdiction of the Northeastern Development Association (regional planning commission for Caledonia County).[81]

Location

Ice jams occur on flowing water such as rivers, streams, and brooks. According to the members of the Planning Committee, ice jams have previously caused flooding and ice jams typically occur once every three years. During the meeting with the Hazard Planning Committee on March 12, three locations of ice jams were noted.

1. Near the intersection of Route 122 and East Burke Road at West Branch Passumpsic River,
2. Near the intersection of Route 122 and East Burke Road at Millers Run,
3. At the Passumpsic River in Lyndonville Center.

Recent news articles were examined. An article from December 2013 reports flooding in Lyndonville near

79 NOAA Storm Events Database. (2015). National Climate Data Center.

80 Ice Jams. (2015). National Weather Service – National Oceanic and Atmospheric Administration. Retrieved from http://www.crh.noaa.gov/Image/dvn/downloads/backgrounder_DVN_Ice_Jams.pdf

81 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

the intersection of routes 5, 112, and 114 occurred due to a rapid rise in water levels on the east branch of the Passumpsic River. Officials were concerned about the Sanbourne Bridge, fearing it could collapse. During this time, the pedestrian bridge upstream in Lyndonville was closed.[82]

Previous Occurrences and Extent

There was a major disaster declaration related to ice jams and flooding in Caledonia County in 1992. During the planning meeting on March 12, 2015, three ice jam events were noted:

1. January 12, 2014
2. Dec 22, 2013
3. January 31, 2013

Additionally, the Ice Jam Database a searchable database of historic ice jam events was investigated. The Ice Jam Database is maintained by the US Corps of Army Engineers, Cold Region Research, and Engineering Lab (CRREL),. Table 14 in the flood section shows the ice jams that were reported in the planning area between 1935 and 2014.[83]

Past ice jam events caused flooding of up to a dozen homes in the center village and the highway and of up to 50 mobile homes in the Northeast Kingdom Mobile Home Park (the second event took place in 1976 before the dike of the trailer park was equipped with interior drainage). Ice jams have also caused flooding of six homes and the State Aid Road #1 bridge resulting in damage of a covered bridge. Closing of Route 114 due to flooding from ice jams has been reported frequently. There are no stage or flow gages on the Passumpsic River near enough to Lyndon to capture the water surface rise which was caused by ice jam events, and no other sources of flood depth information relating to historic ice jams could be found for Lyndon.

Probability of Future Events

According to the Town Planner of Lyndon, ice jams are expected to occur once every 3 years. A probability of likely has been assigned.

Vulnerability Assessment and Estimated Losses

Ice jam events sometimes pass with no significant damage or flooding, while other events may cause major problems. While ice jams are categorized as a winter hazard, their impacts and vulnerability are best aligned with flood impacts. However, all current and future structures and populations should be considered at risk to the flooding caused by this hazard. Economic losses are difficult to estimate; losses may be associated with localized flood losses (depending on where the ice jam occurs). Ice jams have also caused damage (up to collapsing) to bridges as they float down swollen rivers.

Costs in the magnitude of $70,000 were noted to replace a bridge and manage erosion damage (1976, index no. 942) and of $150,000 for the Town and $10,000 for the State as a result of the December 1973 event at Sheldon Brook (index no. 1428). Additional information found in Table 21. In the 1973 event up to 50 mobile homes were flooded. Fifty damaged homes out of 4,600 equals a damage of 1% of the building stock. The impact was assessed as limited.

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82 Ice jam news articles on WPTZ between December 2013 and March 2015. (2015). WPTZ News Channel 5. Retrieved on May 10, 2015 from http://www.wptz.com/news/vermont-new-york/burlington/ice-jams-prompting-flooding-fears/23616300 and http://www.wptz.com/news/all-eyes-on-the-rivers-vermont-watches-for-ice-jams/31638534.

83 Cold Regions Research and Engineering Laboratory. (2015). United States Army Corps of Engineers. Retrieved on May 26, 2015 from http://icejams.crrel.usace.army.mil/

Climate change may impact this hazard due to greater extremes, as winters may be more severe. This may result in thicker ice on the river, which can be more damaging if ice jam conditions arise during warming temperatures. Secondly, as opposed to gradual temperature rises, temperatures may rise rapidly following winter events, which could result in favorable conditions for ice jams.

Ice Storms

Description

According to NOAA's glossary, an ice storm is defined as, "Liquid rain falling and freezing on contact with cold objects creating ice build-ups of 1/4th inch or more that can cause severe damage."[84] With warmer air in the atmosphere above, falling precipitation in the form of snow melt becomes either super-cooled (liquid below the melting point of water) or re-freezes. In the former case, super-cooled droplets can freeze on impact, which is referred to as freezing rain. In the latter case, the re-frozen water particles fall as ice pellets or sleet. Sleet is defined as partially frozen raindrops or refrozen snowflakes that form into small ice pellets before reaching the ground. They typically bounce when they hit the ground and do not stick to the surface. However, it does accumulate like snow, posing similar problems and has the potential to accumulate into a layer of ice on surfaces. Freezing rain, conversely, usually sticks to the ground, creating a sheet of ice on the roadways and other surfaces. All of the winter storm elements – snow, low temperatures, sleet, and ice have the potential to cause significant hazard to a community. Even small accumulations, for example one quarter of an inch, can down power lines and trees limbs, creating hazardous driving conditions. Furthermore, communication and power may be disrupted for prolonged periods of time.

Location

Ice storms will impact the entire planning area.

Previous Occurrences and Extent

The State Plan and National Climatic Data Center reported one ice storm throughout Caledonia County between 1950 and 2014 affecting six counties including Caledonia County[85]:
An ice storm hit the State of Vermont including Caledonia County in January of 1998; it was later declared a federal disaster (DR-1201; however Caledonia County was not listed). An unusual combination of precipitation and temperature led to the accumulation of more than three inches of ice in many locations, causing closed roads, downed power lines, and damage to thousands of trees. This storm was estimated as a 200–500 year event (elsewhere in the State Plan it is called a 100 year event). Power was out up to 10 days in some areas and 700,000 acres of forest were damaged in Vermont. Vermont suffered no fatalities, unlike Quebec where 3 million people lost power and 28 were killed during the same event. Temperatures rose after the storm, causing the ice to melt and permitting crews to reopen roads, which kept many residents from freezing in their unheated homes.

However, according to the Town of Lyndon/Village of Lyndonville Draft Hazard Mitigation Plan (2010), the Town experienced no damage from the major ice storm event of 1998. Table 30 provides information on the 1998 ice storm event.

84 Glossary. (2015). National Weather Service – National Oceanic and Atmospheric Administration. Retrieved at http://w1.weather.gov/glossary/index.php?letter=b

85 State of Vermont Hazard Mitigation Plan. (2013).. Vermont Emergency Management.

Table 30 1998 Ice Storm in Vermont[86]

Date	Affected Areas	Magnitude	Death/ Injuries	Property Damage	Details
1/6/1998	Caledonia, Windsor, Orleans, Orange, Essex, Rutland	<0.75"	0/0	total of $480; $80 per county	The impact on the region ranged from ice accumulations damaging tens of thousands of trees to downed power lines resulted from the weight of the ice with several thousand people without power. Farmers who lost electricity were unable to milk cows with loss of income and damage to cows. Automobile travel was negatively impacted with a number of roads closed due to ice and fallen trees. There were numerous traffic accidents. INDIRECT injuries were reported due to carbon monoxide poisoning while improperly using generators. Falling tree limbs and other debris was a significant hazard during and following the storm.

The maximum extent of ice reported in the planning area was 0.75 inches or less. However, ice can accumulate up to several inches.

No major disaster declarations related to ice storms were issued for Caledonia County itself. According to the State Plan, the great ice storm of 1998 (DR-1201) resulted in just under $6 million in damage and affected six counties. Damages were not uniformly distributed throughout the six counties due to the varying intensity of the conditions geographically.

Electricity and telecommunication companies in Vermont, particularly the Vermont Electric Power Company (VELCO), who own high-voltage transmission assets, consider severe ice storms as the largest threat to their business. Severe snow loads during winter storms are being seen as the second largest threat to transmission and communication lines.[87]

Additional web search produced the following ice storm report:

> In December 2013, rain, freezing rain, snow, icing conditions, and near zero temperatures have impacted six Vermont counties including Caledonia, creating power outages affecting 22,000 households at its peak. In addition, fluctuations in icing conditions and the repeated need to clear and remove debris caused multiple outages for some customers. According to Vermont Electric Cooperative which serves northern Vermont and the northern part of the Northeast Kingdom, the storm cleanup and restoration was estimated to cost $2 million a day.[88]

86 Storm Events Database. (2015). National Oceanic and Atmospheric Administration.
87 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
88 Smith, Robin. (2013). State Seeks FEMA help due to Ice Storm. The Caledonian Record. Retrieved from http://caledonianrecord.com/main.asp?SectionID=180&SubSectionID=778&ArticleID=104622

Probability of Future Events

According to the State Plan, the Great Ice Storm has an assigned frequency of approximately a 100-year event. However, ice storms are known to be more frequent. This has been shown by the countywide event in December 2013. A probability of possible was assigned.

Vulnerability Assessment and Estimated Losses

All current and future buildings and populations should be considered at risk to ice storm. The State Plan estimated $1 million dollars of potential loss per County and $14 million for a statewide incident for a 100-year ice storm based on the losses associated with the 1998 incident. Whatsoever, the NCDC database reports merely a loss of $480,000 statewide and of $80,000 per county for the same event. The reasons for this difference are unknown. However, since these data represent losses for the whole county they are likely an overestimate of annualized losses in the planning area.

With thirty-three percent of the critical facilities being equipped with generators, the impact from loss of power through ice storms could be accommodated to some extent.
Climate change will likely impact this hazard due to increased frequency.

Nor'easter

Description

A Nor'easter is a large weather system traveling from South to North along, or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas from a Northeasterly direction. The sustained winds may meet or exceed hurricane force.

Nor'easters are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. These events are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding. Further, they intensify as they reach the Northeastern Atlantic waters.[89]

The Northeast Snowfall Impact Scale (NESIS) described in the beginning of the section is a scale to measure snowstorms in the Northeast.

Location

The entire planning area is susceptibility to the impacts from a Nor'easter.

Previous Occurrences and Extent

Nor'easters are common in New England in the winter months. The NCDC database does not categorize Nor'easter events. Nor'easter impacts would be likely grouped into winter storm or flood hazards in the database. Therefore, NCDC database, the state plan, and web searches were used to identify significant events of winter storms or flood hazards that have impacted the planning area.

89 Northeast States Emergency Consortium. (2014). Retrieved from www.nesec.org

a) Winter storm:
As mentioned in the blizzard section, NCDC reported 101 winter storms throughout Caledonia County between 1950 and 2014, of which 99 events caused property damage totaling approximately $1,500 million and one event caused property and crop damage totaling $40,000. Damage resulted from power outages, traffic accidents, collapsing barn roofs (due to the weight of heavy snow), closed roads, and lost milk production due to inaccessible roads.

b) Flood hazards:
The state plan references two major disaster declarations in April and July of 2007 that were related to Nor'easters. In both cases, severe Nor'easters and accompanying rainstorms resulted in major flooding. As shown in Table 31, Caledonia County was impacted by Nor'easter events resulting in two disaster declarations:
1. On April 16, 2007, a heavy rain event with rainfall exceeding two inches throughout the day caused high water and flooding of low-laying fields adjacent to the Stannard Brook in Caledonia County. A landslide was caused in Orleans County due to the rain event.
2. On the August 2007 event,, no further information is available

Table 31 Disaster Declarations Related to Nor'easters in Caledonia County[90]

Disaster Name (Date of Event)	Date (Disaster Declaration)	Disaster Number (Type of Assistance)	Declared Areas
Severe Storms, High Winds, Flooding	5/4/2007	DR-1698	Bennington, Caledonia, Essex, Orange, Rutland, Windham, Windsor, and Lamoille (added)
Severe storms, flooding	8/3/2007	DR-1715	Orange, Washington, Windsor, Caledonia, Orleans

In addition, web sources referenced the following Nor'easter events[91]:
- March 30, 2014 (Three Day Nor'Easter that occurred from March 29 to March 31) Lyndonville, Caledonia County: 0.59" of rain
- December 27, 2010 – Lyndonville, Caledonia County: 5" rain

The January 2015 Nor'easter event did not affect the State of Vermont to the same extent as the coastal states.

The extent of Nor'easters varies based on several factors including time of impact and ambient temperature that produces snow or rain. NESIS can also be used to rank severity. Based on the disaster declarations, only one Nor'easter event had a confirmed rating of major. However, stronger nor'easters are possible and may impact the planning area. Nor'easters are capable of producing several feet of snow or several inches of rain that can result in flooding.

Probability of Future Events
Nor'easters are most common in the late fall to early spring from September through April. These typically happen more than once annually, though they vary in degree of severity. Information on previous occurrences in the previous subsection underestimates their frequency, as they are known to occur annually. Therefore, a probability of likely was assigned.

90 State of Vermont Hazard Mitigation Plan.
91 Springfield snowfall totals 15 inches from Nor'easter. (2010). Springfield Vermont News. Retrieved from http://springfieldvt.blogspot.com/2010/12/noreaster-could-dump-as-much-as-15.html; and Three day Nor'easter. (2014). Surf Ski Weather. Retrieved from http://surfskiweather.us/three-day-noreaster/

Vulnerability Assessment and Estimated Losses

All current and future buildings and populations should be considered at risk to Nor'easters. Depending on the atmospheric conditions, these coastal storms may bring rain, ice, or snow. Typical impacts include widespread power outages, downed trees and power lines, and business interruption. Rain events typically result in flooding. Traffic snarls and delays are also common. In general, this hazard does have adequate warning time, which helps to alleviate potential deaths and injuries.

Climate change impacts could increase the frequency of severity of Nor'easters.

Determining a reliable loss estimate is difficult given limited information on losses in the planning area. However, most events will require some storm debris cleanup. Losses may range from a few thousand dollars to several million dollars for each event.

Snow Event

Description

Snow event is a broad category that is used in this plan to describe winter storm and heavy snowfall events. According to the NOAA weather glossary, snow is frozen precipitation composed of ice particles in complex hexagonal patterns. Further, snow forms in cold clouds by the direct transfer of water vapor to ice. A heavy snow event, defined by the National Weather Service, is an accumulation of four or more inches within the timeframe of 12 hours or less. Associated events such as blizzards and nor'easters are described in separate hazard profiles. A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Events may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Winter weather events might be large enough to affect several states, while others might affect only localized areas. Occasionally, heavy snow may also cause significant property damages. For instance, roofs on older buildings can collapse, as they are not made to withstand heavy snow loads.[92]

All winter storm events have the potential to present dangerous conditions to the affected area. Larger snowfalls pose a greater risk as they reduce visibility due to blowing snow that make driving conditions difficult.

NOAA also defines types of public advisory and warnings issued by the National Weather Service with winter weather[93]:

- Winter Weather Advisory: May be issued when 4 to 6 inches of snow or sleet is expected in 24 hours; or any accretion of freezing rain or freezing drizzle is expected on road surfaces; or when blowing or drifting snow is expected to occasionally reduce visibility to 1/4 mile or less. Such events are expected to create hazardous or restricted travel conditions, but not as severe as expected with a winter storm.
- Winter Storm Watch: A significant winter storm may affect the area, but its occurrence, location, and timing are still uncertain. A winter storm watch is issued to provide 12 to 36 hour notice of the possibility of severe winter weather. A watch will often be issued when neither the path of a developing winter storm nor the consequences of the weather event are as yet well defined. Ideally, the winter storm watch will eventually be upgraded to a warning when the nature and location of the developing weather event

92 Glossary. (2015). National Weather Service – National Oceanic and Atmospheric Administration.
93 Glossary. (2015). National Weather Service – National Oceanic and Atmospheric Administration.

becomes more apparent. A winter storm watch is intended to provide enough lead-time so those who need to set plans in motion can do so.
- Winter Storm Warning: Issued when seven or more inches of snow or sleet are expected in the next 24 hours, or 1/2 inch or more of accretion of freezing rain is expected. A warning is used for winter weather conditions posing a threat to life and property.

The NESIS method described in the beginning of the section can be used to measure severity of snow events.

Location

Snow events are atmospheric in nature and may impact the entire planning area.

Previous Occurrences and Extent

The National Climatic Data Center database and State Plan were reviewed for events of heavy snow, winter storms, and winter weather.

As shown in Table 27 (under Blizzards), eight heavy snow events were reported throughout Caledonia County between 1950 and 2014 resulting in a total property damage of $261,000 with the Valentine's Day Blizzard in 2007 being the major contributor.

In addition to snow events, we investigated winter storm and winter weather events. NCDC reported 101 winter storms and 126 winter weather events throughout Caledonia County between 1950 and 2014[94]:

- Of the 101 winter storms, only one event did not result in any damage. Ninety-nine events caused property damage totaling approximately $1,500 million and one event caused property and crop damage totaling $40,000. Damage resulted from power outages, traffic accidents, collapsing barn roofs (due to the weight of heavy snow), closed roads, and lost milk production due to inaccessible roads.
- Of the 126 winter weather events, 113 resulted in damage totaling $624,500. Damage resulted from car accidents, snapped power lines and tree limbs.

Statewide, 505 winter storms, and 573-winter weather events occurred between 2006 and 2012.[95] The winter storms resulted in a property damage of 7,545 million and a crop damage of $145,000. The winter weather events resulted in a property damage of 2,467 million over a period of 6 years.

Table 32 shows an excerpt of 101 winter storm events that took place in Caledonia County between 2005 and 2010. Fatalities or injuries were not reported from these events.

Table 32 Excerpt from Winter Storm Events in Caledonia County from 2005-2010

Begin Date	End Date	Property Damage ($)	Description
12/7/1996	12/8/1996	50,000	Fatal traffic accident, power outages
3/5/1997	3/6/1997	30,000	Power outages, traffic accidents
12/29/1997	12/30/1997	20,000	Sutton: 7.4 " of snow w/ sleet and rail; traffic accidents
4/9/2000	4/9/2000	25,000	Ice and snow(Sutton: 9.2"); broken tree limbs; numerous accidents

94 Storm Events Database. (2015). National Oceanic and Atmospheric Admnistration.
95 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Begin Date	End Date	Property Damage ($)	Description
2/5/2001	2/6/2001	75,000	Minor traffic accidents; barn roof collapsed; Sutton: 14.4"
3/22/2001	3/23/2001	50,000	Power outages; traffic accidents; Sutton: 11.1" of snow
10/25/2005	10/26/2005	50,000	Trees and limbs downed; power outages; Sutton: 9"
2/10/2005	2/10/2005	20,000	Power outages
2/14/2007	2/14/2007	237,192.99*	"Valentine Blizzard"
12/11/2008	12/12/2008	10,000	Snow & freezing rain caused hazardous driving conditions, numerous school closings, civic and government closings, and power outages
2/23/2010	2/25/2010	50,000	Heavy wet snow (Walden: 20") resulted in power outages (>50,000 customers in the region)

*Adjusted for Inflation

There have not been any major disaster declarations related to snow events in Caledonia County. However, on the state level one federal disaster declaration occurred in December 1969 related to a blizzard event.

Probability of Future Events

Eight heavy snow events and 101 winter storms and 126 winter weather events were noted throughout Caledonia County between 1950 and 2014. Snow events and winter storms are very frequent in the region. The reported data suggests a very high likelihood for snow events in Caledonia County: The probability for winter weather to occur twice in a year is 100% and the probability for two winter storm events to occur in one year is 65 %. Future snow events have been assigned a probability of highly likely.

Vulnerability Assessment and Estimated Losses

All current and future buildings and populations are at risk to this hazard. It has a variety of potential impacts. For example, structural damage may occur as heavy snow loads cause roofs and trees to collapse. Large flat roofs, for instance on commercial, retail, and school buildings, are at highest risk to this occurrence. Death and injuries are also possible. There have been reports from carbon monoxide incidents due to blocked heating vents. Additional impacts include road closures (including blocked emergency access road), snow drifts, power outages, business interruption and loss, hazardous driving conditions, frozen pipes, fires due to improper heating, secondary impacts caused by shoveling (such as a heart attack), and flooding.

The following annualized losses within Caledonia County can be noted:

- $4,000 from heavy snow
- $23 million from winter storms
- ~$9,758 from winter weather.

In comparison, the following annualized statewide losses in Vermont can be noted:

- $1257.5 million (property damage) and $24,167 (crop damage) from winter storms
- $411 million from winter weather.

Thirty-three percent of the critical facilities in the planning area are equipped with generators (partly movable) and could accommodate or minimize damage from power outages.

Extreme Cold

Description

Extreme cold and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In Vermont however, extreme cold temperatures can range from temperatures at 0°F to below zero degree over an extended period of time (see Table 33). Whenever temperatures drop decidedly below normal and as wind speed increases, heat can leave the body more rapidly. These conditions may lead to serious health problems. Extreme cold is specifically affecting vulnerable populations, for example those without shelter or who live in a poorly insulated or not heated home. Extreme cold can last for several days or more in Vermont putting people at risk of exposure and stressing heating systems. Extreme cold increases the risk of secondary hazards such as carbon monoxide poisoning and building fires. In addition, water pipes that freeze or break may cause flooding.[96]

Location

Extreme cold is an atmospheric hazard and can impact the entire planning area.

Previous Occurrences and Extent

NCDC reported five extreme cold events for the entire Caledonia County during 1950 and 2015. Table 25 gives more information on the extreme cold events during that timeframe.

Table 33 Extreme Cold Events in Caledonia County from 1950-2015

Date	Death/ Injuries	Property Damage	Description
1/25/2007	0/0	0	-14 degrees (St. Johnsbury); event lasted 2 days (plus another 2 days)
3/6/2007	0/0	0	-15 degrees (Sutton, Caledonia); event lasted approximately 2 days
3/9/2007	0/0	0	-23 degrees in St. Johnsbury (Caledonia); 1 night
1/14/2009	0/0	0	- 37 degrees (Sutton, Caledonia Cty); 2 days
1/7/2015	0/0	0	- 25 degrees (Lyndonville); 1 day

Statewide, 31 cold/wind chill events were noted over six years. There have been no major disaster declarations related to extreme cold in Caledonia County.

Probability of Future Events

Statewide, the annualized probability for cold/wind chill events is highly likely. Countywide, the probability for extreme cold events is less than 8%. The countywide data are likely an underrepresentation. An estimated annual probability of possible was assigned for extreme cold events in the planning area.

Vulnerability Assessment and Estimated Losses

Extreme cold is an atmospheric hazard and has the potential to impact all existing and future assets, essential facilities, and populations. It may be associated with other winter hazards discussed in this plan. In general, this hazard has adequate warning time, beyond 24 hours and lasts for less than a week. It has a large spatial

96 Extreme Temperatures Hazard Profile. (2008). New York State. Homeland and Emergency Services. Retrieved from http://www.dhses.ny.gov/oem/mitigation/archive/documents/2011/3.11-Extreme-Temperatures-2011.pdf

extent, so the entire planning area may be impacted. Extreme cold is unlikely to damage structures severely but may result in broken water pipes. It also poses a health threat in terms of hypothermia and frostbite. Vulnerable populations, including the elderly and infants, have an increased risk and lower tolerance for such events. During extreme cold events travel time may be delayed as bridges and secondary roads may be icy and sidewalks and driveways may become slippery. Risk from improper use of heating devices resulting in fire and carbon monoxide poisoning may cause death and injuries.

Thirty-three percent of the critical facilities are equipped with generators, which could provide backup heating. No losses were reported from this hazard. Future losses are expected to be minimal and would be negligible if annualized over time. Climate change may impact this hazard through increased occurrence and severity.

Fire hazards

Fire-related hazards include drought, wildfire, and lightning for Lyndon, Vermont. Drought and wildfires have not been reported for Caledonia County but are included since they are mentioned in the State Plan.

Drought

Description

The National Drought Mitigation Center (NDMC) defines drought conceptually as "a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield."[97] In general, drought is defined as "a water shortage with reference to a specified need for water in a conceptual supply and demand relationship. It is a complex phenomenon that is difficult to monitor and assess because it develops slowly and covers extensive areas, as opposed to other disasters that have rapid onsets and obvious destruction. Unlike most disasters, the effects of drought can linger long after the drought has ended."[98] It is a normal, recurrent feature of climatic and can occur at any place at any time. Droughts can have very damaging affects to crops, municipal water supplies, recreational uses, and wildlife. High winds, low humidity, and extreme temperatures can all amplify the severity of the drought.

Drought can be described according to meteorological, hydrological, agricultural, or socio-economic criteria. Table 34 lists the different drought types along with background information on those.

Table 34 Drought Types[99]

Drought Type	Description
Meteorological Drought	Meteorological drought is usually based on long-term precipitation departures from normal precipitation pattern in regard to the amount, intensity, or timing of the event as well changes in the temperature, humidity, and wind patterns. The strict threshold differs for every nation; the United States defines meteorological drought as receiving less than 2.5 mm of rainfall in 48 hours. Meteorological drought is the first drought stage detected.
Agricultural Drought	Agricultural drought occurs when there is insufficient soil moisture to meet the needs of a particular crop and non-natural vegetation at a particular time. A deficit of rainfall over cropped areas during critical periods of the growth cycle can result in destroyed or underdeveloped crops with greatly depleted yields.

97 Drought Basics. (2015). National Drought Mitigation Center. Retrieved on May 28 2015 at http://drought.unl.edu/DroughtBasics/WhatisDrought.aspx

98 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergement Management.

99 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Drought Type	Description
Hydrological Drought	Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow, and as lake, reservoir, and ground water levels. It is the last stage of drought and is lagged behind meteorological and agricultural drought because water infiltrates down to the groundwater during the latter portion of the hydrological cycle. Subsurface water supply is the last drought component to return to normal when meteorological conditions and aquifer recharge return.
Socioeconomic drought	Socioeconomic drought is what happens when the consequences of the drought start to affect the socioeconomic sector. It occurs when the demand for an economic good is greater than the available supply due to weather-related drought. Examples of such goods include water, hydroelectric power, food grains, meat, dairy, and much more. Socioeconomic drought affects the associated population both individually and collectively.

The severity of a drought depends on the duration, intensity, and geographic extent of the water shortage as well as the demands on the area's water supply. The US Department of Agriculture (USDA) rates droughts from D0–D4, depending on the severity of the drought, the amount of time it will take for vegetation to return to normal levels, and the possible effects of the drought on vegetation and water supply.[100]

There are several ways to measure drought. The figure below shows drought severity conditions and selected drought monitor indices. Table 35 shows drought severity conditions.

100 Drought Basics. (2015). National Drought Mitigation Center. Retrieved on May 28 2015 at http://drought.unl.edu/DroughtBasics/WhatisDrought.aspx

Table 35 Drought Severity Conditions[101]

Description	Possible Impacts	Drought Monitor Indices		
		NDMC* Drought Category	Standardized Precipitation Index (SPI)	Palmer Drought Index
Abnormally Dry / Minor Drought	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	D0	-0.5 to -0.7	-1.0 to -1.9
Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	D1	-0.8 to -1.2	-2.0 to -2.9
Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	D2	-1.3 to -1.5	-3.0 to -3.9
Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	D3	-1.6 to -1.9	-4.0 to -4.9
Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	D4	<2	-5.0 or less

*NDMC – National Drought Mitigation Center

The Drought Management of the State of Vermont Emergency Management Plan uses drought indices, which are depicted in the following Table 36.

101 US Drought Monitor. (2015). The National Drought Mitigation Center. Retrieved from http://droughtmonitor.unl.edu/

Table 36 State of Vermont Drought Indices [102]

Drought Level	Wildland Fire Potential NFDRS*	Groundwater ***	Public Water Supplies and Public Community Water Supplies	Surface Water
Normal	Low	35% of wells are within the lowest quartile for 2 consecutive months or less **	Less than 1% of PCWS on shortage or outage list. Domestic replacement wells list	The monthly mean is within the lowest quartile for 2 consecutive months or less **
Advisory	Moderate	35% of wells are within the lowest quartile for 3 consecutive months **	1-2% PCWS short or out of water.	The monthly mean is within the lowest quartile for 3 consecutive months **
Watch	High	35% of wells are within the lowest quartile for 4-5 consecutive months **	3-5 % PCWS short or out of water.	The monthly mean is within the lowest quartile for at least 5 out of 6 consecutive months **
Warning	Very High	35% of are within the lowest quartile for 6-7 consecutive months **	6-8 % PCWS short or out of water.	The monthly mean is within the lowest quartile for at least 6 out of 7 consecutive months **
Emergency	Extremely High	35% or more of wells are within the lowest quartile for 8 or more consecutive months **	9 %or greater PCWS short or out of water.	The monthly mean is within the lowest quartile for at least 7 out of 8 consecutive months **

Abbreviation: PCWS - Public Community Water Supply
*The Fire Danger level is calculated daily and subject to frequent change.
** Quartile is 25% of the total number of values over the period of record for the measurement.
*** Doesn't account for deeper overburden or bedrock sources.

Drought differs from other natural hazards in multiple ways. Firstly, drought is not as obvious as other hazards; it does not have the destructive impact on property of a tornado or hurricane. Secondly, there is a lack of an exact and universally accepted definition of drought. Finally, the beginning and end of a drought is difficult to determine. In addition, droughts are often spread over a larger geographic area than other natural hazards. Therefore, the economic effects of a drought can be just as devastating as other natural hazards. Human activities can often exacerbate the impact of drought. For example, water use can deplete ground water supply. An increased drought level also increases the risks for wild fires.

102 Drought Management – Incident Annex 6. (2013). State of Vermont Emergency Management Plan – Vermont Emergency Management.

Location

A drought is a regional event that is not confined to geographic or political boundaries; it can affect several areas at once. However, it can range in severity across those areas. All of the planning area is at risk to drought occurrence.

Previous Occurrences and Extent

The State of Vermont usually receives adequate amounts of rainfall, which makes droughts low frequency hazards; however the climate is highly variable and unpredictable and droughts occasionally do occur. The State Plan reports that moderate and mild droughts are common while several severe droughts were recorded during the last century. A severe protracted drought occurred in 1964 "worsening to extreme in 1965 and 1966." "In the summer of 2003, Vermont experienced drought conditions with many communities reporting the season to be the driest on record."[103]

According to the State Plan, two statewide declared droughts occurred in June and July 1995. There have been no major disaster declarations related to drought in Caledonia County. In general, severe droughts are not frequent occurrences in Vermont.[104]

U.S. Drought Monitor Data was collected from the station nearest to Lyndon, St. Johnsbury. The reporting period is from January 2000 to May 2015. Records include a weekly drought condition including the percent of the area in each classification of drought. Figure 13 shows the drought indices for St. Johnsbury, Vermont between 2000 to 2015.

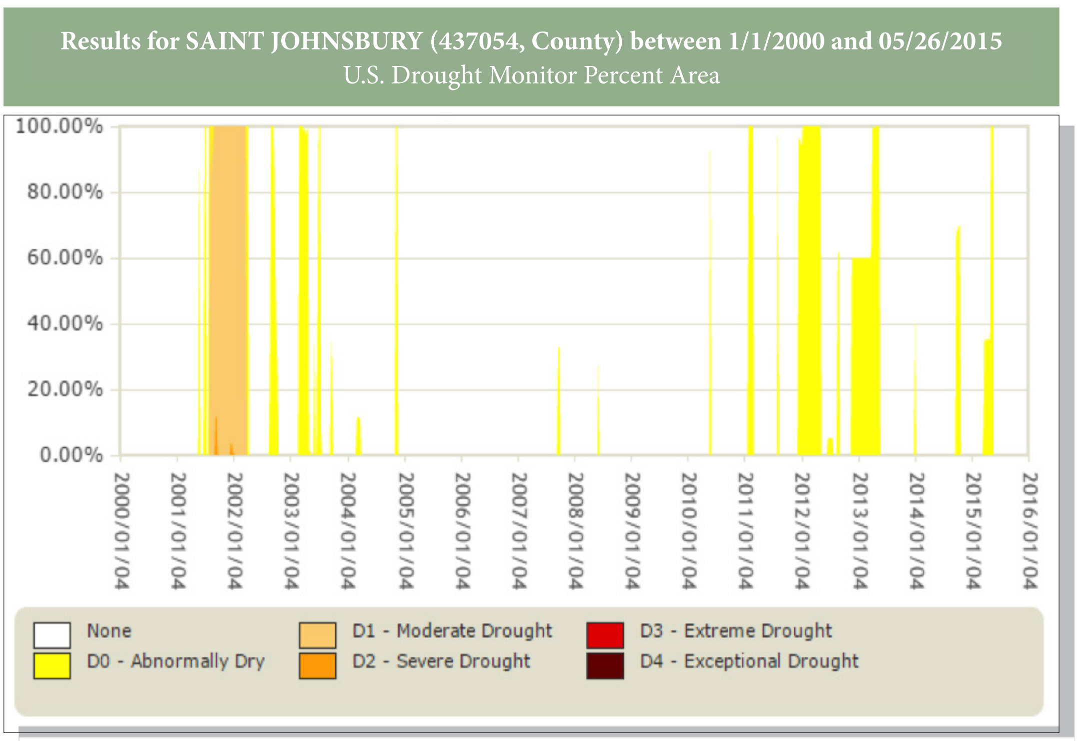

Figure 13 Drought Indices for St. Johnsbury, VT (2000-2015)[105]

103 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
104 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
105 Drought Risk Atlas. (2015). National Drought Mitigation Center. Retrieved on May 28, 2015 from http://droughtatlas.unl.edu/Data.aspx

The drought data for St. Johnsbury was analyzed and results are in Table 37 by reporting the highest drought classification that occurred each year and the number of weeks at that recorded level. Conditions are reported by category as a percentage in the Figure 13. The table presents the drought category without taking the percentage level into account; all percentages are shown. For example, in 2001 D2 may be reported as the highest level but only a small percentage of the area may have been involved in D2 drought levels throughout the reported time in 2001.

Table 37 Drought Monitor Data for St. Johnsbury, VT

YEAR	Maximum Severity
2000	No drought
2001	Up to D2 conditions for 5 weeks
2002	Up to D2 conditions for 2 weeks
2003	Up to D0 conditions for 17 weeks
2004	Up to D0 conditions for 7 weeks
2005	No drought
2006	No drought
2007	Up to D0 conditions for 3 weeks
2008	Up to D0 conditions for 2 weeks
2009	No drought
2010	Up to D0 conditions for 2 weeks
2011	Up to D0 conditions for 11 weeks
2012	Up to D0 conditions for 34 weeks
2013	Up to D0 conditions for 24 weeks
2014	Up to D0 conditions for 8 weeks
2015*	Up to D0 conditions for 11 weeks

*Note: Data was available until May 26, 2015.

The extent of drought can be defined in terms of the drought monitor classifications. The highest classification to occur in St. Johnsbury and Caledonia County is D2. However, more severe conditions are possible.

Probability of Future Events

Drought conditions of D0 (abnormally dry or minor drought) or higher have been reported in twelve out of sixteen years. This results in an approximate of 77 percent, bringing the probability of future minor droughts (D0) to likely.

Vulnerability Assessment and Estimated Losses

Drought is an atmospheric hazard so it has the potential to impact all existing and future assets, essential facilities, and populations. Drought tends to have greater economic, environmental, and social impacts. However, the built environment is rarely affected.

Losses from droughts are not estimated to date. A better understanding of economic losses from droughts could be gained by assessing certain losses such as the reduction in agricultural production during droughts, or the costs for additional water supply for farms and communities, and drilling or deepening of wells to capture additional yields during the drought period.[106]

106 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Climate change may also influence drought. Recent projections from the UMASS Climate System Research Center are showing that the Northeast will warm by 2-3 degrees Celsius and experience more precipitation in the winter months.[107] Warmer temperatures could result in faster evaporation and thus in an increased risk of drought; however this will depend on the actual weather conditions. In general, droughts may become increasingly common in the future.

Lightning

Description

Lightning is a sudden discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. Lightning rapidly heats the sky as it flashes but the surrounding cool air follows the bolt. This rapid heating and cooling of the surrounding air causes thunder, which is often accompanied by lightning strikes.[108]

Lightning typically is less frequent and less intense adjacent to cool ocean and lake surfaces, which reduce the intensity of updrafts in thunderstorms.

Location

Figure 14 was compiled from data for the years 2005 to 2012 to demonstrate the frequency of cloud-to-ground lightning flashes per square mile per year. As shown, lightning is less frequent in the Northeast and in northern New England compared to the western region on this map. The planning area receives about 0.5 to 2 flashes per square mile per year.

It shall be noted that thunderstorms develop more often on slopes than over the highest elevations. Most lightning occurs during June, July, and August. With regard to the time of day, most areas have the most frequent cloud-to-ground lightning activity from afternoon to early evening.[109]

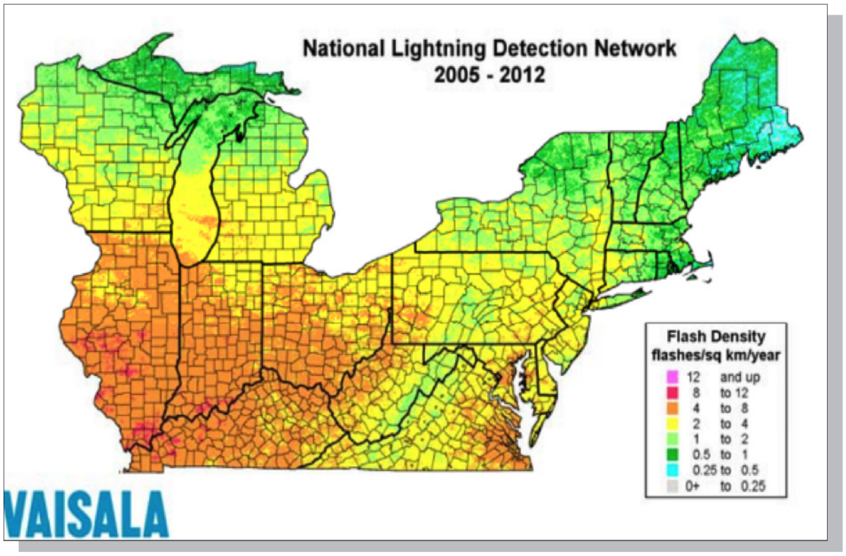

Figure 14 Lightening in the Northeast[110]

107 Climate modelers see possible warmer, wetter winters in Northeast by 2070. (2012). UMass Amherst. Retrieved from http://www.umass.edu/newsoffice/article/climate-modelers-see-possible-warmer-wetterwinters-northeast-2070

108 Lightning. (2015). Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Lightning

109 VAISALA. (2013).

110 VAISALA. (2013).

Previous Occurrences and Extent

The National Climatic Data Center was referenced to determine possible lightning occurrences in Caledonia County. The following events have been reported between 1950 and 2014[111]:

- One lightning event occurred in Lyndonville on 6/29/2003 with no death or injuries or loss in property.
- Seven other lightning events occurred in Caledonia County resulting in a total damage of 187,000 USD (from five events).
- One of these lightning's occurred in St. Johnsbury on 5/11/2007 and resulted in a damage of 150,000 USD.

Probability of Future Events

Based on one lightning strike in Lyndonville over 64 years, a probability of possible was assigned. Other lightning strikes throughout the county have resulted in minor damage. However, in the planning area no damage has been reported.

Vulnerability Assessment and Estimated Losses

Given that lightning may strike anywhere, all current and future buildings and populations are assumed to be at risk to lightning. In the planning area, losses have not been reported for this hazard. However, similar events resulted in a total damage of $187,000 with one singular event causing $150,000 in damage (St. Johnsbury event on 5/11/2007). This equals an average of $37,400 per event or an annualized loss of $2,922.
Losses due to lightning include impacts from structural fires and debris cleanup from downed trees and power lines, and electronic equipment damage.

Wildfire

Description

A wildfire is the uncontrolled burning of woodlands, brush, or grasslands. According to FEMA, there are four categories of wildfires that can occur throughout the United States[112]:

1. **Wildfires:** Fueled by natural vegetation; typically occur in national forests and parks, where federal agencies are responsible for fire management and suppression
2. **Interface or Intermix Fires:** Urban wildfires in which vegetation and the built environment provide fuel
3. **Firestorms:** Events of such an extreme intensity that effective suppression is virtually impossible; occur during extreme weather and generally burn until conditions change or the available fuel is exhausted
4. **Prescribed Fires and Prescribed Natural Fires:** Fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes

"Wildfires can be a result of naturally occurring influences such as lightning, extreme drought and heat, and human influences such as a discarded cigarette butt, improperly extinguished campfire, a stray spark from nearby railroad tracks or intentional arson. The potential for threat of wildfires is dependent upon topography and slope, surface fuel characteristics, recent climate conditions, current meteorological conditions, and fire behavior. Wildfire danger can vary greatly season to season and is exacerbated by dry weather conditions or drought. Once a wildfire threatens a community, it is often too late to protect nearby structures, and populations have to be evacuated for their own safety. These fires have damaged structures and utilities as well as hundreds of acres of woodlands."[113]

111 Storm Events Database. (2015). National Oceanic and Atmospheric Administration.
112 Wildfires. (1997). Federal Emergency Management Agency.
113 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

According to the State Plan, wildfires are uncommon in Vermont but have increased through extended periods of warming as a result of climate change. Risk of fires in wild land, rural areas, state forests, and parks are linked to dry conditions. According to the State of Vermont Emergency Management Plan (Drought Management), wildfires can have moderate to severe impacts on natural resources.[114]

Location

According to the Vermont Forest Resources Plan, Lyndon is located in a rural residential landscape zone made up from rural residential non-forested and forested area, these are defined as following[115]:

- Non-forested lands are lands less than 50% forested per km square,
- Forested lands are 50% or greater of the area in forest cover per km square.

According to this source, rural and rural residential areas are priority areas at risk for wildfire damage. Thereof the Forested Rural Residential Landscape Zone (FRRLZ) is named to have the highest risk of wildfire due to the density of structures in close proximity to forest cover. Figure 15 provides an overview of the land use area in the planning area.

114 State of Vermont Emergency Operations Plan. (2013). Vermont Drought Management.

115 Vermont Department of Forests, Parks and Recreation. (2010). Agency of Natural Resources – Vermont Forest Resource Plan.

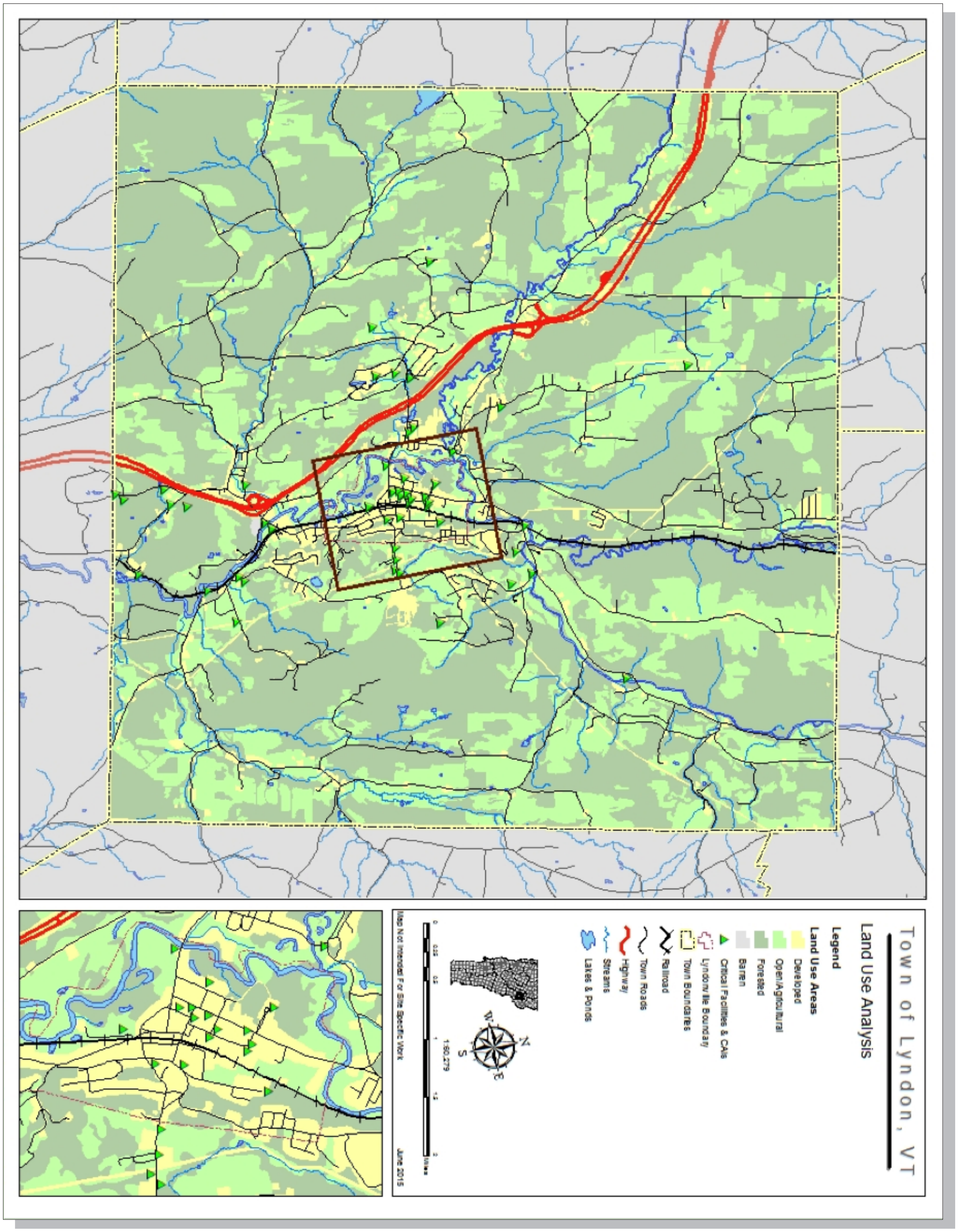

Figure 15 Land Use in the Planning Area

Based on the Town's GIS data used in this figure, Lyndon's planning area is a mix of developed (65.3 acres), open/agricultural (7,606.90 acres), and forested areas (15,591 acres). As shown in Table 38, this results in the following land use type percentages:

Table 38 Land Use Types in the Planning Area

Land use type	Percentage
Forested areas	67%
Open space / agricultural areas	32.7%
Developed areas	0.2%
Barren areas	0.01%

The Lyndon Town Plan notes 8.4 % agricultural and approximately 19 % forested land within land trusts in the planning area.[116]

Fires may be determined by investigating areas where development is near undeveloped areas. The area where urban development meets vegetated, wildfire prone lands is called the Wildland Urban Interface (WUI). The Silvis Lab at the University of Wisconsin has developed the methodology behind wildland urban interface area. The Silvis Lab defines interface areas and intermix areas as follows[117]:

- Interface areas: Housing density between 6.2 and 742 structures/census block combined with Wildland vegetation less than equal to 50% AND within 2.4 kilometers of areas with at least 75% Wildland vegetation.
- Intermix areas: Housing density between 6.2 and 741 structures/census block and Wildland vegetation is greater than 50%.

Based on this method, we developed the WUI for Lyndon and Lyndonville. Figure 16 shows the results of the WUI analysis for the planning area.

116 Lyndon Town Plan. (2014). Town of Lyndon.

117 The wildlife urban interface. (2015). Silvis Lab – University of Wisconsin. Retrieved on May 18 2015 from http://silvis.forest.wisc.edu/maps/wui_main

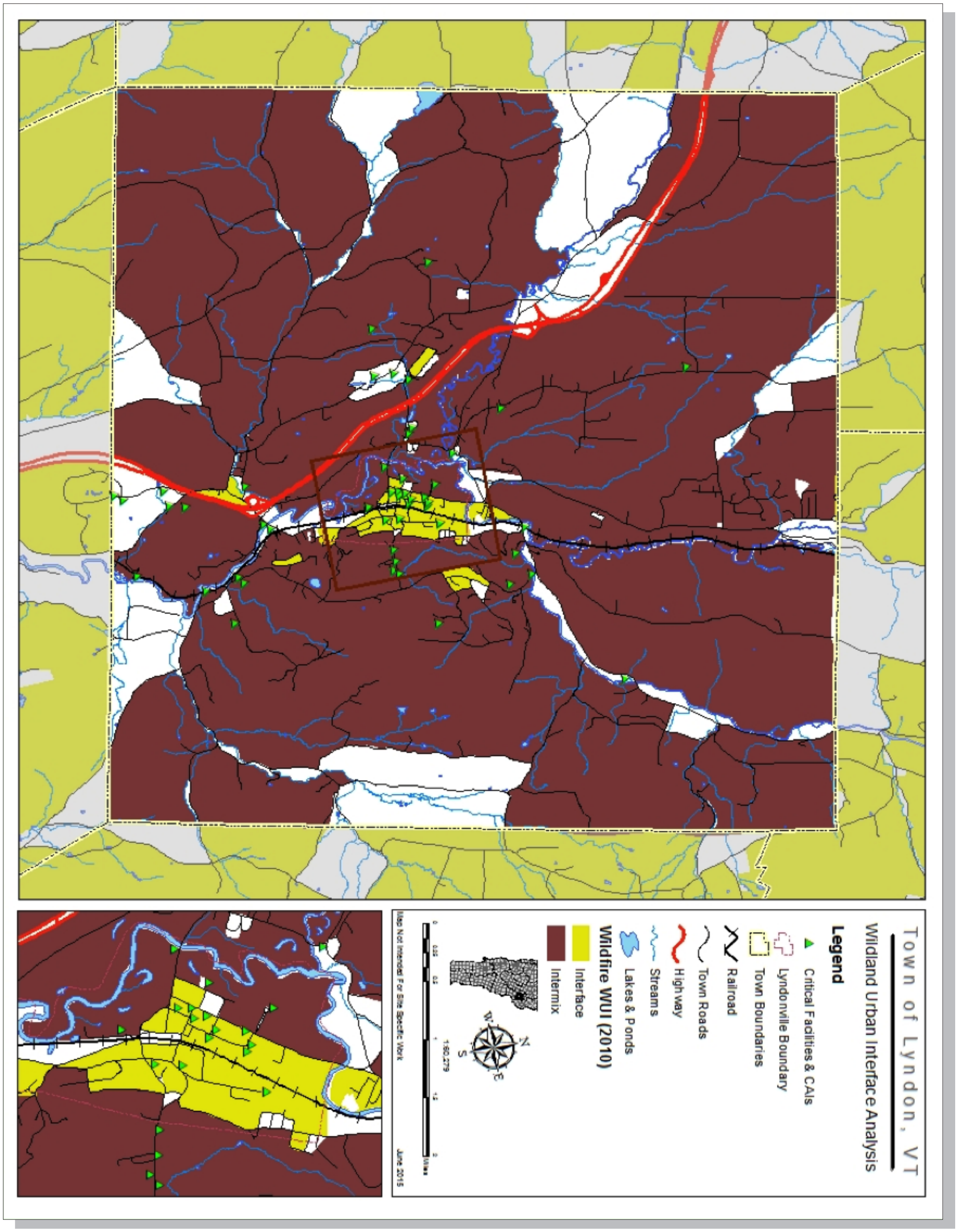

Figure 16 Wildland Urban Interface for the Planning Area

Previous Occurrences and Extent

Several sources were investigated to determine wildfires in the planning area. Limited information was available. There have been no major disaster declarations related to wildfire in Caledonia County. The State Plan notes that wildfires are generally uncommon in the State of Vermont and the threat of wildfire is relatively rare. As shown in the drought section, severe droughts occurred in 1964, worsening to extreme in 1965 and 1966. As a result, in 1966 there were 14 Class C wildfires in Vermont ranging from 10 to 100 acres, much larger than the average forest fire in Vermont of 2.5 acres.[118] For the planning area no event has been reported whatsoever. The probability has been assessed as possible.

Given a typical area of up to 2.5 acres for an average forest fire, the extent of a wildfire can be categorized as small.

Probability of Future Events

Based on the Vermont Forest Resource Plan, Lyndon is located in a zone of low to moderate wildfire risk (see Appendix B).[119] According to the State Plan, wildfire conditions are typically at their worst either in spring when dead grass and fallen leaves from the previous year are dry and new leaves and grass have not come out yet, or in late summer and early fall when that year's growth is dry. In drought conditions, the risk for wildfire is higher.[120] In addition to drought conditions or low humidity, warm temperatures and strong winds can facilitate a wildfire as well.

Limited reporting on previous occurrences makes it difficult to determine a reliable probability. There has not been a major wildfire in Vermont in the last 50 years. Overall, Vermont's climate, vegetation type, and landscape discourage major wildfire[121].

Vulnerability Assessment and Estimated Losses

Wildfire impacts include structural damage or loss, timber and habitat damage and loss, reduced air quality due to smoke, hazardous driving conditions due to smoke and ash, accelerated erosion and increased flood risk. Evacuations due to wildfires are less likely in the planning area as fires may be contained quickly. Climate change may also impact this hazard in terms of earlier onset of spring, warmer summer, and reduced precipitation (increased burnable area).

Small wildfires up to 2.5 acres can be expected in the planning area. No information on previous losses was available.

All current and future buildings and populations are considered at risk to wildfire. WUI data allows GIS intersection analysis to indicate the risk in this area. For the planning area at-risk, WUI parcels have been identified. The results are shown on Table 39.

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118 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
119 Vermont Forest Resource Plan. (2010). Vermont Department of Forests, Parks, and Recreation.
120 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
121 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Table 39 At-Risk WUI Parcels

	Interface Areas	Intermix Areas	Percentage of total area (%)
Number of Parcels	467.00	1823	1.3
Population at Risk	1162.00	3651	83

According to the WUI analysis, 84.3 % of the area and 80 % of the population (totaling 5981 people) would be at risk to wild fires. Critical facilities at risk do have a combined value of $36,303,374. This equals 25% of the total worth.

Table 40 shows the critical facilities potentially at risk from wildfires due to being located in an interface or intermix area.

Table 40 Critical Facilities at Risk to Wildfire (per WUI analysis)

Critical Facilities at risk to wildfire
Municipal Building
Public Safety Building
LED Garage
Village Garage
Lyndon Town School
Riverside School
Thaddeus Stevens School
Cobleigh Public Library
Darling Inn
Riverside Enrichment Center
The Pines
Armory Building
St. Elizabeth's Church
Methodist Church
First Congregational Church
Episcopal Church
Church of Latter Day Saints
Kingdom Hall Jehovah's Witness
Lyndon Center Free Baptist Church
Lyndon Bible Church
VFW
Cell Towers
Wastewater Treatment Center
VELCO Substation

Critical Facilities at risk to wildfire
LED Substation
Pudding Hill Substation
Great Falls Substation & Hydro Dam
Vail Dam
Caledonia County Airport
Northeast Kingdom Waste Management
Center Street Pump Station
Calkin Pump Station
VFW Pump Station
Remington Reservoir
Heath Road Reservoir
Booster Station for Water
Lilly Pond Pump Station
Main Street Pump Station
Water Filtration (treatment) Plant

Based on the WUI analysis, the potential impact from a wildfire was assessed as critical.

Geologic Hazards

A geologic hazard is an extreme natural event in the crust of the earth, which poses a threat to life and property. Examples of geological hazards include earthquakes, volcanic eruptions, tsunamis (tidal waves), and landslides. Geologic hazards analyzed for the planning area include earthquakes and landslides.

Earthquake

Description

An earthquake is a sudden and intense shaking of the ground caused by the sudden movement of large portions of the Earth's crust, potentially causing massive damage to buildings and infrastructure. Earthquakes can occur suddenly at any time, with virtually no warning. Earthquakes in the northeastern United States generally have deep foci (> 10 km).[122]

Earthquake magnitude is measured using the Richter scale, which is an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. Each magnitude unit increase on the Richter scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) scale based on direct and indirect measurements of seismic effects. The MMI scale levels are typically described using roman numerals, ranging from "I" corresponding to imperceptible (instrumental) events to "XII" for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in Table 42. The Richter Scale is depicted in Table 41.

Table 41 Richter Scale [123]

Richter Magnitudes	Earthquake Effects
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

122 Ebel, J.E. and A.L. Kafka (1991). Earthquake activity in the northeastern United States, in Decade of North American Geology, vol. GSMV-1. Chapter 15, 277-290.
123 Richter Magnitude Scale. (2015). Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Richter_magnitude_scale

Table 42 Modified Mercalli Intensity (MMI) Scale[124]

Scale	Intensity	Description Of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs.	--
II	Feeble	Some people feel it.	< 4.2
III	Slight	Felt by people resting; like a truck rumbling by.	--
IV	Moderate	Felt by people walking.	--
V	Slight strong	Sleepers awake; church bells ring.	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	Very strong	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	--
IX	Ruinous	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	Very disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Location

Vermont is classified as an area with low to moderate seismic activity[125]. Typically, earthquakes occur along fault lines, but these deep faults are not always expressed on the ground surface. Although there are numerous faults exposed at the ground surface in the northeastern United States, there is no evidence for significant motion along these faults.[126] Therefore, location of where earthquakes will occur in the Northeast is still uncertain. The hard bedrock terrain in the northeast permits earthquake energy waves to travel long distances while dissipating slowly, which may result in a big impact.

The Northeast States Emergency Consortium (NESEC) indicates that New England experienced 2403 earthquakes from 1638 through 2007, 73 of which were located in Vermont. The vast majority of these earthquakes were minor in nature. Minor earthquakes, such as those less than 3.0 in magnitude, occur frequently in the region.[127] However, they are virtually undetectable and do not cause damage and do not warrant concern.

124 Modified Mercalli Intensity Scale. (2015). U.S. Geological Survey. Retrieved from http://earthquake.usgs.gov/learn/topics/mercalli.php; Mercalli Sclae vs Richter Scale. (2015). Diffen. Retrieved from http://www.diffen.com/difference/Mercalli_Scale_vs_Richter_Scale; adapted

125 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management. P.4-91.

126 Ebel, J.E. and A.L. Kafka (1991). Earthquake activity in the northeastern United States, in Decade of North American Geology, vol. GSMV-1. Chapter 15, 277-290.

127 Earthquakes Hazards. (2015). The Northeast States Emergency Consortium. Retrieved from http://nesec.org/earthquakes-hazards/

Although the risk of a major earthquake to occur is low, the effects of a potential major earthquake may be devastating and may affect the entire region. Nearly all critical infrastructure is vulnerable, including roads, bridges, utilities, communications, etc. State and federal emergency response might be delayed or hindered as a result of roads or bridges having been destroyed during the quake or due to damage and debris that might block access to roads.

All areas of the planning area are susceptible to an earthquake occurrence. Fault lines, however, are not a sufficient indicator of earthquake location in the Northeast. Figure 18 was used to indicate possible earthquake locations. It shows the location of relative seismic risk for the state of Vermont. This indicates that the planning area is in an approximate zone of 10 to 14 percent g hazard area (correlating to strong perceived shaking). Percent g refers to the acceleration due to gravity. Peak acceleration is measured on an intensity scale similar to the Mercalli scale.

Figure 17 depicts the risk of damage from earthquakes in the US. Figure 18 shows a seismic hazard map for Vermont. As illustrated, Vermont is located within a region of moderate risk of damage from earthquakes.

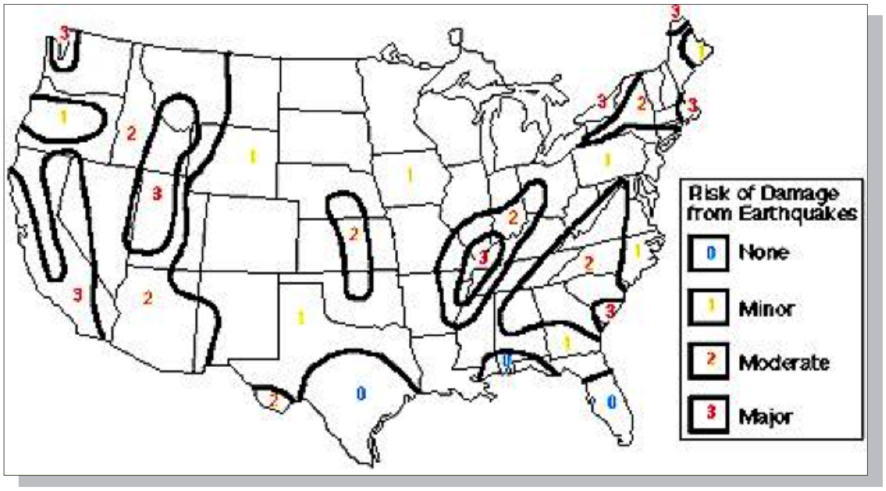
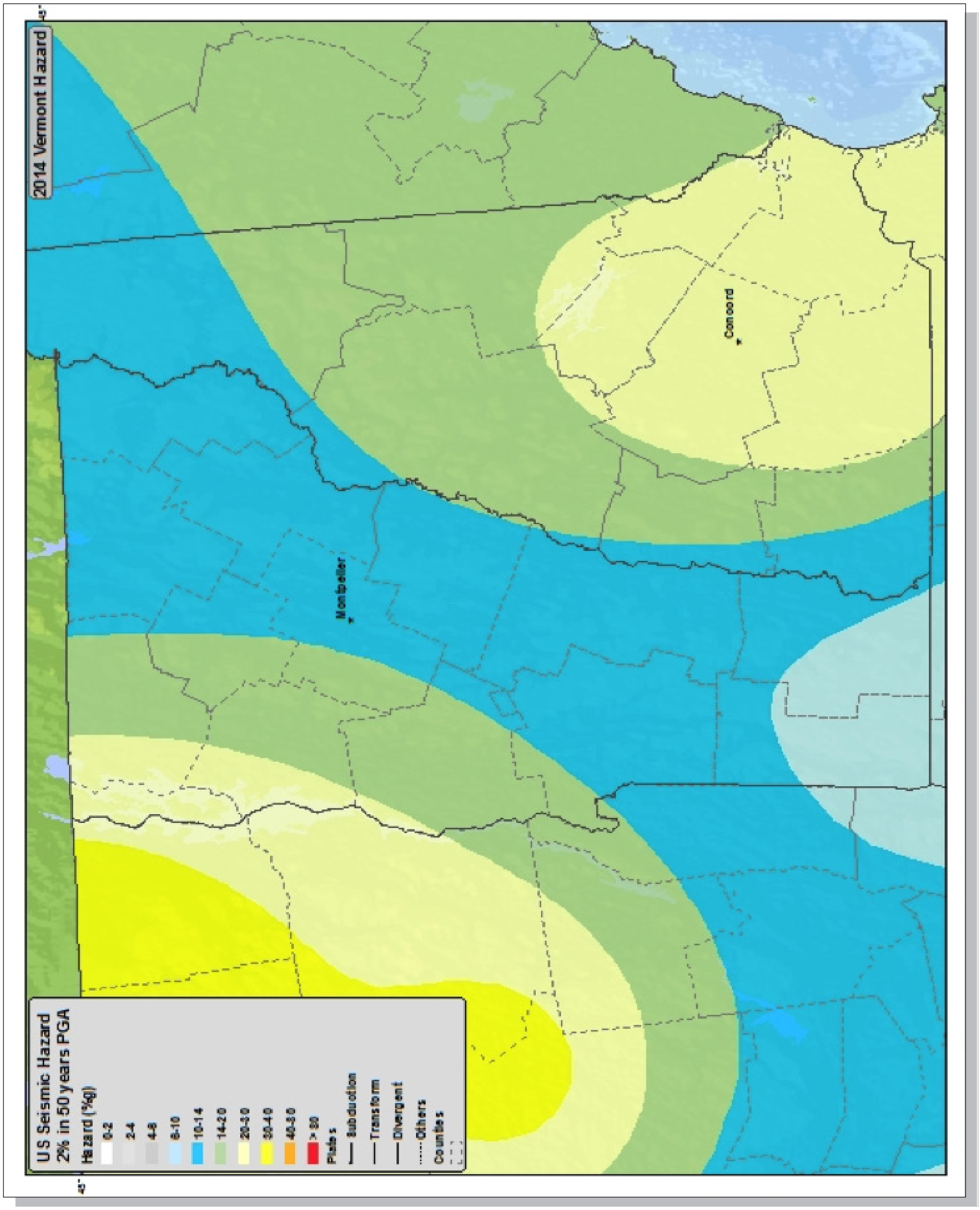


Figure 17 Risk of Damage from Earthquakes[125]

128 Stearns and Miller. (1977).



**PGA – peak ground acceleration (mapped on an intensity scale similar to the Mercalli scale*

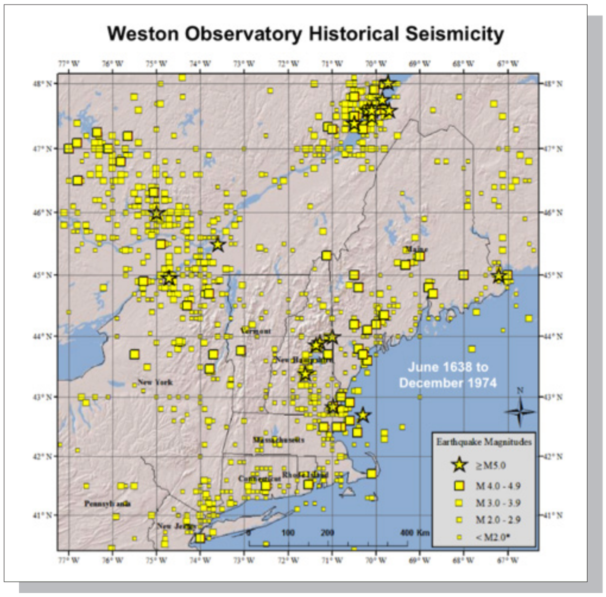
Figure 18 Seismic Hazard Map for Vermont 129

129 U.S. Geological Survey. (2014).

Previous Occurrences and Extent

There have been no major disaster declarations related to earthquakes in Caledonia County. However, several earthquakes have been located near Lyndon, Vermont. As already mentioned, earthquakes further away can and have caused considerable damage in the planning area.

Figure 19 shows historical occurrence of earthquakes in the Northeast. The figure on the left depicts 1638 to 1974 earthquake occurrences and the figure on the right shows earthquake occurrences from 1975 to 2014. Table 43 lists notable historic earthquakes in Vermont from 1638 – 2007 with a magnitude or intensity of 4 or greater.



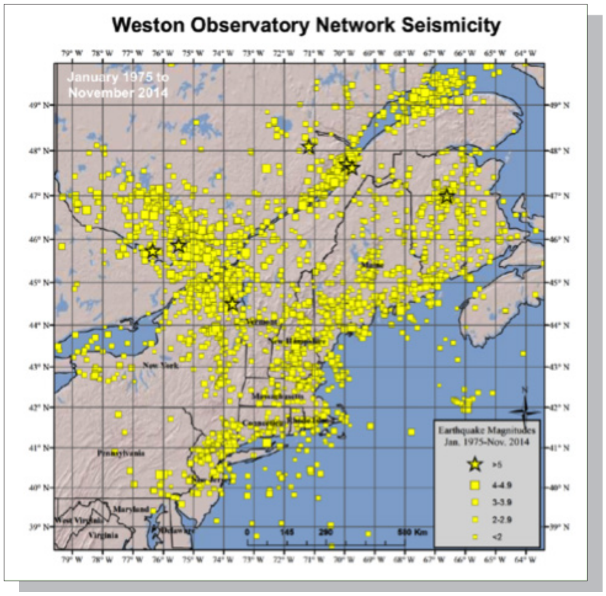


Figure 19 Historical Occurrence of Earthquakes in the Northeast[130]

130 Kafka, Alan L. (2014). Why Does the Earth Quake in New England? Boston College. Weston Observatory Network Seismicity. Retrieved May, 22, 2015 from https://www2.bc.edu/~kafka/Why_Quakes/why_quakes.html

Date	Location	MMI	Magnitude
10-Apr-1962	Middlebury, VT	5	4.1
31-Mar-1953	N/A	5	4
6-Jul-1943	Swanton, VT	4	4.1

Table 43 Notable Historic Earthquakes in Vermont from 1638-2007 (Magnitude or Intensity 4 or Greater) [131]

The two strongest recorded earthquakes measured in Vermont were of a magnitude 4.1 on the Richter scale. One was centered in Swanton and occurred on July 6, 1943, and the second occurred in 1962 at Middlebury. The 1962 earthquake was felt throughout New England and resulted in broken windows and cracked plaster, while the Swanton earthquake caused little damage. "The total felt region covered about 52,000 square kilometers of Vermont, Maine, Massachusetts, New Hampshire, and New York." The event resulted in broken windows and cracked plaster. The 1943 Swanton earthquake caused only little damage.[132] No further information is known about the 1953 magnitude 4 events.

According to the State Plan, it is likely that small earthquakes will continue to occur in Vermont in the coming years. Earthquakes centered outside the state have been felt in Vermont as well:

> "New England has had a history of earthquakes including those recorded by the first settlers, and by the Plymouth Pilgrims in 1630. The major earthquake of Cape Ann, MA on November 18, 1755 with a magnitude of 6 affected a very large area (about 777,000 square kilometers) including all of Vermont. Twin earthquakes of 5.5 occurred in New Hampshire in 1940. In 1988, an earthquake with a magnitude of 6.2 on the Richter scale took place in Saguenay, Quebec and caused shaking in the northern two-thirds of Vermont.[133] "On April 20, 2002, a 5.1 magnitude event in Plattsburgh caused shaking in Vermont with damage near the epicenter in New York."[134]

The earthquake index was consulted as well. The earthquake index value is calculated based on historical earthquake events data using USA.com algorithms. It is an indicator of the earthquake level in a region. A higher earthquake index value means a higher chance of an earthquake. The results retrieved for Lyndon, Vermont and the entire US are shown in Table 44.

Location	Earthquake Index
Lyndon Center, VT	0.19
Vermont	0.31
U.S.	1.81

Table 44 Earthquake Index for Selected Locations [135]

131 Earthquakes, Vermont. (2015). The Northeast States Emergency Consortium. Retrieved from http://nesec.org/earthquakes-vt/; State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

132 Vermont: Earthquake History. (2015). U.S. Geological Survey. Retrieved from http://earthquake.usgs.gov/earthquakes/states/vermont/history.php; State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

133 Ebel, John, Richard Bedell and Alfredo Urzua. (1995). A Report on Seismic Vulnerability of the State of Vermont. Vermont Geological Survey. Retrieved on July 23, 2015 at http://www.anr.state.vt.us/dec/geo/ebel.htm.

134 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

135 US Earthquake Index State Rank. (2015). USA.com. Retrieved from http://www.usa.com/rank/us--earthquake-index--state-rank.htm

Probability of Future Events
According to the State Plan, Vermont is located in a zone of low to moderate seismic activity. A computer earthquake damage simulation (HAZUS-MH program) conducted by the Vermont State Geologist's Office suggests "that there is little earthquake risk in Vermont at 100-year and 250-year recurrence intervals; however, there is a potential risk at the 500-year recurrence level."[136] A probability of possible was assigned. The HAZUS-MH analysis performed by the Vermont State Geologist's Office is described in the following section.

Vulnerability Assessment and Estimated Losses
It can be assumed that all existing and future buildings and populations are at risk to the earthquake hazard. According to the State Plan, impacts from earthquakes are "expected to be minor to catastrophic; building damage and fatalities are possible."[137] Earthquake events may cause cracked plaster and chimneys, broken windows, and shaken buildings and building collapse. When natural gas pipelines rupture from earthquakes, fire events are possible. Climate change is not anticipated to impact losses or impacts for this hazard.

An HAZUS-MH analysis was conducted by Vermont's Geologist's office and is described in the following[138]:

> The analysis is based on a Report on The Seismic Vulnerability of the State of Vermont (Ebel, et al., 1995) who postulated six 500-year "strong" earthquake epicenters in the Northeast that could be expected to cause damage in Vermont.
>
> The epicenters and magnitudes of past earthquakes as shown in Table 45 were applied and a HAZUS-MH analysis was run for these. Figure 20 shows earthquakes with a magnitude greater than 3 that might affect the State of Vermont.

Table 45 Epicenters and Magnitude of Past Earthquakes with Impact on the State of Vermont[139]

Epicenter	Magnitude
Middlebury, VT	5.7
Swanton, VT	5.7
Montreal, Quebec	6.8
Goodnow, New York	6.6
Tamsworth, New Hampshire	6.2
Charlevoix, Quebec, Canada	6.6

Using these epicenters and magnitudes, the Vermont Geologist confirmed through further HAZUS-MH runs that five of the earthquakes (minus Charlevoix) shown in Table 45 could cause ground shaking in certain parts of Vermont sufficient to result in millions of dollars in damage:

> Five of these six possible 500-year earthquakes have moment magnitudes and epicenters close enough to Vermont to cause significant damage. These five earthquakes have predicted peak ground accelerations greater than 0.1 g and would cause widespread damage resulting in tens to hundreds of millions of dollars in structural and economic losses and undetermined casualties.

136 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
137 Ibid.
138 Ibid.
139 Ibid.

The Swanton and Middlebury earthquakes were estimated to have PGAs of 0.4 g and total losses exceeding $300 million dollars each (State of Vermont HAZUS-MH projections). In addition to the 5 postulated 500-year earthquakes that would affect Vermont, the recent occurrence of a 5.1 magnitude earthquake near Plattsburgh (Ausable Forks), New York, indicates that this epicenter also would need to be considered.

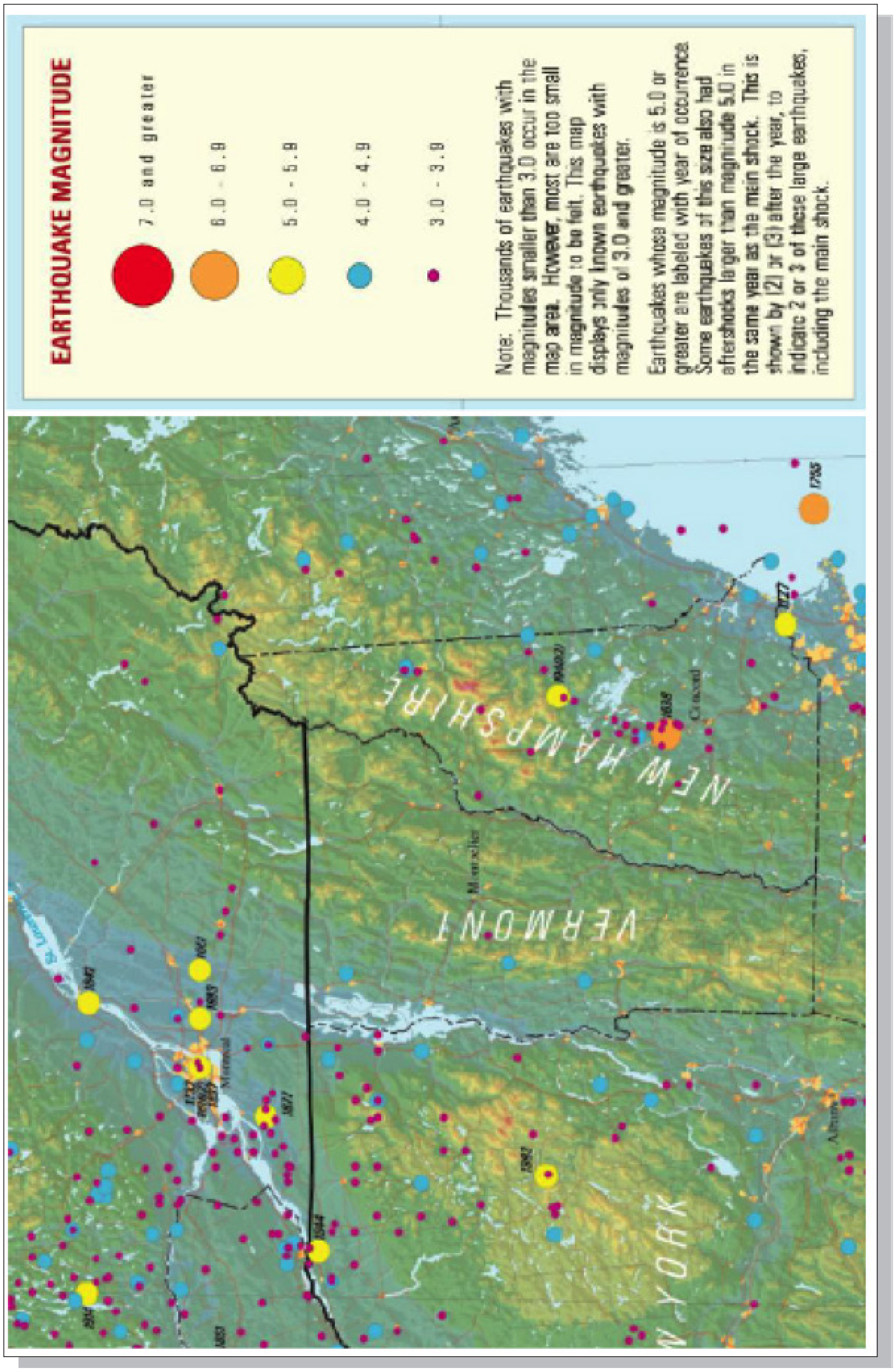


Figure 20 Earthquake Magnitude [140]

140 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Table 46 shows the results from the described HAZUS-MH analysis. These probable impacts are derived from the worst-case earthquake scenarios for the State of Vermont.

Table 46 Probabilistic Earthquake Scenarios (HAZUS-MH Analysis Performed by State Geologist)[141]

Impact		**Middlebury, VT**	**Montreal**
Building Damage	moderate damage	>3,600 buildings; 1 school moderately damaged	>3,400
	severe damage	38 (destroyed)	23 (destroyed)
	displacement/shelter needs	262 families displaced; 62 in need of shelter	229 families displaced; 56 in need of shelter
Transportation and Utility	transportation	minimal disruption	no disruption
	utility	2,000 households w/out power for up to 3 days	no loss of power
Casualties	light treatment	69	70
	severe (hospitalized)	12	12
	killed	2	2
Economic Loss	direct	>$308 million; thereof 10% from business interruption	>198 million; thereof 17% from business interruption
	transportation system	$34 million	$18 million
	repair of damaged communication systems	$0.21 million	$0.03 million
Gov't Buildings	slight damage	14	15
	moderate damage	6	7
	extensive damage	1	1

Both of the probabilistic events (For Middlebury and Montreal earthquake information, see Table 46) would damage a considerable amount of buildings equaling 2% of Vermont's overall building stock. Buildings made from un-reinforced masonry (i.e., "red brick") are particularly vulnerable to damage or collapse in the event of an earthquake. The planning area is mostly made up from wooden structures. According to the Town Planner, 1% of the buildings in the town are made from masonry (50 out of approximately 4,600 buildings).

While the State of Vermont has adopted seismic provisions on the state level into there building codes for certain types of construction (1987 BOCA National Building Code with the 1988 supplement), only a few municipalities in Vermont have adopted the state code. "Building plans are not reviewed for seismic design in any community except Burlington and at the state level".[142] Lyndon does not have a building code.

Thirty-three percent or eleven of the critical facilities have been built after 1972. It is assumed that newer

141 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
142 Ebel, John, Richard Bedell and Alfredo Urzua. (1995). A Report on Seismic Vulnerability of the State of Vermont. Vermont Geological Survey. Retrieved on July 23, 2015 at http://www.anr.state.vt.us/dec/geo/ebel.htm.

buildings are less vulnerable to earthquakes. However, any large earthquake event such as the Middlebury, Swanton, or Montreal event could cause severe damage in the area.

Landslides

Description

The term "landslide" describes a wide variety of processes that result in the downward and outward movement of slope-forming materials including rock, soil, artificial fill, or a combination of these. The materials may move by falling, toppling, sliding, spreading, or flowing.[143] Landslides are common on clayey to sandy lacustrine deposits throughout Vermont. In many cases, the displaced material has been at least partially eroded away by stream flow.[144]

Although landslides are primarily associated with mountainous regions, they can also occur in areas of generally low relief. In low relief areas, landslides occur as cut-and-fill failures (roadway and building excavations), river bluff failures, lateral spreading landslides, collapse of mine-waste piles (especially coal), and a wide variety of slope failures associated with quarries and open-pit mines.[145]

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

Fluvial erosion is considered the most important contributing factor to landslides.

Location

According to the State Plan, landslides rarely occur in Vermont.[146]

Figure 21 shows the results of the landslide risk assessment. The GIS analysis identified categories of slopes with certain slope angles. The GIS data was grouped into four categories based on their slope angle (slope angle <15%, 15-25%, 25-40%, >40%). The planning area is relatively flat, as can be seen in Figure 21. Most of the Village of Lyndonville is located within the floodplain area. 29% of the planning area has a slope angle below <15 %, 26% between 15-25 %, 32 % between 25-40% and 13% over 40% slope.

Due to terrain with a mostly low incident, the area is not very susceptible to landslides. Landslides in the planning area may be expected within the floodplain area as a result of fluvial erosion. This topic has been addressed in the flood hazard section.

143 Highland and Bobrowsky (2008). Landslides 101 – Landsilde Hazards Program. U.S. Geological Survey. Retrieved June 8, 2015. Available at http://landslides.usgs.gov/learn/ls101.php
144 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
145 Ibid.
146 Ibid.

Another important factor for triggering landslides are specific soil types. Expansive soils are soil types that shrink or swell as the moisture content decreases or increases; samples are clayey soils.[147] Expansive soils are more prone to landslides. The soil in the planning area is mostly made up from sandy or loamy soils and less susceptible to landslides.[148]

Figure 21 shows the results of the landslide risk assessment. Figure 22 gives an overview of areas susceptible to landslides within the State of Vermont and County of Lyndon.

147 Glossary. (2015). U.S. Geological Survey. Retrieved from http://landslides.usgs.gov/learn/glossary.php#e

148 Geologic Soils_SO – County Surveys. (2011). County Soil Survey Data – Natural Resource Conservation Service. Retrieved from http://dware.vcgi.org/search_tools/moreinfo.cfm?catalog_id=1&layer_id=100&layer_name=GeologicSoils_SO

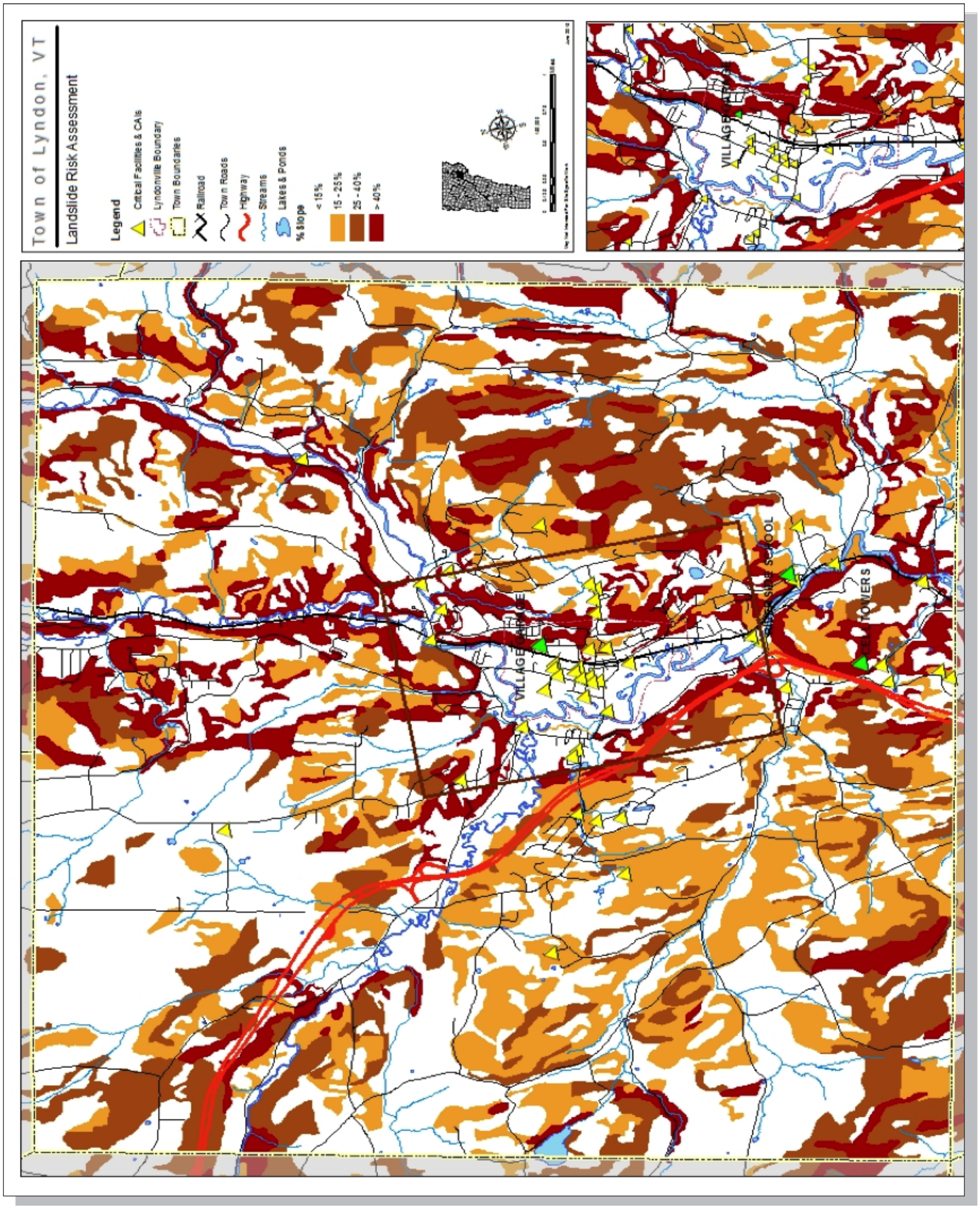
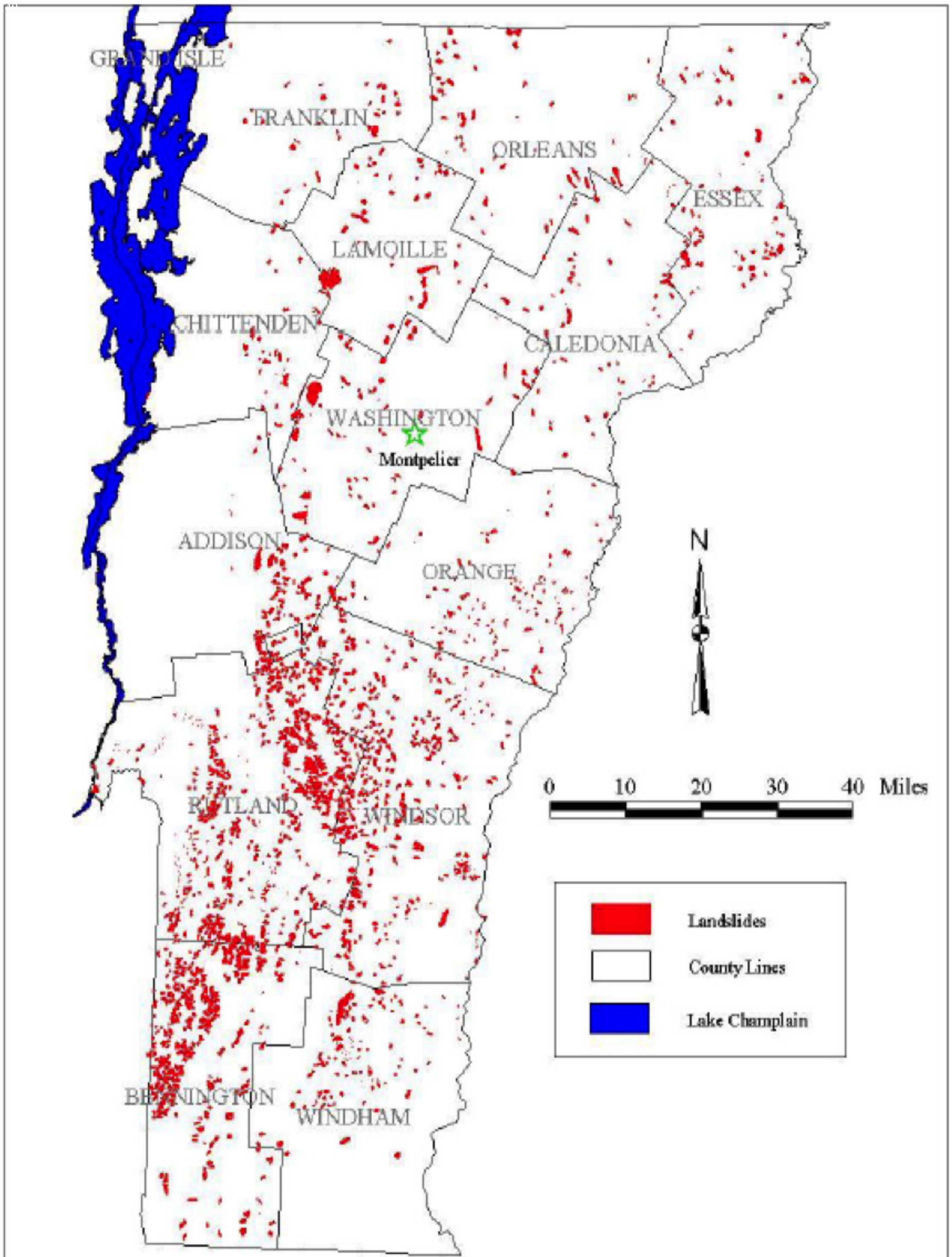


Figure 21 Landslide Risk Assessment for the Planning Area



Preliminary map of areas susceptible to landslides in Vermont. Data from U.S. Geological Survey Open File Report 90-621, compiled at 1:250,000 scale. Map produced by Vermont Geological Survey in cooperation with Norwich University Dept. of Geology, March, 2004.

Figure 22 Area Susceptible to Landslides in Vermont [149]

149 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.

Previous Occurrences and Extent

There have been no major disaster declarations related to landslides in Caledonia County.

Several sources were investigated for previous landslide occurrences including web searches, NCDC, USGS, the Draft Town Hazard Mitigation Plan, and State Plan. However, no data could be retrieved for the planning area. The State Plan lists the following events in Vermont[150]:

- The Jeffersonville slide on the Brewster River (about 64 miles west of Lyndon) took place in April 1999. It occurred on steep clayey soils with an overall angle of 34 degree and cost nearly $300,000 in channel and floodplain restoration and buyout of one residence.
- In 2011, extensive landslides occurred due to high water conditions resulting from the melting of the thick snowpack and the heavy spring rains as well as from flash flood event in May 2011 and due to Tropical Storm Irene in central Vermont.

Probability of Future Events

Data on previous landslide occurrences in the planning area has been limited. Therefore, it is difficult to assess its future probability. The researched literature and GIS analysis indicate that the planning area is in general not susceptible to landslides due to the relatively low incident terrain and an overall absence of expansive soils. Landslides in the floodplain area and on steeper slopes would be possible. As depicted on Figure 21, there are critical facilities located on terrain with a slope angle of >40%.

Three critical facilities are located on a terrain with a slope angel of >40%:

1. Village Garage
2. Riverside School
3. Cell Towers

Those facilities on terrain with a slope angle of >40 % would be considered more prone to landslides. In addition, there might be areas within the area that may be more susceptible to landslides. A further analysis with more specific planning area data could bring more detailed information. A probability of possible was assigned.

Vulnerability Assessment and Estimated Losses

According to the State Plan, landslides rarely occur in Vermont. Landslides commonly occur with other major natural disasters, such as earthquakes and floods as shown in the landslides associated with Tropical Storm Irene (see Previous Occurrences). Reconstruction efforts and development and other land use expansions can also increase landslide related disasters.

According to the Town Plan, the Town of Lyndon is growing and new developments are expected to be built.[151] Landslide susceptibility, i.e. in floodplain areas, should be considered when permitting new developments. Losses from landslides have been reported of up to $300,000 for one single event in Jeffersonville, Vermont. However events of these magnitude are not expected for the planning area and would likely only result in minor losses.

Climate change does have the ability to impact the hazard through more frequent and severe events including increased rain, hurricanes, tropical storms, and wildfires. All of these events may increase the risk of landslide occurrence in the planning area. However, as noted above, there is limited risk in the planning area.

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150 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
151 Lyndon Town Plan. (2015). Town of Lyndon.

Other Potential Hazards

Other potential hazards that may impact the planning area are extreme heat, water supply contamination, hazardous materials, and invasive species.

Extreme Heat and Heat Wave

Description

Extreme heat is defined as excessively dry and hot conditions where temperatures hover 10 degrees or more above the region's average high temperature that last for several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a high atmospheric pressure traps hazy, damp air near the ground. As a result, both drought and dust storms could occur.[152]

Location

Extreme heat and heat wave are atmospheric hazards and can impact the entire planning area.

Previous Occurrences and Extent

In order to understand temperature extremes, the norms and record temperatures were investigated. In addition, previous occurrences from NCDC were reviewed. The average high temperature in Saint Johnsbury, Vermont is 81 Fahrenheit (July).[153] Saint Johnsbury is the closest weather station to the planning area. The National Climatic Data Center reported six events of extreme heat throughout Caledonia County between 1950 and 2014. One of these events resulted in a loss of $750,000 whereas the other events did not incur any damages. The event is described in more detail in the following. Table 47 lists the heat events in Caledonia County between 1950 and 2014.[154]

Table 47 Heat Events in Caledonia County from 1950 - 2014[153]

Date	Death/Injuries	Crop Damage
1/18/1996	0/0	0
1/19/1996	0/0	0
12/7/1998	0/0	0
8/1/2006	0/0	0
7/21/2011	0/0	0
3/17/2012	0/0	750 K

Description of the 3/17/2012 event [156]:

The winter of 2011-12 was largely abnormal with temperatures that averaged 4-5 degrees above normal

152 Extreme Heat Prevention Guide. (2015). Centers for Disease Control and Prevention. Retrieved from http://emergency.cdc.gov/disasters/extremeheat/heat_guide.asp

153 US Climate Data for St. Johnsbury. Retrieved from http://www.usclimatedata.com/climate/saint-johnsbury/vermont/united-states/usvt0208

154 Weather Warehouse. Past Monthly Weather Data for Saint Johnsbury, Vermont. July, 1900 – 2015. Retrieved from http://weather-warehouse.com/WeatherHistory/PastWeatherData_SaintJohnsburyFairbanksMuse_SaintJohnsbury_VT_July.html

155 NOAA Storm Events Database

156 NOAA Storm Events Database

and snowfall was 40-60% of normal. On March 17, 2012 temperatures reached the mid-50s to lower 60s in Vermont, temperatures then climbed into the 70s on March 18th with 70s and lower 80s on March 19th through March 22nd. In comparison, the normal high temperature during this period is considered mid-30s to lower 40s. These record temperatures combined with winter 2011 and winter 2012 conditions accounted for the Maple Sugaring industry to end by the last week of March. A preliminary loss of 20% was calculated. The ski industry experienced loss from early closure. There have been no major disaster declarations related to extreme heat and heat waves in Caledonia County.

Extent

Extreme heat can be defined by record high temperatures. Record temperatures in Saint Johnsbury were 101 (1977) and 99 Fahrenheit (1977). In the past ten years the highest temperatures measured ranged from 88 to 94 Fahrenheit with highest temperatures above 90 Fahrenheit in the past 5 years. It is anticipated that climate change will increase the amount of heat days in the future."[157]

Probability of Future Events

Based on six events over 64 years countywide, heat events occur about every 10.6 years. An estimated annual probability of possible was assigned for extreme heat events to occur in the planning area.

Vulnerability Assessment and Estimated Losses

Extreme heat is an atmospheric hazard so it has the potential to impact all existing and future assets, essential facilities, and populations. In general, this hazard has adequate warning time that extends beyond 24 hours and lasts for less than a week. It has a large spatial extent, so the entire planning area would be impacted. Extreme heat is unlikely to damage structures though occasionally buildings buckle due to prolonged high heat exposure. It also poses a health risk in terms of heat stroke and heat exhaustion. Those working or exercising outdoors should exercise with caution. Vulnerable populations, including the elderly and babies, have an increased risk and lower tolerance for such events.[158]

Losses from one event were reported for this hazard. This event was tied to a very early onset of spring/summer and caused losses in the maple and ski industry. The extreme heat event in the spring resulted in a damage of $750,000, which mainly affected agriculture. Annualized over time this loss results in a damage of $11,719. The impact was assessed as limited.

Climate change may impact this hazard through increased occurrence and severity.

Water Supply Contamination

Description

Water supply contamination is the introduction of point and non-point source pollutants into public groundwater and/or surface water supplies. The causes of water contamination are numerous and range from failing septic systems and leaking underground tanks to improper use of household chemicals.[159] The most obvious concern about an unsafe water supply is the health risks to humans. Water contamination serves as

157 Weather Warehouse. Past Monthly Weather Data for St. Johnsbury, Vermont. July 1900 - 2015

158 Extreme Heat Prevention Guide. (2015). Centers for Disease Control and Prevention. Retrieved from http://emergency.cdc.gov/disasters/extremeheat/heat_guide.asp

159 Ferrey, Steven. (2007). Environmental Law.

a source of bacteria, viruses, and parasites that can cause gastrointestinal problems or transmit contagious diseases.

Municipal wastewater collection systems often receive additional water during heavy storm events as a result of inflow and infiltration. This may cause the wastewater treatment system to reach its maximum treatment capacity. In this event, untreated excess flow will be directed into waterways, resulting in water contamination.

Location

According to the Vermont Forest Resource Plan, Lyndon is located in a zone with ground water source protection.[160] The planning area has two reservoirs supplied by wells within wellhead protection areas. The wellheads are close to the floodplain. According to the Town Planner, the wellheads are sealed and not under threat of contamination from flooding. Lyndon's municipal water system has 1,044 commercial and residential connections.[161]
The sewage treatment plant is located in the floodplain zone; but the structure itself along with the access road is raised. Stormwater overflow capacity from the sewer plant has been reduced according to the Town Plan.[162] In case of rain events, some amounts of stormwater overflow will flow directly into the river.

Road or rail incidents with associated leakage from hazardous materials or form hazardous materials stored within the planning area might happen. These could result in water supply contamination.

Previous Occurrences and Extent

There have been no major disaster declarations related to water supply contamination in Caledonia County. However, the wells have been previously vandalized and contaminated. In addition to this, infiltration from old wastewater lines previously caused contamination to the surface and ground water. According to the Town Planner, several old wastewater lines have been replaced in order to reduce infiltration problems. But in the case of heavy rain events, some amount of stormwater overflow will be directed directly into the river and might potentially carry contaminants.

Probability of Future Events

Serious events of contamination are unknown and have not been reported. Structural damage from this hazard is unlikely. The wellheads have been securely locked and large boulders have been placed to deter mobilized intrusion. In addition, regular inspections are in place. Further contamination of the wellheads is therefore reduced. However, due to the location of the wellheads in the floodplain area, the risk remains of wells potentially being infiltrated, which might cause further contamination of the water supply. In addition to this, a risk of infiltration of contaminants is given through storm water overflow and through potential road or rail incidents or leakage of hazardous materials stored close to the floodplain. A probability of possible has been assigned.

Vulnerability Assessment and Estimated Losses

Detailed data on previous contaminations were not available. Therefore it cannot be predicted to what extent potential contaminations might pose a health risk. However it is assumed that serious water supply contamination would affect the entire population of the planning area.

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160 Vermont Forest Resource Plan. (2010). Vermont Department of Forests, Parks, and Recreation.
161 Draft Mitigation Plan. (2010). Town of Lyndon.
162 Lyndon Town Plan. (2015). Town of Lyndon.

Hazardous Materials

The risk assessment focused on natural hazards primarily. This section aims at considering secondary risks from hazardous materials that may be triggered by a natural hazard such as flooding or fire. The description on hazardous materials itself is not deemed to be comprehensive.

Description

Hazardous materials or toxic releases can cause deaths, shut down facilities, and cause affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions directly affect how the hazard develops. The micro-meteorological effects of the buildings and terrain can alter travel and duration of agents. Shielding in the form of sheltering-in-place can protect people and property from harmful effects.

Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time for hazardous materials incidents is minimal to none.[163]

Location

Spills from hazardous materials can occur via roads, rail, air, water, and from fixed sites that use or produce hazardous materials. Therefore, all locations in the planning area are considered at risk. The EPA's Toxic Release Inventory (TRI) program was researched to determine fixed HAZMAT sites in Lyndon, Vermont but returned no results.[164]

As of 2009, there are 37 Tier II reporting sites of hazardous materials in the planning area, according to the Town of Lyndon's Draft Mitigation Plan.[165] According to a report published by Middlebury College, the planning area contains the following facilities:[166]

- Active Hazardous Waste Sites: 20
- Air Pollution Emitters: 5
- Large Quantity Hazardous Waste Generators: 6
- Small Quantity Hazardous Waste Generators: 9
- Superfund: 2 (Darling Hill Dump and Parker Sanitary Landfill, both closed)

Hazardous materials are stored within the St. Johnsbury/Lyndon Industrial Park and within close distance from flood hazard areas within the Village of Lyndonville according to the Towns Draft Mitigation Plan.[167] Based on the results from the flood hazard analysis, most of these locations are not contained within the FEMA flood hazard area.

The following tier II reporting sites are located within the FEMA flood hazard area:

- Calkins Rock Products, Inc.
- Great Falls Hydro Electric Generation Station
- Vail Hydro Generation Station

163 Superfund: Hazardous Substances and Hazardous Waste. (2015). U.S. Environmental Protection Agency. Retrieved from http://www.epa.gov/superfund/students/clas_act/haz-ed/ff_01.htm

164 Toxic Releases (TRI) Database. (2014). The Right-To-Known Program. Retrieved from http://www.rtknet.org/db/tri.

165 Draft Town of Lyndon and Village of Lyndonville. All Hazards Pre-Disaster Mitigation Plan.

166 Middlebury College. Toxics Action Center. Toxics in Vermont: A Town-by-Town Profile.

167 Draft Town of Lyndon and Village of Lyndonville. All Hazards Pre-Disaster Mitigation Plan.

A few other locations of hazardous materials are located in close distance to the flood hazard area. The industrial zone is located outside the FEMA flood hazard area except for a small zone in the north adjacent to the Passumpsic River.

It is assumed that the Vermont Rail System ships hazardous materials on their railroad which runs through the planning area along the river. Two 15 to 20-car trains travel daily on that route. The line is continually being upgraded, and rail traffic through the Village is limited to 10 mph.[168]

Previous Occurrences and Extent

There have been no major disaster declarations related to HAZMAT in Caledonia County. The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration were consulted to determine previous occurrence information. However no incidents were retrieved from their database for Lyndon, Vermont.[169]

The National Priorities List (NPL) lists known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is primarily intended to guide the EPA in determining which sites warrant further investigation. Lyndon, Vermont contains two closed/inactive superfund sites. Table 48 shows the National Priorities List of known or threatened releases of hazardous substances for the planning area.

Table 48 National Priorities List of Known or Threatened Releases of Hazardous Substances in Lyndon, VT [167]

Name	Description	Status
Parker Sanitary Landfill (closed)	- Covers 25 acres in the southeastern portion of the Town of Lyndon. - Has been operated as a solid waste landfill since 1972. - Prior to 1983, approx. 1.3 million gallons of liquid wastes plus 760 tons of solid or semisolid wastes, including metal plating rinse waters, waste oils, electroplating sludges, paint sludges, chlorinated solvent sludges, caustic cleaners, and metallic salts, were disposed of in three areas of the landfill. - A site inspection in May 1984 detected contaminants in a stream, in ground water, and in four private wells located at or near the landfill. - The site is located in a residential area, and an estimated 3,200 people obtain drinking water from a municipal well field approximately 2 miles from the landfill; 124 private wells are located within 3 miles. - The stream flows into the Passumpsic River, which is used for recreational activities.	The site is currently undergoing initial and long-term remediation and cleanup measures.

168 Ibid.

169 Incident Statistics. (2015). U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. Retrieved May 26, 2015 from https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/search.aspx

170 Parker Sanitary Landfill. (2015). Environmental Protection Agency. Retrieved from http://www.epa.gov/superfund/sites/npl/nar63.htm; Yosemite.epa.gov; http://yosemite.epa.gov/r1/npl_pad.nsf/f52fa5c31fa8f5c885256adc0050b631/3423C7EB2835D8598525690D00449685?OpenDocument

Name	Description	Status
Darling Hill Dump (inactive)	- Previous superfund site; - Former waste site; illegal dumps of liquid and solid industrial wastes; - Closed in 1989; - Low levels of contaminants do not pose a risk to public health since carbon filtration system is in place.	- Deleted from the NPL for Waste Site Clean Up in 1999; - A carbon filtration system was installed to ensure safe municipal water supply.

Probability of Future Events

With the exception of the two dumpsites, which are both being treated and remediated, there have not been any reported events and the probability of future events seems low. But due to its location within close vicinity to I-91 and railroad tracks running through the planning area future incidents are possible. The risk for derailment and potentially associated HAZMAT incidents remains low as the railroad is only used infrequently. A likelihood of possible was assigned.

Vulnerability Assessment and Estimated Losses

It cannot be predicted where a hazardous materials incident may occur. It may occur in one of the fixed locations where hazardous materials are stored, along the rail line or along the highway I-91, which is within 1 mile from the Planning area or elsewhere.

All of these locations and corridors have the potential for an incident that could impact the planning area. Therefore all existing and future buildings, facilities and populations in the planning area are considered to be equally exposed to this hazard and could potentially be impacted. Hazardous materials stored in the FEMA flood hazard area might be flooded. It is assumed that necessary precautions will be taken to minimize any impacts from potential flooding of these facilities. The exposure extent from this risk was assessed as limited. Information on past damages associated with this hazard was not available. Therefore losses have not been estimated.

Invasive Species

Description

The National Invasive Species Council defines an invasive species as one that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.[171] Invasive species can overwhelm native species and their habitats, forcing the native species out. Invasive plants in Vermont, such as Japanese knotweed, phragmites, and purple loosestrife, can change soil composition, change water tables, and disrupt insect cycles. They often lack food value that wildlife depends upon. Some invasive animals prey heavily upon native species while others such as the alewife and zebra mussel out-compete native species for food and nutrients with significant impacts reverberating up and down food chains.

171 Invasive Species Definition Clarification and Guidance White Paper. (2006). Invasive Species Advisory Committee. Retrieved from http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf

According to the State Plan, the State of Vermont maintains three different lists of invasive species[172]:

1. The first is a watch list of non-native plants that have some potential to become invasive in Vermont based on their behavior in northeastern states. One-third of the plant species found in Vermont are not native to the state, but only about eight percent have the potential to create environmental and economic harm due to their ability to grow rapidly, profusely, and widely. These are the plant species monitored on the watch list.)
2. The second list is composed of invasive species that are currently in the state and is divided into three categories depending on the species' impact on the environment.
3. The third list is the Quarantine #3 Noxious Weeds list. The quarantine was created to regulate the importation, movement, sale, possession, cultivation, and/or distribution of certain invasive plants. These plants either pose a threat to the Vermont environment or are already negatively impacting waterways and natural areas in the state. Many of these plants are becoming such a problem that there is no alternative prevention method.

Location

According to the Vermont Forest Resource Plan, an amount of two to seven invasive species has been observed in Lyndon and Lyndonville. The scale ranges from 0 to 13. Figure 23 shows non-native invasive plant species throughout the State of Vermont.

Previous Occurrences and Extent

According to the Vermont Emergency Management Plan, Vermont has periodically dealt with occurrence of infestations or invasive species. Nonnative, invasive plants, and animals – from Eurasian milfoil to zebra mussels – have caused millions of dollars in damage throughout Vermont. (The invasion of "worms" from 1770 is noted as well, which were most likely the same armyworms that recently caused over $8 million dollars in damage to the 2001 Vermont hay crop.).[173] The overall risk is assessed as low and the severity as minor to major. Specific data for the planning area has not been found.

Probability of Future Events

According to the Vermont Emergency Management Plan, the frequency of infestations or invasive species is unlikely.[174]

Vulnerability Assessment and Estimated Losses

The impacts from invasive species to property and government services and functions are considered minimal. Losses have not been assessed since specific data were not available for the planning area.

172 State of Vermont Hazard Mitigation Plan. (2013). Vermont Emergency Management.
173 Vermont Emergency Management Plan. (2013). Vermont Emergency Management.
174 Ibid.

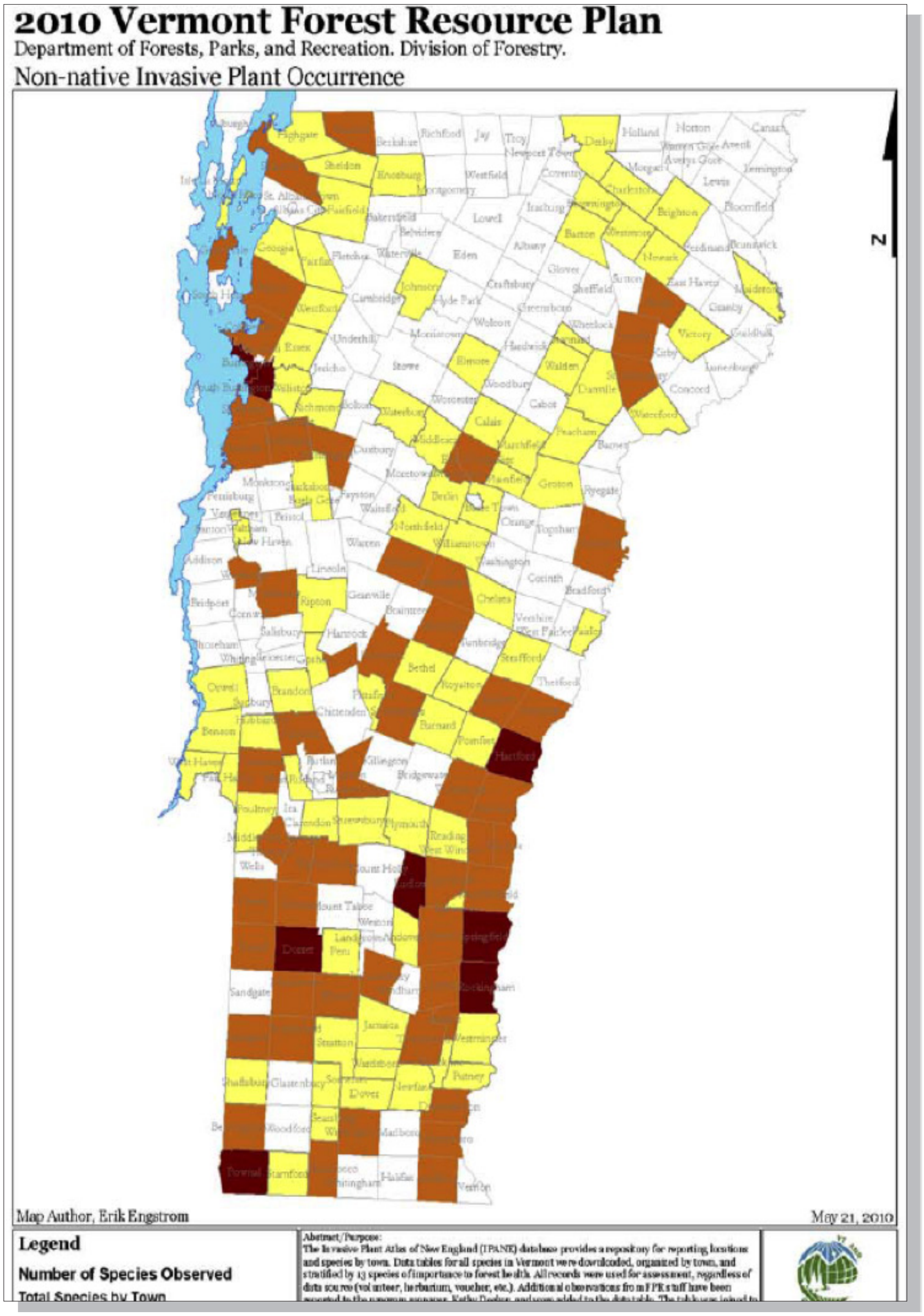

Figure 23 Map of Non-Native Invasive Plant Species [170]

Climate change

Climate change is not a hazard by itself, but many of the priority hazards identified in planning area are likely to become more frequent and more extreme in the face of a changing climate. Scientists expect that severe storms, hurricanes and tropical storms, severe winter storms, ice storms, heavy rain and flooding will all increase in the coming years.[175]

Historically, Caledonia County has seen many cold-related hazards (such as unseasonal frosts and deep freeze periods in the winter), but there is little associated damage reported. Fewer heat spells have affected the area, but NCDC does report six heat-related hazards in the data it tracks. All six heat waves have occurred since 1996, and the data includes a dry spell in 2012 that resulted in significant crop damage. Droughts may become increasingly common, as many hazards related to invasive species and infectious diseases thrive in a changing climate.

Climate studies predict that extreme weather events including heat waves and cold spells are likely to become more frequent and more significant as climate change continues; the planning area should expect both more heat spells and more cold snaps, as well as generally more unstable climate patterns in the future. These changes pose risks to property, crops, and public safety, but also to the economy and businesses such as ski areas.

Critical Facility Analysis

Critical Facilities in the planning area have a combined building replacement value of $145 million. All critical facilities are assumed to be at risk to hurricane, microburst, tornado, blizzard, hail, ice storms, nor'easter, snow events, lightning, wildfire, earthquake, extreme cold, and hazardous materials.

However, data permits further GIS analysis to determine potential risk to specific buildings based on certain hazard areas including ice jam, landslides, and wildfire. Many hazards do not pose a risk to all critical facilities based on location such as flood related hazards. For example, only critical facilities near rivers or brooks may also be susceptible to flooding caused by ice jams. This is the case for the Miller's Run pump station.

The Wildfire Intersection analysis has shown that almost 85% of the critical facilities would be at risk in case of wildfire (this would equal 25% of the total critical facilities worth). The landslide risk analysis shows a risk for the Village Garage, Riverside School, and Cell Towers based on a steep incident; however as noted in the landslide section only specific soil types are prone to landslides and should be investigated further for a more complete understanding of this risk.

Additionally, it should also be noted that not all hazards would cause extensive structural damage including drought, erosion, and extreme temperatures, for example. The extent of the hazard also has a direct impact on building damage.

An NFIP-insured structure that has had at least two-paid flood losses of more than $1,000 each in any 10-year period since 1978 is considered a repetitive loss structure. Tropical Storm Irene in August 2011 greatly

175 Climate Change Indicators in the United States. (2015). Environmental Protection Agency. Retrieved May 22, 2015 from http://www.epa.gov/climate/climatechange/science/indicators/weather-climate/index.html

increased the number of repetitive loss properties in Vermont.[176] The Town of Lyndon has reported 37 repetitive loss claims, including 8 claims for properties located outside of the SFHA.[177] Table 49 provides a list of repetitive loss properties in the planning area and the associated number of losses and amount of payments. Without mitigation, these properties will likely continue to experience flood losses.

Table 49 Repetitive Loss Properties in the planning area[176]

Mitigated?	Insured?	No. of Losses	Total Building Payment	Total Contents Payment	Total Paid	Average Pay Per Loss
NO	NO	2	$31,807	$7,100	$38,907	$19,454
NO	YES	2	$15,267	$0	$15,267	$7,634
NO	YES	3	$0	$181,648	$181,648	$60,549
NO	YES	2	$0	$45,949	$45,949	$22,975
NO	YES	3	$154,369	$2,556	$156,925	$52,308
NO	YES	2	$10,955	$0	$10,955	$5,477
NO	YES	2	$20,246	$0	$20,246	$10,123
NO	NO	2	$5,131	$0	$5,131	$2,565
NO	YES	2	$11,000	$6,633	$17,633	$8,817
NO	YES	2	$49,529	$8,871	$58,400	$29,200
NO	NO	2	$9,978	$0	$9,978	$4,989
NO	YES	4	$17,325	$0	$17,325	$4,331
NO	NO	2	$5,103	$0	$5,103	$2,551
NO	NO	5	$358,129	$30,000	$388,129	$77,626
NO	YES	2	$22,137	$0	$22,137	$11,068
YES	NO	2	$11,440	$0	$11,440	$5,720

176 State of Vermont Hazard Mitigation Plan. (2013). Vermont Department. of Public Safety, Division of Emergency Management and Homeland Security. Retrieved from http://vem.vermont.gov/sites/vem/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP_scrubbed_cleanedMCB.pdf

177 Flood Ready Vermont – Community Reports. (2015). Vermont Agency of Natural Resources, Department of Environmental Conservation. Retrieved from http://floodready.vermont.gov/assessment/community_reports

178 State of Vermont Hazard Mitigation Plan. (2015). Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. Retrieved from http://vem.vermont.gov/sites/vem/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP_scrubbed_cleanedMCB.pdf

Summary of Risk

Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)

Hazard Risk Summary

This section provides a brief summary of the hazards that impact the planning area. Table 50 gives a summary of hazards in the planning area. It lists impacts, number of occurrences and associated timeframe, spatial extent, probability, and estimated losses to date. In addition, the table highlights whether or not critical facilities may be at risk.

The Town of Lyndon and Village of Lyndonville are ranked 9 out of 11 municipalities with the greatest flood hazard vulnerability measured in terms of total number of flood insurance policies in effect.[179]

While designated areas can help identify and plan for riverine flood hazards (e.g., SFHAs and river corridors), other types of flooding such as flash floods or urban flooding put all current and future structures, infrastructure, and people at risk.

Table 50 Summary of Hazards in the Planning Area

Hazard	Potential Impacts	Previous Events	Spatial Extent	Probability	Estimation of Pot. Annualized Losses ($)	Critical Facilities at risk?
FLOOD HAZARDS						
Flooding and Fluvial Erosion	Damage to homes, public facilities and infrastructure, loss of emergency access, loss of life	Tropical Storm Irene (9/1/2011), November 4, 1927; June 30, 1973; June 12, 2002; others	Areas adjacent to the Passumpsic River and its tributaries	Likely	Unknown but should be expected	yes
Flash Flooding	Damage to homes, public facilities and infrastructure, loss of emergency access, loss of life	December 22, 2013; May 11, 2000	Areas adjacent to the Passumpsic River and its tributaries	Possible	Unknown but should be expected	yes
Dam Breach Flooding	Damage to homes, public facilities and infrastructure, loss of emergency access, loss of life	None known	Areas adjacent to the Passumpsic River and its tributaries	Unlikely	Unknown but should be expected	yes

179 State of Vermont Hazard Mitigation Plan. (2015). Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. Retrieved from http://vem.vermont.gov/sites/vem/files/VT_SHMP2013%20FINAL%20APPROVED%20ADOPTED%202013%20VT%20SHMP_scrubbed_cleanedMCB.pdf

Hazard	Potential Impacts	Previous Events	Spatial Extent	Probability	Estimation of Pot. Annualized Losses ($)	Critical Facilities at risk?
WIND HAZARDS						
Hurricanes	Power outage, high wind, flooding, property damage (blown off roofs);	Tropical Storm Irene (9/1/2011), Floyd (1999), Gloria (1985), 1938 Hurricane	town-wide	possible	43,000 (Gloria HAZUS-MH model)	yes
Microburst	Similar to tornado and thunderstorm wind; Power outage, high wind, property damage (blown off roofs); vegetative debris	05/2015 (25 miles from Lyndon)	town-wide	possible	unknown but should be expected (debris)	yes
Tornadoes	Power outage, high wind, property damage (blown off roofs, blow out windows, trees on houses); debris; vegetative debris	10 (within 26 miles); 1 county-wide	town-wide	possible	390 to 1,562	yes
WINTER HAZARDS						
Blizzard	Power outage, high wind, heavy snow; hazardous driving; property damage (blown off roofs, blow out windows, trees on houses); debris; vegetative debris; downed power lines	8 heavy snow events incl."Valentine Blizzard" 2007;	town-wide	possible	up to $23 million (county wide); 200,000 from one event (county)	yes
Hail	Property damage (Roof and cars)	10 for Lyndon; 33 countywide	town-wide	possible	1,360 (county)	yes
Ice Jams	Localized flooding; road closed; homes flooded (trailer park)	every 3 years	small	likely	70,000 to 150,000	yes
Ice Storms	Power outages (potentially days), downed power lines and trees; hazardous driving conditions; vegetative debris; business interruption; death/ injury	1998 (DR-1201); 2013	town-wide	possible	80,000 to 1 million (county; "100 year snow storm")	yes

Hazard	Potential Impacts	Previous Events	Spatial Extent	Probability	Estimation of Pot. Annualized Losses ($)	Critical Facilities at risk?
Nor'easter	High winds, heavy rain or snow, ice; hazardous driving conditions; travel snarls; power outages; roof collapse; vegetative debris; death/ injury	annual	town-wide	likely	unknown but should be expected (snow removal, debris)	yes
Snow Events	hazardous driving conditions; travel snarls; power outages; roof collapse; death/injury	annual	town-wide	highly likely	up to $23 million (county wide)	yes
Extreme Cold		5 (over 65 years)	town-wide	possible	not assessed	no
FIRE HAZARDS						
Drought	Water conservation measures; elevated wildfire risk; minimal structural impacts	2 statewide D0 (1995, 1964-66)	town-wide	DO likely	not assessed	no
Wildfire	Property damage; Smoke impacts (driving and air quality hazard); Increased emergency rescue/response time	none, a few statewide	town-wide	possible	none reported	yes
Lightning	Electrical damage; Structure fire; Wildfire	6/29/2003 (Lyndon); 8 county-wide (1950 - 2014)	town-wide (but strikes are localized)	possible	2,922	yes
GEOLOGICAL HAZARDS						
Earthquake	Damage possible, especially to older building stock; broken windows and dishes; collapsed chimneys; death/injury	Middlebury, VT (1962, 4.1), Swanton, VT (1962, 4.1)	town-wide	possible	>300 million (for 4.1 million event	yes
Landslide	Minimal risk in area low incident); Blocked or damaged roads	none	areas of steep slope	possible	negligible	yes
OTHER POTENTIAL HAZARDS						
Extreme Heat and Heat Wave	Health impacts on vulnerable populations; buildings may buckle	6; one with damage	large	possible	700,000 (one event)	no

Hazard	Potential Impacts	Previous Events	Spatial Extent	Probability	Estimation of Pot. Annualized Losses ($)	Critical Facilities at risk?
Water Supply Contamination	contamination of ground and drinking water; i.e. stormwater overflow	well contamination	town-wide	possible	not assessed	no
Hazardous Materials	Environmental contamination; health impacts due to contamination	no reported incidents; superfund site (dump) has been remediated	town-wide (but may be localized); 8 (out of 37) HAZMAT storages located close to flood hazards	low	none reported	yes
Invasive Species	economic or environmental harm to human health; impacts to food chain	2-7 species reported (State Plan)	town-wide (but may be localized)	possible	not assessed; minor to major	no

PRI Results

To prioritize and categorize the flooding risks in the planning area, the Priority Risk Index (PRI) tool was used. PRI results provide a numerical value for each hazard that allows hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value from 1 to 4 and a weighting factor. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor, and the products for each category are summed. This information was used to rank the hazards presented in Table 51 (Summary of Hazards in Lyndon and Lyndonville). Table 52 shows the ranked hazards according to their PRI score.

Table 51 Priority Risk Index Results

Hazard	Category / Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI score
FLOOD HAZARDS						
Flooding and Fluvial Erosion	Likely	Critical	Moderate	12 to 24 hours	More than 24 hours	3.0
Flash Flooding	Possible	Critical	Small	6 to 12 hours	6 to 12 hours	2.4
Dam Breach Flooding	Unlikely	Critical	Small	Less than 6 hours	Less than 6 hours	2.1
WIND HAZARDS						
Hurricanes	possible	limited	large	>24 h	< 24 h	2.3
Microburst	possible	limited	small	<6 hours	<6 hours	2.1
Tornadoes	possible	minor	small	<6 hours	<6 hours	1.8
WINTER HAZARDS						
Blizzard	highly likely	critical - catastrophic	large	>24 h	up to 24 - 48 hr	3.4
Hail	likely	minor	negligible	<6 hours	<6 hours	2.0
Ice Jams	likely	limited	small	>24 h	< 1wk	2.0
Ice Storms	possible	catastrophic	large	<24 h	< 24 hr	2.5
Nor'easter	likely	critical - catastrophic	large	>24 h	< 24 hr	3.0
Snow Events	highly likely	critical	large	>24 h	< 24 hr	3.2
Extreme Cold	possible	minor	large	>24 h	1 weekk	2.1
FIRE HAZARDS						
Drought	likely (D0)	minor	large	>24 h	>1 week	2.5
Wildfire	possible	critical	small	<6 hours	<24 h	2.5
Lightning	possible	minor	negligible	<6 hours	<6 hours	1.6
GEOLOGICAL HAZARDS						
Earthquake	possible	minor - catastrophic	large	<6 hours	<6 hours	2.4
Landslide	possible	minor	areas of steep slope	<6 hours	<6 hours	1.5
OTHER POTENTIAL HAZARDS						
Extreme Heat and Heat Wave	possible	limited	town-wide	>24 h	< 24 h	2.3
Water Supply Contamination	possible	minor	moderate - large	12-24 h	< 24 h	2.0

Hazard	Category / Degree of Risk					
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**PRI score**
Hazardous Materials	possible	limited	small - moderate; town-wide (but may be localized); 8 (out of 37) HAZMAT storages are located close to flood hazards	<6 hours	< 24 h	2.3
Invasive Species	possible	minor	negligible	>24 h	1 week	1.6

Hazard Ranking

The ranking of hazards was based on the PRI results. Table 52 shows all hazards in the planning area ranked according to their PRI score and then modified by the Hazard Mitigation Committee to more accurately reflect concerns in the planning area.

Table 52 Hazard Ranking

Ranking	Hazard
High Hazards	Flood and Fluvial Erosion Blizzard Snow Events Nor'easter
Moderate Hazards	Ice Storms Wildfire Hurricanes Hazardous Materials Ice Jams Extreme Cold
Low Hazards	Microburst Hail Water Supply Contamination Tornadoes Drought Earthquake Lightning Extreme Heat and Heat Wave
Very Low Hazards	Invasive Species Landslide

The majority of the hazards addressed are atmospheric in nature and with the exception of floods which will affect the entire plan area. Impacts are to be expected in the same amount to the Town of Lyndon and Village of Lyndonville which is incorporated within the Town of Lyndon. For example, although Lyndonville Electric Department is based in the Village and controlled by the Village Trustees, the electric infrastructure extends throughout the Town so the entire community would be vulnerable to hazards that impact the electric infrastructure. As described in detail in Chapter II, responsibility for management of public buildings and infrastructure in the Town of Lyndon falls to the Village Trustees, the Town, or State agencies.

In summary, all of the hazards addressed in this plan pose a threat to the Town of Lyndon and Village of Lyndonville, including the assets and population within. The hazards of greatest concern are floods, blizzards, snow events, Nor'easters followed by ice storms, drought, wildfire, earthquakes, hurricanes, extreme heat and heat wave, and hazardous materials. Of lesser concern are microbursts, extreme cold, hail, ice jams, water supply contamination, and tornadoes. Lightning, invasive species, and landslides pose the least concern.

The risks posed to town residents by flood hazards, the effect of repetitive flood damage claims on flood insurance rates for residents, and the cumulative costs to the municipality for repair of flood damaged infrastructure are significant issues for the town. Areas of particular concern compiled from the Town Plan[180] and the collaborative planning process include:

- The Sanborn Bridge, which poses a potential hazard for ice and debris jams
- The Bridge at the intersection of Lily Pond Road and Route 114, where the channel of the East Branch Passumpsic River is constrained and ice jams and flooding has occurred
- The area of the Millers Run near the covered bridge at the Park & Ride where the river is disconnected from its floodplain
- The ineffectiveness of the series of culverts under Route 5 south of the intersection with Route 114 at conveying flood flows
- Flooding at the major intersection of Routes 5, 114 and 122, which hampers emergency response during disasters

Figure 24 Flooding Near the Intersection of Routes 5, 114, and 122 due to Tropical Storm Irene, August 2011, Photo courtesy of Heinz Fischer

180 Lyndon Town Plan. (2015). Town of Lyndon, Vermont. Retrieved from http://www.lyndonvt.org/LyndonTownPlan_Adopted02_09_2015.pdf

- The Town garage, which is located within the river corridor
- Ice jam potential at sharp bends in the river, such as those near Powers Park and along Stevens Loop
- Ineffective (disconnected) storm drainage on Pleasant Street and Passumpsic Street
- A bank slide along Hawkins Brook

CHAPTER V

Capability Assessment

Capability Assessment Purpose

Does the plan document each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs? FEMA Requirement §201.6(c)(3)

The purpose of conducting the capability assessment is to identify the strengths and weaknesses of the planning area in terms of mitigating risks. This analysis will point to shortfalls and weaknesses as well positive measures already in place, which should continue to be supported.

The capability assessment serves as the foundation for designing an effective hazard mitigation strategy. It not only helps establish the goals and objectives for the planning area but it ensures that those goals and objectives are realistically achievable under given local conditions.

The capability assessment must answer two questions:

1. Does the Plan document each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs?[1]
2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate?[2]

The capability assessment includes a comprehensive examination of the following capabilities as summarized in Table 1.

Table 1 Capability Assessment Components

Components	Description
Planning and Regulatory Capabilities	Does the planning area have plans in place that include natural hazards? Do the plans identify mitigation projects? Can the plan be used to implement mitigation actions?
Administrative and Technical Capabilities	What skills does the planning area have and can they be used for mitigation planning?
Financial Capabilities	Is the planning area eligible for or have access to funding sources for hazard mitigation?
Education and Outreach Capabilities	What education and outreach programs are currently in place to communicate hazard-related information?
Safe Growth Analysis	Evaluates the extent to which the planning area is positioned to grow safely relative to its natural hazards. Included are the following topical areas: • Land Use • Transportation • Environmental Management • Public Safety • Zoning Ordinance • Subdivision Regulations • Capital Improvement Program and Infrastructure Policies

1 44 CFR 201.6(c)(3)
2 44 CFR 201.6(c)(3)(ii)

Components	Description
National Flood Insurance Program (NFIP)	How does the planning area participate in the NFIP?
Capability Assessment Conclusions	A summary of capability findings.

Planning and Regulatory Capabilities

Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? 44 CFR 201.6(b)(3)

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. The first step in the capability assessment was to gather and review existing plans to gain an understanding of the region's ability to mitigate risk. The following tables are similar to FEMA's Worksheet 4.1[3] in the Local Mitigation Planning Handbook. It was used by the Planning Team to review the planning and regulatory capabilities of the planning area including plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards.

Table 2 Existing Plans Reviewed

Plan	Does the plan address hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
State of Vermont, Hazard Mitigation Plan, November 2013	Yes – All hazards	Yes	No – But, it is good support to the mitigation plan.
Lyndon Town Plan, November 2014 (considered Comprehensive/ Master Plan)	Yes - Flooding	Yes	Yes – Multiple mitigation actions are recommended throughout the Town Plan.
Lyndon Zoning Bylaws, June 2013	Yes – Flooding and other hazards	No	The bylaws support mitigation.
Lyndon Local Emergency Operations Plan – maintained by Municipal Administrator	Yes – Fire, Hazardous Materials, Flooding and other hazards	No	No
Northeast Kingdom Regional Plan, NVDA 2013	Yes - Flooding	Includes a Flood Resilience section.	Offers analysis as well as suggestions related to land use and flooding.

3 Capability Assessment Worksheet 4.1, Local Mitigation Planning Handbook, Federal Emergency Management Agency.

Plan	Does the plan address hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Planning for Flood Recovery and Long-Term Resilience in Vermont, EPA 2014	Yes - Flooding	Yes – 4 types of flood mitigation recommended.	No – But, it is good support to the mitigation actions recommended in the mitigation plan.
East Branch Passumpsic River Corridor Plan, Burke and Lyndon, January 2009	Yes – Flooding	Yes – Lists projects intended to reduce river corridor erosion and other flood related hazards. Plan notes that floodwater storage on the Upper Passumpsic tributaries is critical to mitigating floods on the Passumpsic River main stem.[4]	No – But, it is good support to the mitigation plan.
Lower Passumpsic River Tributaries, River Corridor Plan, Caledonia County, August 2010	Yes – Flooding	The Plan provides a preliminary list of site-specific projects designed to mitigate flood and erosion hazards. These include the resizing of bridges and culverts to adequately accommodate the floodprone width, the removal of berms that restrict access of the river to the floodplain, bank stabilization measures, removal of obstructions from the stream channel that trap large amounts of sediment and debris, and buffer plantings. Many of the recommended site-specific projects are located in Lyndon, and a number identify the municipality as a key potential partner.[5]	No – But, it is good support to the mitigation plan.
Lyndon TH 77 (Simpson Drive) over unnamed brook site about 200' southwest of TH 76 (Sheldon Brook Road), Memo July 2011	Yes – Flooding	Yes – provides several recommendations for a new structure that meets the hydraulic standards, fits the natural channel width and the roadway grade.	Yes

4 Lyndon Town Plan. (2015). Town of Lyndon. P.80
5 Ibid.

Plan	Does the plan address hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Miller's Run River Corridor Plan, Lyndon, Wheelock and Sheffield, October 2009	Yes – Flooding	Yes – Lists projects to "help attenuate floodwaters, reducing flooding downstream. Proposed projects are also intended to improve water quality and enhance habitat. Recommendations include obtaining easements to expand floodplain access, replacing undersized bridges, and updating land use regulations to prevent filling in the floodplain.[6]	Yes
North Main Street Overflow Culverts, Alternatives Analysis, Memo April 2012	Yes – Flooding	The study concluded that the flooding in the location of the Main Street Bridge was a function of both reduced local conveyance of floodwaters and backwatering from the Vail Dam. This analysis was based on the hydraulic model prepared by VTrans in 2004. The study noted the need for updated data.[7]	Yes
Passumpsic River Basin, Stormwater Infrastructure Mapping Project, March 2014	Yes – Flooding	This March 2014 report primarily addresses projects to mitigate non-point source pollution, including the upgrading of existing detention basins to treat runoff before it enters the receiving waters. The maps of stormwater infrastructure, including the location of storm drains and catch basins, are also useful in assisting with emergency preparedness during events of heavy rains or spring snowmelt.[8]	No – But, it is good support to the mitigation plan

6 Lyndon Town Plan. (2015). Town of Lyndon. P.81.
7 Ibid.
8 Ibid.

Plan	Does the plan address hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Passumpsic River Flood Mitigation Study, November 2006	Yes Flooding	Yes • Replacement of dry culverts under Main Street (State Route 5) with dry bridge (done) • Development of River Corridor protection Plans (done) • Limit further encroachment in the floodplain with conservation easements and/or acquisition	No – But, it is good support to the mitigation plan
Passumpsic and Upper Connecticut River Tactical Basin Plan, June 2014	Yes – Flooding	One of the top ten actions identified in this plan is to improve river corridor and floodplain protections for the Passumpsic, Millers Run, East and West Branch Passumpsic River in town zoning bylaws to allow these streams to develop new floodplains and reduce flood damage.[9]	No – But, it is good support to the mitigation plan
West Branch Passumpsic River and Calendar Brook Corridor Plan, Caledonia County, August 2010	Yes – Flooding	Watershed-level approaches to flood mitigation include the river corridor (or fluvial erosion hazard area) zoning in the towns of Sutton, Lyndon and Burke to encourage long-term channel stability. Site-level projects are also proposed, including buffer plantings and bridge replacement. The corridor protection areas identified in the report focus on undeveloped areas in the river corridor that are a high priority because of their potential to reduce downstream flooding in developed areas, including Lyndonville Village.[10]	No – But, it is good support to the mitigation plan

9 Lyndon Town Plan. (2015). Town of Lyndon. P.81.
10 Ibid.

The Town of Lyndon and Village of Lyndonville do not have the following plans:

Table 3 Plans not specifically in place

Plans Not Specifically In Place	Description
Capital Improvements Plan	This mitigation plan recommends starting a Capital Improvements Budget. The Town of Lyndon does have projects in mind but they do not set-aside funds for them.
Economic Development Plan	Lyndon Area Chamber of Commerce is working on outreach designed to encourage sustainable development. The Town Plan includes multiple elements of an economic development plan.
Continuity of Operations Plan	The Lyndon Fire Department has an Emergency Response Plan but the planning area does not have Continuity of Operations Plan.
Transportation Plan	Town Plan does include some transportation information. Also, Rural Community Transportation is a nonprofit organization that runs a bus service and transports Medicare patients to appointments.
Stormwater Management Plan	Passumpsic River Basin Stormwater Infrastructure Project March 2014 identifies locations of drains and could be used toward a Stormwater Ordinance or Municipal Management Program.
Community Wildfire Protection Plan	The State of Vermont has Wildfire protection regulations that the planning area must adhere to.

Zoning and Land Use Regulations

The zoning bylaws in the planning area do support hazard mitigation; Table 4 indicates which zoning ordinances are in-place and Figure 1 shows the zoning districts. "One of the requirements of membership in the NFIP is that the Town administer flood hazard regulations. Flood hazard regulations contained in Article XI of the Town's bylaws regulate development within the special flood hazard areas identified on the Flood Insurance Rate Map (FIRM). While these regulations address the flood hazard areas identified by FEMA, they do not necessarily address fluvial erosion hazard areas associated with the movement of rivers and streams. Lyndon's land use regulations also allow for Planned Unit Developments, which can be a way to allow more flexible requirements for developments that achieve environmental benefits, such as preservation of open space, and minimization of impervious surfaces."[11]

Table 4 Land Use Planning and Ordinances

Land Use Planning and Ordinances	Yes/No	**Is the ordinance an effective measure for reducing hazard impacts?** Is the ordinance adequately administered and enforced?
Zoning ordinance	Yes	Zoning Bylaws June 2013
Subdivision ordinance	Yes	Zoning Bylaws June 2013
Floodplain ordinance	Yes	Zoning Bylaws June 2013 – includes flood hazard regulations

11 Lyndon Town Plan. (2015). Town of Lyndon. P.79.

Land Use Planning and Ordinances	Yes/No	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Sewer and Wastewater Ordinance and Solid Waste Management Ordinance in Lyndon, Wastewater and Water Ordinances in Lyndonville. The Town relies on state issued stormwater permits for development disturbing over an acre of land.
Flood insurance rate maps	Yes	These maps are not digitized
Acquisition of land for open space and public recreation uses	No	Neither jurisdiction has an Open Space Plan

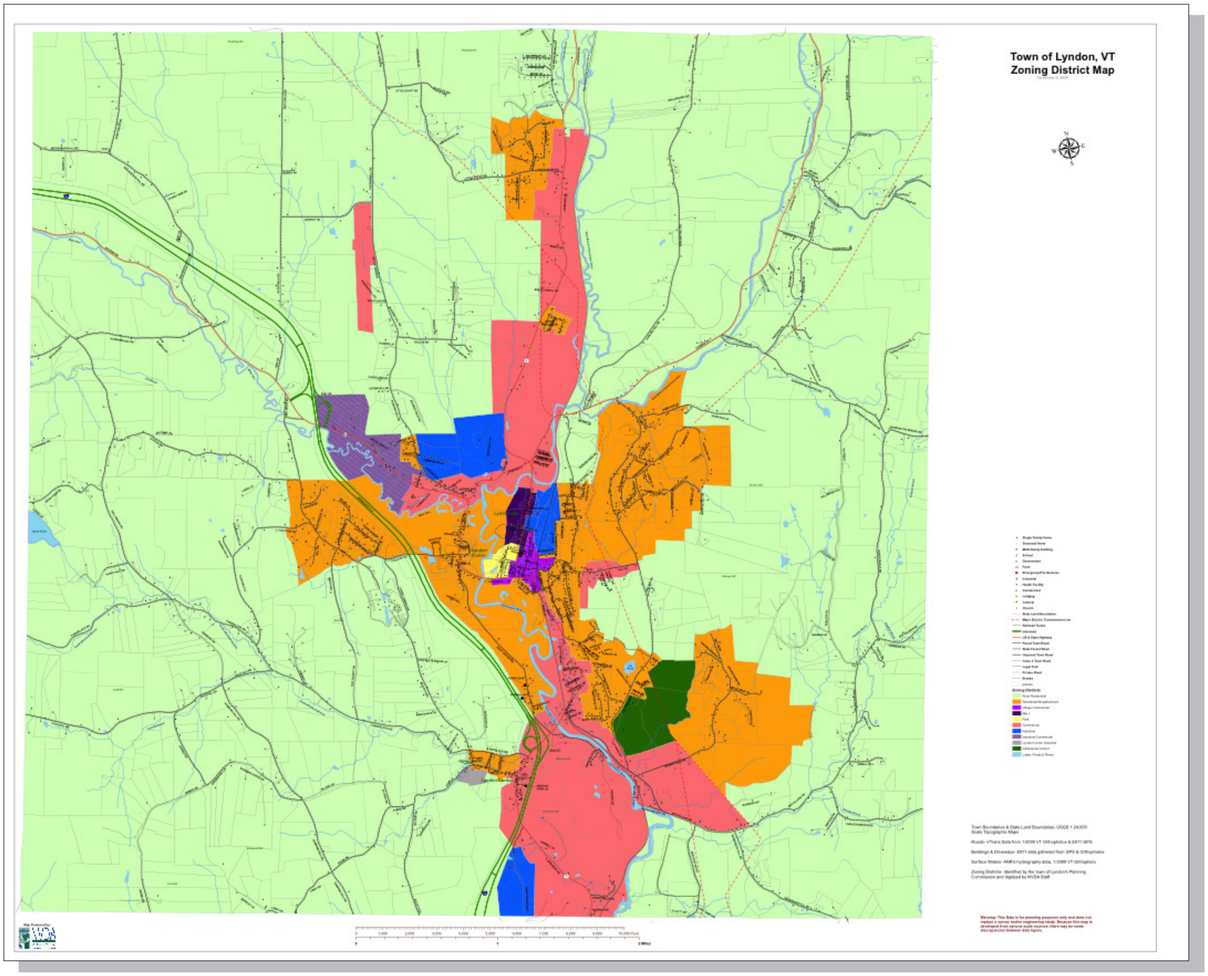

Figure 1 Zoning District Map

In addition to zoning regulations, the planning area has building code and site plan requirements as show in Table 5 below.

Table 5 Building Code and Site Plan Requirements

Building Code, Permitting, and Inspections	Yes/No	Are codes adequately enforced?
Building Code	Yes	The planning area adheres to state building code standards for public buildings. These are enforced by district fire marshals employed by the state. The planning are does not have municipal codes or enforce state codes. Vermont Residential Building Energy Standard (RBES) – The RBES has been revised as of November 24, 2014. Revisions take effect March 1, 2015 and "shall apply to construction commenced on and after the date they become effective". RBES applies to all new residential construction, including additions, alterations, renovations, and repairs. On June 17, 2013, the Vermont legislature adopted Act 89, which clarifies the applicability of Vermont's residential (and commercial) building energy codes to mixed-use buildings and includes various amendments to promote compliance with those codes, such as using existing State and local permit processes to encourage compliance.[12]
Fire department ISO rating		Rating: Fire Hydrant District = 4 Outside of the fire hydrant district = 6
Site plan review requirements		The Zoning Bylaws (Section 9.1) include site plan requirements for all development in town except 1 family and 2 family dwellings. Those requirements include vehicular safety, landscaping, setbacks, screening, and protection of renewable energy

12 Residential Building Emergency Standards. (2015). Vermont Public Service Department. Retrieved March 23, 2015 from http://publicservice.vermont.gov/topics/energy_efficiency/rbes

Implications of Growth and Development Patterns

The Town of Lyndon and Village of Lyndonville are growing in population, infrastructure, and buildings. Figure 2 shows the Future Land Use Map for the planning area. With the risk of flood and the growth in population and development smart growth is a concept to consider. Smart Growth is "development that is compact and walkable, provides a range of housing and transportation choices, and fosters distinctive, attractive communities with a strong sense of place. Smart growth approaches use land efficiently, enhance community vitality, protect natural resources, reduce costs for public services, save taxpayers' money, and create a higher quality of life."[13] The Hazard Mitigation Committee and the Lyndon Town Planning Commission are aware of the following mart growth principles:

- Mix land uses.
- Take advantage of compact building design.
- Create a range of housing opportunities and choices.
- Create walkable neighborhoods.
- Foster distinctive, attractive communities with a strong sense of place.
- Preserve open space, farmland, natural beauty, and critical environmental areas.
- Strengthen and direct development towards existing communities.
- Provide a variety of transportation choices.
- Make development decisions predictable, fair, and cost effective.
- Encourage community and stakeholder collaboration in development decisions.

FEMA and the Environmental Protection Agency (EPA) can provide assistance to the planning area through the Smart Growth Implementation Assistance Program.

13 Planning for Flood Recovery and Long-Term Resilience in Vermont. (2014) Environmental Protection Agency. P.6.

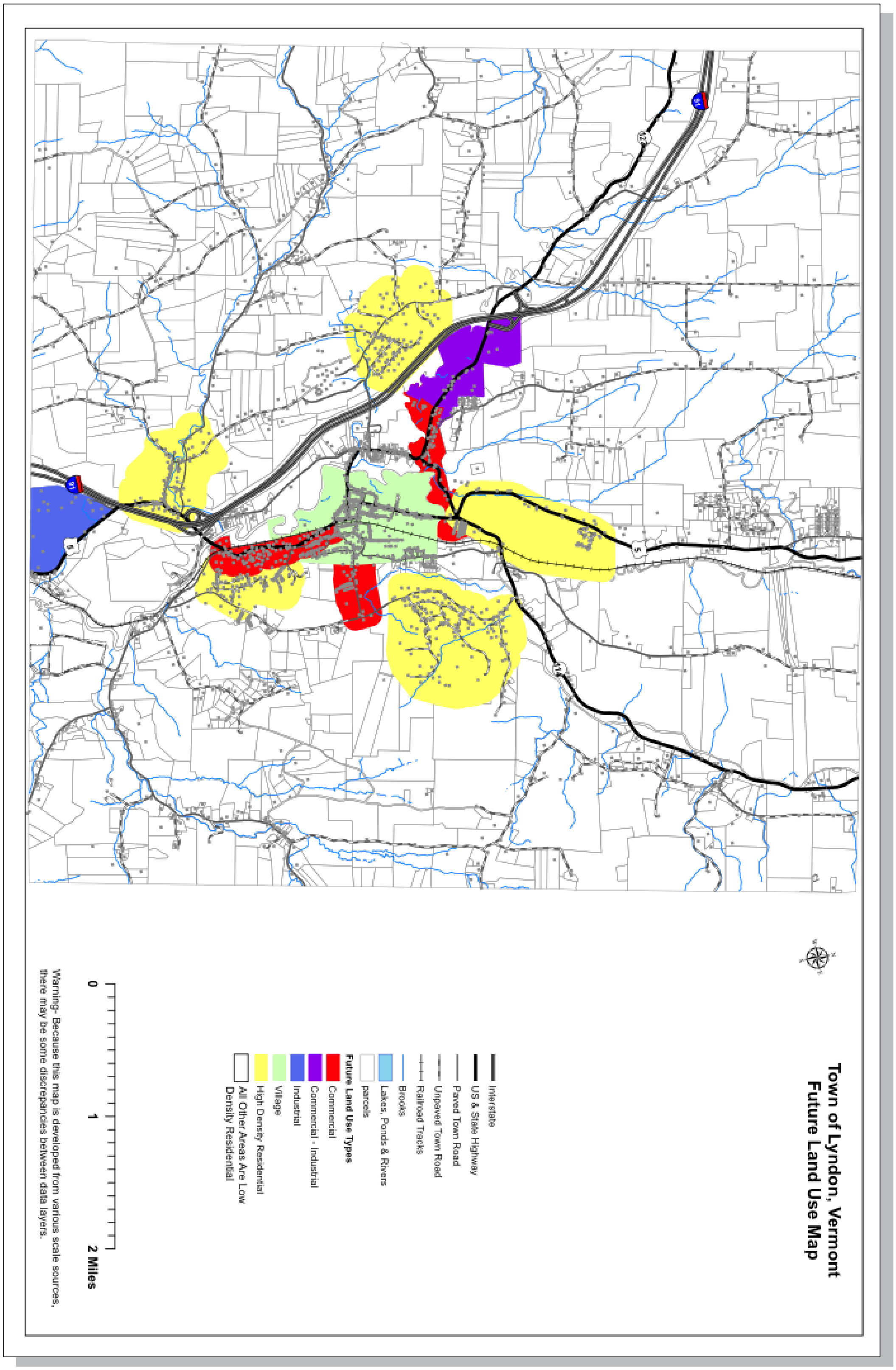

Figure 2 Future Land Use Map

Administrative and Technical Capabilities

Table 6 represents Worksheet 4.1 from FEMA's Local Mitigation Planning Handbook.[14] It was used by the Planning Team to review administrative and technical capabilities of the town. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. The Yes/No column answers the question, Does the position or document listed in the first column exist.

Table 6
Administrative and Technical Capabilities

Administration	Yes/No	Describe capability Is coordination effective?
Community Planning Commission	Yes	Responsible to prepare and update zoning bylaws and to help with land use for future development. Planning Commission supports the Town and Village.
Mitigation Planning Committee	Yes	Formed for the purposes of completing this plan. This committee will remain active to work on the implementation of this Plan.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes	Do have an Urban Forest Program to identify trees. Tree trimming and clearing drainage systems is a function of each jurisdiction's Department of Public Works.
Mutual aid agreements	Yes	Mutual Aid Agreements are in place with all surrounding towns, including: Burke, Wheelock, St. Johnsbury, Kriby, Granby, etc.

Staff	Yes/No	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation?
Chief Building Official	No	Buildings are not inspected. It is not feasible for the jurisdictions to appoint a Building Official.
Floodplain Administrator	Yes	Zoning Administrator
Emergency Manager	Yes	Fire Chief Greg Hopkins serves as the Emergency Manager for both the Town and Village.
Community Planner	Yes	Zoning Administrator
Civil Engineer	No	
GIS Coordinator	No	The Town sub-contracts for GIS tax base maps and relies on NVDA for GIS support.

14 Capability Assessment Worksheet 4.1, Local Mitigation Planning Handbook, Federal Emergency Management Agency. .

(Cont'd) Table 6 Administrative and Technical Capabilities

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Warning systems/ services **(Reverse 911, outdoor warning signals)**	No	Do use Radio Station for announcements and the College has a student email system that can send announcements.
Hazard data and information	No	Hazard data is not maintained. However, a list of updated/retrofitted buildings does exist.
Grant writing	Yes	Town Administrator, Town Planner and NVDA. A mitigation action has been developed to maintain hazard data as it becomes available.
Hazus analysis	No	The jurisdictions would be unduly burdened if they attempted to implement HAZUS. They rely on the support of NVDA for GIS.

Financial Capabilities

The table below represents Worksheet 4.1 from FEMA's Local Mitigation Planning Handbook.[15] It was used by the Planning Team to identify eligibility and access to hazard mitigation funding.

Table 7 Financial Capabilities

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	No	A specific fund does not exist but the Planning Commission may allocate funds for capital improvements.
Authority to levy taxes for specific purposes	Yes	The Town can have a bond vote and they have used this authority to buy out two houses as a part of a FEMA project.
Fees for water, sewer, gas, or electric services	Yes	Wastewater, water, and electric service all have service fees
Impact fees for new development	No	The State has the ability through Act 250.
Storm water utility fee	No	
Incur debt through general obligation bonds and/or special tax bonds	Yes	The Town regularly incurs debt through bond. The jurisdictions do not feel the public would approve a stormwater utility fee in the future.
Incur debt through private activities	No	

15 Capability Assessment Worksheet 4.1, Local Mitigation Planning Handbook, Federal Emergency Management Agency. .

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Community Development Block Grant	Yes	The planning area has received funds for Gilman Housing, Rural Edge and Darling Inn.
Other federal funding programs	Yes	USDA for Water, Wastewater and Infrastructure
State funding programs	Yes	Vermont Transportation – for the pedestrian bridge and road paving, Land and Water Conservation Fund for municipal pool repairs. The approval and adoption of this plan should open up additional funding sources.

Education and Outreach Capabilities

The table below represents Worksheet 4.1 from FEMA's Local Mitigation Planning Handbook.[16] It was used by the Planning Team to identify education and outreach programs used to implement mitigation activities.

Table 8 Education and Outreach Capabilities

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Planning Commission is the most active in terms of emergency preparedness. Also have the Village Improvement Society to assist with pool maintenance and the Development Review Board to focus on conditional use permits, and Chamber of Commerce for business improvement.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	No	A couple of mitigation actions have been included to remedy this lack of public education.
Natural disaster or safety related school programs	No	The Lyndon Institute has a J Term program that includes education about pollution on the Passumpsic Valley Watershed
StormReady certification	No	
Public-private partnership initiatives addressing disaster-related issues	No	When the mitigation actions related to public education are implemented it may become feasible for a public-private partnership related to disasters to develop.

16 Capability Assessment Worksheet 4.1, Local Mitigation Planning Handbook, Federal Emergency Management Agency. .

National Flood Insurance Program (NFIP) Compliance

Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? 44 CFR 201.6(c)(3)(ii)

Both the Town of Lyndon and the Village of Lyndonville are members of FEMA's National Flood Insurance Program (NFIP), which enables property owners in flood hazard areas to purchase flood insurance. Details regarding participation in the NFIP by property owners are below in Table 9 and in Appendix I. The Planning Team used the Capability Assessment Worksheet 4.3 to collect information regarding the Town's participation in the NFIP. The worksheet also helped the Planning Team identify potential mitigation actions. The Town Planner functions as the floodplain manager for both the Village and the Town and she will ensure that each jurisdiction maintains NFIP compliance. Many of the mitigation actions in this plan relate to flooding, several relate specifically to NFIP compliance including participation in the Community Rating System, buying repetitive loss properties and education related to floodproofing for home and business owners.

Table 9 National Flood Insurance Program Worksheet

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	Of the 87 buildings in the SFHA within the Town in Lyndon, 26, or approximately 30%, hold flood insurance policies through the NFIP.[17] Of the 26 buildings in the SFHA within the Village of Lyndonville none of them have flood insurance polices.[18] The total premium is $50,160 on 41 policies and the total coverage is $5,920,800.[19]
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	A total of 74 claims amounting to approximately $1.65 million have been paid to the Town of Lyndon (including Village of Lyndonville) NFIP policyholders since 1980.[20]
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	There are no V-Zone properties, 30 A-Zone properties.[21]
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	

17 Expanded Community Report for Lyndon. (2015). Flood Ready Vermont. Retrieved from https://anrweb.vt.gov/DEC/FoFReports/SSRSReportViewer.aspx?RepName=ExpandedCommunityReport&Municipality=Lyndon

18 Ibid.

19 NFIP Insurant Report, Vermont. (2015). Federal Emergency Management Agency. Retrieved from http://floodready.vermont.gov/sites/floodready/files/documents/NFIP%20Insurance%20Report%20VT%201.26.15.pdf

20 Ibid.

21 Ibid.

NFIP Topic	Source of Information	Comments
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	The Town Planner functions as the floodplain manager for both the Village and the Town and she is not certified.
Is floodplain management an auxiliary function?	Community FPA	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	The Town Planner has multiple responsibilities, which is not uncommon for a town, this size in Vermont.
Compliance History		
Is the community in good standing with the NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	The Town and the Village are in compliance with the NFIP. The Town Planner who is responsible for overseeing the NFIP for both jurisdictions will continue maintaining compliance and enforcing flood regulations through zoning administration.
Are there any outstanding compliance issues (i.e., current violations)?	No	
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	2011	
Is a CAV or CAC scheduled or needed?	No	
Regulation		
When did the community enter the NFIP?	Community Status Book http://www.fema.gov/ national-flood-insurance- program/ national-flood-insurance-program-community-status-book	June 1980

NFIP Topic	Source of Information	Comments
Are the FIRMs digital or paper?	Community FPA	Paper A mitigation action is included to encourage FEMA to develop digital FIRMs.
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Community FPA	Meet
Provide an explanation of the permitting process.	Community FPA, State, FEMA NFIP Flood Insurance Manual http://www.fema.gov/ flood-insurance-manual Community FPA, FEMA CRS Coordinator, ISO representative CRS manual http://www.fema.gov/ library/ viewRecord.do?id=2434	Permit applications including: current and proposed elevations and contours, distance from streambed, existing infrastructure, and existing 1st floor levels are submitted to the zoning administrator. Then sent to the state FEMA coordinator/ State floodplain manager for comment. Then a public hearing is held by the local Development Review Board on the application.
Community Rating System (CRS)		
Does the community participate in CRS?	Community FPA, State, FEMA NFIP	No – however a mitigation action related to participation is included in this plan.
What is the community's CRS Class Ranking?	Flood Insurance Manual http://www.fema.gov/ flood-insurance-manual	
What categories and activities provide CRS points and how can the class be improved?		
Does the plan include CRS planning requirements	Community FPA, FEMA CRS Coordinator, ISO representative CRS manual http://www.fema.gov/ library/ viewRecord.do?id=2434	Yes – see table below for details

Community Rating System

The Town Planer and the Hazard Mitigation Committee are interested in the Community Rating System (CRS) program. During the planning process, they participated in a webinar about the CRS. Table 10 indicates how the planning process to develop this 2015 Multi-Jurisdiction Hazard Mitigation Plan meets many of the requirements to receive CRS credit.

Table 10 CRS Requirements Met in this Mitigation Plan

Mitigation Planning Process Tasks	Actions Taken in Planning Process	CRS Credit Requirements
Adopt Mitigation Plan	Plan formally adopted as a resolution. The resolution is included in the front of the plan.	Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. The adoption must be either a resolution or ordinance.
Planning Process - Organize	Chapter 3 describes the mitigation planning process.	Credit is based on how the community organizes to prepare its floodplain management plan.
Planning Process - Public Comment	Two public meetings were held to give the public an opportunity to provide feedback on the mitigation plan. They were able to review and provide feedback on the entire draft plan, which was posted to the Town's web page.	The planning process must include an opportunity for the public to comment on the plan during the drafting stage and before plan approval. The term "public" includes residences, businesses, property owners, and tenants, as well as stakeholders in the community such as business leaders, civic groups, academia, nonprofit organizations, and major employers.
Planning Process - Public Involvement	The public had an opportunity to participate in the planning process through the Public Preparedness Survey and two Town Hall Meetings. Representatives from neighboring towns participated in the Hazard Mitigation Committee. Representatives from large corporations in the Town were also invited to participate in the Hazard Mitigation Committee.	Other agencies and organizations must be contacted to see if they are doing anything that may affect the community's program and to see if they could support the community's efforts. Coordination with neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development as well as businesses, academia, and other nonprofit interests.
Existing Plans and studies	This chapter includes a review of existing studies.	CRS requires that a plan include a review of existing studies, reports, and technical information and of the community's needs, goals, and plans for the area.

Mitigation Planning Process Tasks	Actions Taken in Planning Process	CRS Credit Requirements
Risk Assessment - Hazard Assessment	Chapter 4 includes describes the local of all natural hazards in the Town including their location, previous occurrences and the probability of future events. Participation in the NFIP is reviewed in Chapter 4 and here in Chapter 5.	Credit is based on what the community includes in its assessment of the hazard. The minimum requirement is for the flood hazard only. However, additional credit can be earned by identifying and including a description of all other natural hazards. Credit is based on what is included in the assessment of vulnerability to the hazards identified. At a minimum the plan must include an overall summary of each hazard and its impact on the community. CRS credits is given for an assessment that includes a review of all properties that received flood insurance claims (in addition to repetitive loss properties) or an estimate of the potential dollar losses to vulnerable structures.
Risk Assessment - Assess the Problem	Critical facilities are identified in Chapter 4 and they are mapped according to hazard risk. Vulnerability of each critical facility is described.	CRS credits the identification of the number and types of buildings subject to the hazards as well as the identification of critical facilities and infrastructure located in the hazard areas. CRS gives credit for a description of the development, redevelopment, and population trends and a discussion of what the future brings for development in the community.
Mitigation Strategy - Set Goals	Hazard mitigation goals are identified in Chapter 6.	Credit is based on a statement of goals of the community's floodplain management or hazard mitigation program.
Mitigation Strategy - Review Possible Activities	Chapter 6 includes justification for past mitigation actions were or were not implemented. It also provides rationale for each of the newly identified mitigation actions.	Credit is based on a comprehensive review of floodplain management or hazard mitigation activities are reviewed in the plan. The review must include a description of why certain activities were recommended and why others were not.

Mitigation Planning Process Tasks	Actions Taken in Planning Process	CRS Credit Requirements
Mitigation Strategy - Draft an Action Plan	Several tables in Chapter 6 identify for each mitigation action that is responsible for implementation, when the action is to be implemented and a potential funding source. Chapter 6 shows the priority order of mitigation actions and their associated cost.	Credit is based on an action plan that identifies who does what, when it will be done, and how it will be financed. The actions must be prioritized and include a review of the benefits of the proposed projects and their associated costs.
Plan Maintenance – Implement, Evaluate, and Revise	Chapter 7 indicates how the plan will be implemented and calls for updating the plan on a five-year cycle.	Credit is based on how a community monitors and evaluates its plan on annual bases and updates it on a five-year cycle.

Regional Relationships
The Town of Lyndon and Village of Lyndonville have an excellent working relationship with adjacent communities and the NVDA.

Capability Assessment Conclusions

Each of the jurisdictions in the planning area is capable of mitigating risk. Their ability to collaborate increases their mitigation capabilities. The Town of Lyndon has a current Municipal Plan, an official town map, and they have adopted subdivision regulations/bylaws. They have a Planning and Zoning Commission and a Development Review Board. They also have a flood hazard district and have adopted Vermont's Land Use and Development law, Local Act 250 Review per 24 V.S.A. 4420(b)(1). Each of these speaks to their ability to mitigate risk.

The capabilities of the Town and Village are intertwined. As described in detail in Chapter II of this Plan, responsibility for the management of public buildings and infrastructure within the Town of Lyndon falls to the Village Trustees, the Town Select Board, or State agencies. The Municipal Administrator oversees departments for both the Town and Village. The planning and regulatory documents listed are also relevant for both the Town and Village. The collaboration with State and regional agencies involved with implementing the mitigation actions included in this Plan would expand the capabilities of both the Town and the Village.

The lack of a conservation commission or historic commission could hinder mitigation activities, however the Planning Commission fills these roles to some degree. The lack of stormwater management and erosion prevention/sediment control could also hinder mitigation activities. The Hazard Mitigation Committee is aware of their strengths and weaknesses in terms of mitigating risk and many of the mitigation actions in the following chapter address these weaknesses.

CHAPTER VI

Mitigation Strategy

The hazard mitigation strategy is the culmination of work presented in the town profile, risk assessment, and capability assessment. It is also the result of multiple meetings and public outreach. The work of the Hazard Mitigation Committee was essential in creating the mitigation goals. They also worked to prioritize the mitigation actions.

Table 1 consists of problem statements based on the risk assessment and capability assessment. These statements are of particular interest with regard to primary hazards of concern, geographic areas of concern, and vulnerable community assets. If possible potential solutions or mitigation actions are mentioned with the statements. This analysis helped bridge the gap between identifying risk and developing realistic solutions.

Table 1 Problem Statements

Town of Lyndon and Village of Lyndonville Problem Statements
Flooding at the major intersection of Route 5, Route 114 and Route 122, hampers emergency response during disasters.
The area of the Millers Run near the covered bridge at the "park and ride" where the river is disconnected from its floodplain is an area at risk to flooding.
The series of culverts under Route 5 south of the intersection with Route 114 are designed poorly and ineffectively transport floodwaters.
The LynBurke/Sanborne Bridge is narrow and poses a potential hazard for ice and debris jams.
Ice jams and flooding have occurred at the Bridge at the intersection of Lily Pond Road and Route 114, where the channel of the East Branch Passumpsic is constrained.

Hazard Mitigation Goals

Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? FEMA Requirement §201.6(c)(3)(i)

In the first Hazard Mitigation Committee meeting on March 12, 2015, the committee members reviewed the 2010 Draft Mitigation Plan goal statements as a part of their meeting. Taking into consideration FEMA's requirements and the interests of committee members, the goals were modified to represent five categories. The following table shows a comparison between the 2010 Mitigation Plan goals and those identified for the 2015 Mitigation Plan. The goal statements reflect the long-term vision of the Hazard Mitigation Committee to protect its citizens and critical facilities from hazards identified in the risk assessment.

Table 2 Comparisons of 2010 and 2015 Goals

2010 Hazard Mitigation Plan Goals	2015 Multi-Jurisdiction Hazard Mitigation Plan Goals
1. Reduce the loss of life and injury resulting from all hazards.	**Save Lives and Protect Property** Reduce or eliminate risk to people and property from natural and man-made hazards.
2. Mitigate financial losses incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters.	**Community Planning** Integrate hazard mitigation policies and practices into local planning.
3. Reduce the damage to public infrastructure resulting from all hazards.	**Regional Collaboration** Build capacity for hazard mitigation through regional collaboration.
4. Recognize the connections between land use, stormwater road design and maintenance and the effects from disasters.	**Public Awareness** Increase public awareness of hazards by implementing outreach and education programs.
5. Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.	**Preservation** Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.
6. Encourage all-hazard mitigation planning as a part of the municipal planning process.	

The five goals identified by the Hazard Mitigation Committee fall into the following five categories below:

1. Save Lives and Property
2. Community Planning
3. Regional Collaboration
4. Public Awareness
5. Preservation

These categories represent themes that the Hazard Mitigation Committee is devoted to in their long-term vision of mitigating risk to natural hazards. The following table shows the Goal Categories and the Goal Statements.

Table 3 2015 Multi-Jurisdiction Hazard Mitigation Plan Goals

Goal Categories	Mitigation Plan Goal Statements
Save Lives and Property	1. Reduce or eliminate risk to people and property from natural and man-made hazards.
Community Planning	2. Integrate hazard mitigation policies and practices into local planning.
Regional Collaboration	3. Build capacity for hazard mitigation through regional collaboration.
Public Awareness	4. Increase public awareness of hazards by implementing outreach and education programs.
Preservation	5. Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.

Identification and Analysis of 2006 Mitigation Actions

Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? 44 CFR 201.6(c)(3)(ii) and 44 CFR 201.6(c)(3)(iv)

Table 4 illustrates that each Mitigation Goal is effective toward mitigating multiple natural hazards, while each hazard considered in the plan is addressed.

Table 4 Mitigation Goals Relate to Identified Hazards

Mitigation Goals	High Risk Hazards	Moderate Risk Hazards	Low Risk Hazards	Very Low Risk Hazards
	Flood and Fluvial Erosion Blizzard Snow Events Nor'easter	Ice Storms Wildfire Hurricanes Hazardous Materials Ice Jams Extreme Cold	Microburst Hail Water Supply Contamination Tornadoes Drought Earthquake Lightning Extreme Heat and Heat Wave	Invasive Species Landslide
1. Reduce or eliminate risk to people and property from natural and man-made hazards.	✓	✓	✓	✓
2. Integrate hazard mitigation policies and practices into local planning.	✓	✓	✓	✓

Mitigation Goals	High Risk Hazards	Moderate Risk Hazards	Low Risk Hazards	Very Low Risk Hazards
	Flood and Fluvial Erosion Blizzard Snow Events Nor'easter	Ice Storms Wildfire Hurricanes Hazardous Materials Ice Jams Extreme Cold	Microburst Hail Water Supply Contamination Tornadoes Drought Earthquake Lightning Extreme Heat and Heat Wave	Invasive Species Landslide
3. Build capacity for hazard mitigation through regional collaboration.	✓	✓	✓	✓
4. Increase public awareness of hazards by implementing outreach and education programs.	✓	✓	✓	✓
5. Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.	✓	✓	✓	✓

2010 Mitigation Action Status

The Town of Lyndon attempted to complete a hazard mitigation plan update in 2010. As part of this effort they developed a thorough list of mitigation actions. Table 5 shows the mitigation actions from 2010 in their order of priority, with their corresponding relevance for 2015. Mitigation actions that remain relevant and were not implemented were moved forward into the 2015 Multi-Jurisdiction Hazard Mitigation Plan.

Was the plan revised to reflect progress in local mitigation efforts? 44 CFR 201.6(d)(3)

	Project Name	Description	Justification/Notes	Contacts	Funding Sources	2015 Status
1	Rte 114/5/122 Junction	Examine Conflict Area	Engineering need to determine why conflicts are so high. Could be bundled with engineering of dry culverts. Catch Basin by LynBurke Motel is backing up. Dan Hill has contacted V-trans to address this.	Lyndon – Dan Hill, CCNRCD[1] – Kerry O'Brien, VT RMP[2]– Staci Pomeroy	HMGP[3]/other FEMA	Still a priority for 2015. Intersection study to determine causes of flooding and cost effective mitigation measures. Look specifically at the stormwater drain at the intersection as well as elevating the roadway.
2	Village Sports Shop	Examine Conflict Area	Engineering needed to determine best solution to flood problems. Options may include check valve/ pump system, elevating road/structure, or buyout	Leach Engineering, Village Sports Shop – Chris Hibshman, CCNRCD, NVDA[4]	FEMA, Clean and Clear	The Village Sport Shop is not specifically mentioned in the 2015 plan. However, the area of conflict remains an issue. It is included in three mitigation actions: 1. Railroad Flooding Around Broad Street 2. Floodproofing Education for Business Owners and Homeowners 3. Education for Business Owners on Broad Street.
3	Lyndon Town Garage	Relocate and remove structures at existing location, protect as active floodplain	Garage currently location at sharp bend in river, flooded in 2002.	Town of Lyndon	FEMA	The Lyndon Town Garage plans to merge with Lyndonville Garage. The area of the old Lyndon Town Garage remains an area of concern. The revised mitigation action includes removing the old structures and preserving the area for open space.

1 Caledonia County Natural Resources Conservation District (CCNRCD)
2 Vermont River Management Program (VRMP)
3 Hazard Mitigation Grant Program (HMGP)
4 Northeastern Vermont Development Association (NVDA)

	Project Name	Description	Justification/Notes	Contacts	Funding Sources	2015 Status
4	Rte 5 Dry Relief Culverts	Determine steps for engineering, costs for replacement to dry bridge	Debris jamming potential is high. Preliminary studies show more than 1-foot water elevation increase when not functioning. Dry bridge would increase relief conveyance, limit plugging	Caledonia County Natural Resources Conservation District (CCNRCD) – Kerry O'Brien, VT River Management Program (RMP)– Staci Pomeroy, Barry Cahoon, Lyndon - Dan Hill	Clean and Clear, HMG/other FEMA	This mitigation action remains a priority with the description to replace the culvert with a dry bridge.
5	Trailer Park	Examine conflict area	Long term conflict area at trailer park, high risk. Determine evacuation plan, floodproofing and or buy/out $ and potential		FEMA	The Mobile Home Park remains an area of concern. Two mitigation actions in the 2015 plan address this area: 1. Mobile Home Park Community Preparedness and Response Plan 2. Mobile Home Park Elevation.

	Project Name	Description	Justification/Notes	Contacts	Funding Sources	2015 Status
6	Broad Street Businesses	Examine Conflict Area	Engineering needed to examine drainage and conveyance along RR embankment. Determine RR maintenance. Explore floodproofing options/ impacts		Clean and Clear, FEMA	This area of the communities remains a concern. Four mitigation actions in the 2015 plan address the concern: 1. Railroad Flooding Around Broad Street 2. Elevate transportation corridors at problem locations 3. Floodproofing Education for Business Owners and Homeowners 4. Education of Businesses on Broad Street.
7	Center Street Bridge Area	Examine Conflict Area	Engineering/evaluation needed to examine flooding/conyeyance. Nearby homes typically underwater during flood	[5]		This mitigation action was revised to Buyout Repetitive Loss Structures.
8	Elevate transportation corridors at problem locations		Miller's Run Bridge, Jct of Rte 114/5/122; Rte 5 near Village Sports Shop; Center St bridge area typically underwater during nuisance floods. Explore options/engineering for improvements	V-trans, Town of Lyndon, Leach Engineering	V-trans, FEMA	This remains a 2015 mitigation action.
9	Maximize Floodplain Resources	Map out floodwater storage capacities	Floodwater storage needed upstream to reduce volume of floodwater conveyed to Lyndonville. Upstream tributaries are not currently accessing their floodplain due to channel incision.	CCNRCD, VT RMP	Clean and Clear, Easements or fee purchases bought by PVLT, VRC, VLT, State/ Federal Partner programs	River's accessing their floodplains continues to be an issue in the region. The revised mitigation action is: reconnect the river to existing floodplains upstream from the village by securing easements on private land.

5 Vermont Agency of Transportation (VTrans)

	Project Name	Description	Justification/Notes	Contacts	Funding Sources	2015 Status
10	Bridge and Culvert Assessment	Identify, monitor or Replace/ retrofit undersized structures,	Undersized structures may fail during flood events. Lily Pond bridge is undersized with upstream residents at risk. Debris/ ice jamming a hazard or culvert failure from flood volume that exceeds capacity	CCNRCD – Kerry O'Brien, NVDA, V-Trans	Upper Connecticut Mitigation and Enhancement Fund – Current Funding for culvert assessment, V-Trans, FEMA	Multiple bridge and culvert assessments have been completed. However recommendations still need to be done. Therefore, the 2015 mitigation action is: implement recommendations from the bridge and culvert assessments
11	Explore Fluvial Erosion Hazard Mapping	Reduce erosion hazards	Current floodplain mapping only addresses flood inundation, and not erosion. Current state of upper Passumpsic is at high risk in areas for erosion hazards. FEH mapping provides overlay for planning tool	CCNRCD, VT River Management	Clean and Clear, Current Funding	This project has been modified for the 2015 plan to: 1. Regulate future development along river corridors to prevent erosion and property loss.
12	Buyout repetitive loss structures	Indentify list of structures/ land that may be appropriate for buyout when favorable, conversion to active floodplain	Develop plan to mitigate areas of repetitive loss and areas with potential for development that are high risk.		State, FEMA	This remains a priority for the communities and is carried forward.

	Project Name	Description	Justification/Notes	Contacts	Funding Sources	2015 Status
13	Stormwater Assessment and Upgrades		Sections of stormwater system antiquated, under capacity, and in need of upgrades. Overflows occur on streets.	CCNRCD, Lyndon Public Works Director, Leach Engineering	Clean and Clear	Stormwater management remains a concern. It is included in two mitigation actions: 1. Connect Broad Street residences across Route 5 to stormwater system. 2. Implement repairs and continue to track status of stormwater system 3. Stormwater Master Planning.
14	Vail Dam		Explore long term cost-benefit analysis for removal/maintenance. Engineering needed for more study of impacts	LED [6]		The Vail Dam remains a concern. It is included in the 2015 plan with the following description: Review past engineering study to determine if removal of Vail Dam would decrease flooding downstream. If necessary conduct an updated study.
15	Install Stream Buffers		Potential project identified in River Corridor Plans on East Branch, West branch and Miller's Run. Landowner participation to be determined.	CCNRCD	CCNRCD, Upper Connecticut Mitigation and Enhancement Fund	Installing stream buffers remains a priority with the following description: implement recommendations for planting and preservation of stream buffers, as outlined in River Corridor Plans.

6 Lyndon Electric Department (LED)

Consistency Between Planning Mechanisms

The Planning Team reviewed multiple plans in the State and the region for information regarding mitigation for the planning area. The following paragraphs outline some of the information gleaned from these other plans. This multi-jurisdiction plan is consistent with the recommendations from the other plans.

The Lyndon Town Plan and the State of Vermont Hazard Mitigation Plan "encourage flood resilient communities."[7] Specifically, state statute directs:

A. New development in identified flood hazard, fluvial erosion, and river corridor protection areas should be avoided. If new development is to be built in such areas, it should not exacerbate flooding and fluvial erosion.
B. The protection and restoration of floodplains and upland forested areas that attenuate and moderate flooding and fluvial erosion should be encouraged.
C. Flood emergency preparedness and response planning should be encouraged.[8]

The Environmental Protection Agency (EPA) "Planning for Flood Recovery and Long-Term Resilience in Vermont: Smart Growth Approaches for Disaster –Resilient Communities" was an excellent resource for the Planning Team. This document defines flood resilience as "measures taken to reduce the vulnerability of communities to damage from flooding and to support long-term recovery after an extreme flood."[9] The same study also recommends "easy ways to improve resilience"[10]

A. Update and integrate comprehensive plans and Hazard Mitigation Plans
B. Conduct thorough policy and regulatory audits
C. Amend zoning, subdivision, and stormwater policies and regulations to match plans.
D. Consider participating in the NFIP CRS.

The same report recommends four categories of land use policy options, which represent different areas within a river valley to improve flood resiliency. These categories, listed below, were incorporated in the developed mitigation actions for this plan:

1. River Corridors: Conserve land and discourage development in particularly vulnerable areas along river corridors such as flood plains and wetlands.
2. Vulnerable Settlements: Where development already exists in vulnerable areas, protect people, buildings, and facilities to reduce future flooding risk.
3. Safer Areas: Plan for and encourage new development in areas that are less vulnerable to future floods.
4. The Whole Watershed: Implement enhanced stormwater management techniques to slow, spread, and infiltrate floodwater.

The Northeast Kingdom Regional Plan listed six strategies[11] (listed below) in the Flood Resilience chapter that the Planning Team considered when developing their list of mitigation actions.

1. Coordinate with the County Conservation Districts in hosting flood mitigation workshops for residential landowners and business owners, to educate them on measures to reduce flood risk and damage.
2. Encourage Towns to include restriction of development within River Corridors, as mapped by the

7 Lyndon Town Plan. (2014). Town of Lyndon. P.76.
8 Ibid.
9 Environemental Protection Act, Planning for Flood Recovery and Long-Term Resilience in Vermont, July 2014, p.3.
10 Environmental Protection Act, Planning for Flood Recovery and Long-Term Resilience in Vermont, July 2014 p.9.
11 Flood Resilience. Northeast Kingdom Regional Plan. Retrieved August 3, 2015 from http://www.nvda.net/files/Flood%20Resilience.pdf.

Vermont Agency of Natural Resources.

3. Encourage Towns to amend zoning and subdivision regulations to include limits on clearing and impervious coverage, and that avoids impacts to wetlands and steep slopes (slopes greater than 20%).
4. Encourage Towns to incorporate Planned Unit Development provisions in their bylaws as a means to minimize impervious coverage and clearing.
5. Encourage towns to engage in a working partnership with adjacent communities to address control of stormwater runoff and actions that will allow rivers and streams to regain access to floodplains.
6. Assist Towns in seeking funding to implement hazard mitigation projects identified in plans.

The Lyndon Town Plan lists a number of possible hazard mitigation actions. They were each considered and many incorporated into this plan. In the Working Landscape section of the Lyndon Town Plan thirteen strategies[12] are included, five of those (listed below) are especially relevant to this mitigation plan.

1. To aid planning efforts, Lyndon should encourage FEMA to update existing flood plain maps.
2. Maintain appropriate culvert sizes.
3. Encourage water quality and watershed health through the implementation of wooded vegetative buffers along rivers, brooks and streams.
4. Review conclusions of the 2006 Flood Mitigation Study to determine which, if any, suggestions are feasible and cost effective for near term implementation.
5. Explore and encourage a working partnership with upstream towns that addresses flood mitigation efforts.

The Flood Resilience section of the Lyndon Town Plan also includes a list of relevant mitigation actions (shown below),[13] many of which were carried forward into this mitigation plan. Consistency of mitigation actions between plans within a local jurisdiction makes sense and increases the likelihood of implementation.

1. Increase awareness of the most effective means of reducing future flood damage, as identified in past engineering studies and Stream Geomorphic Assessments, by holding local public outreach meetings.
    - 1.1. Coordinate with the Caledonia County Conservation District in hosting flood mitigation workshops for residential landowners and business owners, to educate them on measures to reduce flood risk and damage.
2. Protect areas identified and designated as flood plains, river corridors and land adjacent to streams:
    - 2.1. Amend the Town's Flood Hazard Regulations to include restriction of development within River Corridors, as mapped by the Vermont Agency of Natural Resources.
    - 2.2. Amend the Town's zoning and subdivision regulations to include standards that minimize the amount of clearing and impervious coverage created from development, and that avoids impacts to wetlands and steep slopes (slopes greater than 20%).
    - 2.3. Engage in a working partnership with upstream towns that addresses control of stormwater runoff and actions that will allow rivers and streams to regain access to floodplains.
    - 2.4. Encourage property owners seeking to develop their land to utilize the existing Planned Unit Development provisions in the Town's bylaws as a means to minimize impervious coverage and clearing.

12 Lyndon Town Plan. (2014). Town of Lyndon. P.33.
13 Lyndon Town Plan. (2014). Town of Lyndon. P.82-83.

3. Mitigate risks to public safety, critical infrastructure, historic structures, and municipal investments.
   3.1. Evaluate the recommendations contained in the 2006 Gomez and Sullivan Flood Mitigation Study, the 2012 Milone & MacBroom analysis, and the recommendations and site-specific projects listed in the River Corridor Plans to formulate a plan of action.
   3.2. Update the Local Hazard Mitigation Plan.
   3.3. Educate residents on high-risk areas in Town so that they can be prepared in a flood event.
   3.4. Seek funding to implement hazard mitigation projects identified in plans, including the items of special concern noted above.

Mitigation Actions Added in 2015

Based on the hazard risk assessment, the capability assessment, and the identified problem areas, the Planning Team, with the help of the Hazard Mitigation Committee, developed a list of mitigation actions. The Planning Team took into account the mitigation actions in the 2010 draft mitigation plan as well as FEMA's mitigation action categories. The mitigation actions in the following table are listed under the heading of one of the five mitigation plan goals. They are not listed within that goal in a particular order. Each mitigation action includes a description as well as justification statements.

Table 6 2015 Mitigation Actions

Mitigation Action	Description	Justification/Notes
Goal 1 Save Lives and Property: Reduce or eliminate risk to people and property from natural and man-made hazards.		
Rte. 114/5/122 Junction	Intersection study to determine causes of flooding and cost effective mitigation measures. Look specifically at the stormwater drain at the intersection as well as elevating the roadway.	This is the first area of town to become flooded during any rain event and is an important transportation route, particularly for emergency vehicles. A study needs to be done to determine what actions to take to keep the road open, and whether elevating the transportation corridor is a viable option.
Rte. 5 Dry Relief Culverts	Replace the culvert with a dry bridge.	Debris jamming potential is high. Preliminary studies show more than 1-foot water elevation increase when it is not functioning. A dry bridge would increase relief conveyance and limit plugging of the culvert. Water comes into a pipe at a 90-degree angle and does not work properly.
Maintain data on cost to town related to flooding in repetitive loss areas.	Document costs incurred by Town and Village departments impacted by flooding and flood remediation.	Documenting costs the Town incurs due to flooding will assist with future benefit-cost analysis justification.

Mitigation Action	Description	Justification/Notes
Mobile Home Park Community Preparedness and Response Plan	Develop and document strategies for increasing the resilience of the Mobile Home Parks in Lyndon. This mitigation action addresses multiple hazards that impact the Town and Village.	Mobile home parks provide an important source of affordable housing, and are home to many seniors. A Preparedness and Response Plan would develop strategies for increasing the resilience of all four mobile home park communities, particularly Riverview Estates where a majority of the lots are located in a flood hazard area. This project will engage a variety of stakeholders, including park residents and park owners.
Riverview Estates Mobile Home Park Elevation	Raise the lots of each structurally sound mobile home within two-years.	This Mobile Home Park is in a high-risk area and includes a vulnerable population of elderly and low-income residents. The owner knows he can't expand the property and has not expressed interest in a buyout.
Centre Covered Bridge	Retrofit the bridge span to ease the "pinching" of the river at this location.	The span of bridge is inadequate and results in pinching of the river. The East and West Branches of the Passumpsic River come together here and create the Main Branch. This bridge is privately owned and not actively used. The Chamber of Commerce is investigating using it as a walking path. A previous study found the cost of retrofit to be prohibitive.
Burrington Bridge (AKA Randall Bridge)	Examine bridge structures. Examining this bridge relates to multiple hazards that impact the Town and Village such as winter storms, flooding, and hazards that may close roads.	The abutments of both the historic covered bridge and the adjacent modern bridge structures are channel constrictions on the East Branch Passumpsic. Motorized vehicles no longer use the historic covered bridge, except snowmobiles. Restore or retrofit both bridges.
Railroad Flooding Around Broad Street	Coordinate with VTrans about causes and remediation measures of flooding on either side of the railroad tracks.	Discussion and coordination is needed to examine drainage and conveyance along the railroad embankment. The tracks separate the open floodplain from the businesses in the floodplain and may serve as a berm. They have been washed out in past events.
Elevate transportation corridors at problem locations	Conduct an engineering study of flooding along transportation corridors.	Miller's Run Bridge, Junction of Rte. 114/5/122; Rte. 5 near Village Sports Shop; Center St bridge area typically underwater during nuisance floods. Develop options to improve the area.

Mitigation Action	Description	Justification/Notes
Reconnect the river to existing floodplains upstream from the village by securing easements on private land.	Pursue acquiring river corridor easements to allow the river to reconnect with its natural floodplain, using the locations identified in the River Corridor studies as a guide. In some cases, berms need to be removed to restore connectivity to floodplain.	Floodwater storage needed upstream to reduce volume of floodwater conveyed to Lyndonville. Upstream tributaries are not currently accessing their floodplain due to channel incision. Flooding needs to be accommodated in a safe way. (See the Appendix for list of project locations)
Implement Recommendations from the Bridge and Culvert Assessments	Implement the retrofit or replacement of undersized structures.	Undersized structures create problems during flood events. (see appendix for list of project locations)
Regulate future development along river corridors to prevent erosion and property loss and Implement Recommendations from the River Corridor Studies	Review studies and implement recommendations related to erosion prevention and property loss along river corridors.	The State will maintain and refine river corridor mapping. The Town must review these studies and implement recommendations.
Buyout repetitive loss structures	Identify list of structures that may be appropriate for buyout and conversion to active floodplain.	Repetitive loss structures should be bought and the land zoned as green space.
Vail Dam	Review past engineering study to determine if removal of Vail Dam would decrease flooding upstream. If necessary conduct an updated study.	The river naturally pinches and dams at this location. Removal of the dam may decrease pinch but an engineering study that includes a cost/benefit analysis is necessary.
Install Stream Buffers	Implement recommendations for planting and preservation of stream buffers, as outlined in River Corridor Plans	Potential project identified in River Corridor Plans on East Branch, West branch and Miller's Run. Landowner participation to be determined.
Equipment Protection	Pre-position DPW equipment away from high hazard flood areas.	Equipment should be moved prior to a flooding event to make sure it remains accessible. The Fire and Police Departments do this with their equipment.
Connect Broad Street residences across Route 5 to stormwater system	Connect stormwater runoff from residences across Rte. 5 to stormwater system.	Three streets in Hadleyville: Passumpsic, Pleasant and Boston, have stormwater runoff that does not connect to the stormwater system. It needs to be connected across Route 5 to the rest of the system.

Mitigation Action	Description	Justification/Notes
Implement repairs and continue to track status of stormwater system.	Continue to chart and repair the stormwater system.	The Department of Public Works Supervisor inspects the status of the stormwater system. His list of repairs must be implemented.
Goal 2 Community Planning: Integrate hazard mitigation policies and practices into local planning.		
Build to the snow load standard.	Lyndon Zoning Administrator will coordinate with the State Fire Marshall's Office to evaluate the integrity of all new structures.	All critical facilities and public buildings (those not owner occupied or single family) must abide by the 2012 International Building Code and the NFPA 1 & 101 Life Safety and Fire Safety codes.
Stormwater Master Planning	Develop a Stormwater Master Plan.	Sections of stormwater system antiquated, under capacity, and in need of upgrades. Overflows occur on streets.
Create a Capital Budget	Create a capital budget for funding maintenance and capital improvements. A capital improvement budget would allow the Town and Village to mitigate risks to multiple hazards by protecting infrastructure and facilities the communities depend upon for resilience.	The Town of Lyndon does not currently set-aside funding for capital repairs making it difficult to fund repairs or other capital projects.
Community Rating System Participation	Participate in the NFIP CRS if a regional body shares the responsibility of participation requirements.	Participation in the Community Rating System would decrease annual insurance rates and promote hazard mitigation.
Flooding ordinances and hazard zoning	Implement stormwater management, erosion prevention, and sediment control ordinances. Implement fluvial erosion hazard zoning. Amend the Town's Flood Hazard Regulations to include restriction of development within River Corridors, and minimize impacts to wetlands and steep slopes.	The Town's Flood Hazard Regulations are inadequate in terms of development along river corridors and impacts to wetlands and steep slopes. The ordinances need to be amended.

Mitigation Action	Description	Justification/Notes
Planned Unit Development Provisions	Encourage property owners seeking to develop their land to utilize the existing Planned Unit Development provisions in the Town's bylaws as a means to minimize impervious coverage and clearing.	The Town's bylaws cover ways to minimize impervious coverage and clearing but the Town does not specifically enforce these provisions. The mitigation action includes developing and implementing a plan to encourage property owners to abide by the provisions.
Goal 3 Regional Collaboration: Build capacity for hazard mitigation through regional collaboration.		
VTrans District 7 Transportation Advisory Meetings	Participate in VTrans Advisory Meetings.	Many of the mitigation actions identified by the Town and Village require collaboration with VTrans. With this in mind, an additional mitigation measure was added to increase coordination with VTrans.
Watershed Collaboration for Stormwater Management	Collaborate with upstream towns to address control of stormwater runoff and actions that will allow rivers and streams to regain access to floodplains.	The actions of communities up and down-river from Lyndon and Lyndonville impact their flooding. Limiting flooding requires collaboration between all communities in the watershed.
Goal 4 Public Awareness: Increase public awareness of hazards by implementing outreach and education programs.		
Education for Business Owners and Homeowners.	Implement workshops to educate business owners and homeowners on how they can mitigate risk to all of the natural hazards identified in this plan.	Both business owners and homeowners should be educated on steps they can take to protect their property from a host of natural hazards. In addition, businesses can learn what steps to take to enable their business operations to continue in the event of disasters. Coordinate with the Vermont Small Business Development Center.
Floodproofing Education of Businesses on Broad Street	Implement workshops for business owners and homeowners.	This is the main commercial corridor in the region. Floodproofing is essential to the businesses that have not elevated their platforms. The Town is aware that flooding can never be entirely prevented. For this reason it is important to educate business owners and residents of steps they can take to protect their property. Workshops in the past have been useful and several businesses, including the Bagel Depot, have made improvements. Coordinate with Caledonia County Natural Resources Conservation District.

Mitigation Action	Description	Justification/Notes
Goal 5 Preservation: Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.		
Plan for Lyndon Town Garage Site	Remove structures at this site, as it contains hazardous materials that could get into the river, and protect the area as green space.	The site of the Lyndon Town Garage frequently floods. The Town is interested in demolishing the buildings on the site and protecting the area from future building. This area could be used as a designated flood area to store floodwaters. The East Branch of the Passumpsic River contributes the most to flooding in the region. Potential issues include that the former garage building is elevated and it is the former location of hazardous materials including creosote on the barns. As a "green space" the site may become an access point for local recreation accessible from this location.
FEMA Flood Maps	Encourage FEMA to update and digitize floodplain maps.	Digitized FEMA flood maps would make working within the watershed easier. Working with paper maps and different versions of digital maps leads to inconsistencies.
Watershed Health and Water Quality	Encourage water quality and watershed health through the implementation of wooded vegetative buffers along rivers and streams.	A healthy watershed decreases the amount of flooding and property loss in the watershed.

Mitigation actions are more specific than mitigation goals. Mitigation actions also identify an activity or process that is intended to reduce or eliminate risk to natural hazards. They can be categorized into the following four categories:

1. Local Plans and Regulations,
2. Structure and Infrastructure Projects,
3. Natural Systems Protection and
4. Education and Awareness Programs.

The following table, taken from the Local Mitigation Planning Handbook, clearly defines each of these mitigation types and provides examples.[14]

14 FEMA Local Mitigation Planning Handbook. (2013). Federal Emergency Management Agency. P.6-4.

Table 7 Mitigation Action Types[15]

Mitigation Action Categories	Description of Category	Examples of Mitigation Actions
1. Local Plans and Regulations	These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.	• Comprehensive plans • Land use ordinances • Building codes and enforcement • Capital improvement programs • Open space preservation • Stormwater management regulations and master plans
2. Structure and Infrastructure Projects	These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.	• Acquisitions and elevations of structures in flood prone areas • Utility undergrounding • Structural retrofits. • Floodwalls and retaining walls • Detention and retention structures • Culverts • Safe rooms
3. Natural Systems Protection	These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.	• Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements
4. Education and Awareness Programs	These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. A greater understanding and awareness of hazards and risk among local officials, stakeholders, and the public is more likely to lead to direct actions.	• Radio or television spots • Websites with maps and information • Real estate disclosure • Mailings to residents in hazard-prone areas. • StormReady • Firewise Communities

The following table further defines each mitigation action. The mitigation actions are listed under their appropriate goal statement. Each mitigation action includes details regarding which FEMA mitigation action category is represented, which hazards are mitigated, which the responsible partners are, potential funding sources, timeframe, and an estimated cost. Cost was determined based on a range of low, medium and high. Low cost is under $25,000, medium cost represents $25,000 - $100,000 and high cost is over $100,000. Gathering all of this data was a necessary step toward identifying all of the mitigation actions and preparing to rank them according to priority. It should be noted that the costs are estimates and the dollar amounts are not meant to represent specific funding requirements. "One of the challenges of conventional, structural engineered approaches to flood resilience is their cost. Armoring riverbanks and rebuilding and elevating structures can be very expensive. Engineered approaches can also cause future unintended flood damage upstream and down. Riprap tends to increase the speed of water flow and can cause erosion downstream in some areas while contributing to siltation in other areas."[16] The Planning Team considered the cost and benefit of each mitigation action when developing the final list of actions. For those interested Appendix H includes mitigation action tables sorted with different criteria, for instance by FEMA's mitigation action category, by hazards mitigated, by estimated cost and by timeframe. Table 9 shows how the Planning Team assessed benefit or value of each

15 Ibid.

16 Planning for Flood Recovery and Long-Term Resilience in Vermont. (2014). Environmental Protection Act. P.20.

mitigation action and the resulting score each action received. Table 10 shows how the cost and benefit of each mitigation action were then prioritized.

Table 8 2015 Mitigation Actions Detailed

Mitigation Action	FEMA's Mitigation Action	Hazards Mitigated	Responsible Organization(s)	Funding Source(s)	Implementation Timeframe	Estimated Cost
Goal 1 Save Lives and Property: Reduce or eliminate risk to people and property from natural and man-made hazards.						
Rte. 114/5/122 Junction	Structure and Infrastructure Projects	Flood Hazards	Lyndon DPW, VTrans, CCNRCD, VT RMP	VTrans, FEMA	Spring 2016 - Winter 2021	Medium
Rte. 5 Dry Relief Culverts	Structure and Infrastructure Projects	Flood Hazards	Lyndon DPW, VTrans, CCNRCD, VT RMP	FEMA, Ecosystem Restoration Program	Spring 2016 - Winter 2021	High
Maintain data on cost to town related to flooding in repetitive loss areas.	Local Plans and Regulations	Flood Hazards	Lyndon Selectboard, Lyndon Municipal Administrator	Town of Lyndon	Ongoing activity as disasters occur throughout 2016-2021 period.	Low
Mobile Home Park Community Preparedness and Response Plan	Education and Awareness Programs	All Hazards	Mobile Home Park Owner, LEPC District 9, Vermont Mobile Home Park Research Collaborative (CVOEO & UVM)	CVOEO [17]	Winter 2016 - Winter 2017	Low
Riverview Estates Mobile Home Park Elevation	Structure and Infrastructure Projects	Flood Hazards	Park Owner	Park Owner	Winter 2016 - Winter 2017	High
Centre Covered Bridge	Structure and Infrastructure Projects	All Hazards	Chamber of Commerce, Property Owner, DEC RMP	USDA Rural Development Community Facilities Grant,[18] FEMA,[19] PTV (Preservation Trust of Vermont)	Spring 2016 - Winter 2021	High

17 Champlain Valley Office of Economic Opportunity (CVOEO)
18 Passumpsic Valley Land Trust (PVLT)
19 Vermont Land Trust (VLT)

Mitigation Action	FEMA's Mitigation Action	Hazards Mitigated	Responsible Organization(s)	Funding Source(s)	Implementation Timeline	Estimated Cost
Burrington Bridge (AKA Randall Bridge)	Structure and Infrastructure Projects	All Hazards	Chamber of Commerce, DEC RMP	USDA Rural Development Community Facilities Grant, FEMA, PTV (Preservation Trust of Vermont)	Spring 2016 - Winter 2021	High
Plan for Lyndon Town Garage Site	Natural Systems Protection	Flood Hazards	Lyndon Selectboard, PVLT, Kingdom Trails	FEMA, PVLT, VLT	Spring 2016 - Fall 2018	High
Railroad Flooding Around Broad Street	Structure and Infrastructure Projects	Flood Hazards	Lyndon Selectboard, VTrans	Lyndon Selectboard, VTrans	Spring 2016 - Winter 2021	Medium
Elevate transportation corridors at problem locations.	Structure and Infrastructure Projects	Flood Hazards	Lyndon Selectboard, VTrans	VTrans, FEMA	Spring 2016 - Winter 2021	Medium
Reconnect the river to existing floodplains upstream from the village by securing easements on private land.	Natural Systems Protection	Flood Hazards	CCNRCD, DEC	ERP,[20] Easements or fee purchases by PVLT, VRC,[21] VLT, State/ Federal Partner Programs	Spring 2016 - Fall 2018	Low
Implement recommendations from the Bridge and Culvert Assessments	Structure and Infrastructure Projects	Flood Hazards	Lyndon Selectboard, CCNRCD, NVDA, VTrans	Upper Connecticut Mitigation and Enhancement Fund – Current Funding for culvert assessment, V-Trans, FEMA	Ongoing throughout the span of the plan from Winter 2016 - Winter 2021.	Low

Mitigation Action	FEMA's Mitigation Action	Hazards Mitigated	Responsible Organization(s)	Funding Source(s)	Implemen-tation Timeline	Estimated Cost
Regulate future development along river corridors to prevent erosion and property loss and implement recommendations from the River Corridor Studies	Natural Systems Protection	Flood Hazards	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Winter 2016 - Winter 2021	Low
Buyout repetitive loss structures	Structure and Infrastructure Projects	Flood Hazards	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	Spring 2016 - Spring 2019	High
Vail Dam	Structure and Infrastructure Projects	Flood Hazards	Lyndon Trustees, Lyndon Selectboard, LED	ERP	Spring 2016 - Winter 2021	Low
Install Stream Buffers	Natural Systems Protection	Flood Hazards	CCNRCD, PVLT, DEC RMP	ERP	Spring 2016 - Spring 2020	Low
Equipment Protection	Structure and Infrastructure Projects	Flood Hazards, Wind Hazards, Winter Hazards	Lyndon DPW, Lyndonville DPW,	Lyndon DPW, Lyndonville DPW	Ongoing throughout the span of the plan from Winter 2016 - Winter 2021	Low
Connect Broad Street residences across Route 5 to stormwater system.	Structure and Infrastructure Projects	Flood Hazards	Lyndon DPW, VTrans	VTrans	Spring 2016 - Winter 2021	High
Implement repairs and continue to track status of stormwater system.	Structure and Infrastructure Projects	Flood Hazards	Lyndon DPW	Town of Lyndon	Ongoing throughout the span of the plan from Winter 2016 - Winter 2021	Low

Mitigation Action	FEMA's Mitigation Action	Hazards Mitigated	Responsible Organization(s)	Funding Source(s)	Implementation Timeline	Estimated Cost
Protect and Retrofit Covered Bridges	Structure and Infrastructure Projects	Flood Hazards, Wind Hazards, Winter Hazards	Town of Lyndon and VTrans	Preservation Trust of Vermont, Vermont Division of Historic Preservation	Spring 2016 - Winter 2021	High
Goal 2 Community Planning: Integrate hazard mitigation policies and practices into local planning.						
Build to the snow load standard.	Structure and Infrastructure Projects	Winter Hazards	Lyndon Zoning Administrator and Lyndon Planning Director, State Fire Marshall's Office	Town of Lyndon, VT Dept. of Public Safety	Ongoing throughout the span of the plan from Winter 2016 - Winter 2021	Low
Stormwater Master Planning	Local Plans and Regulations	Flood Hazards	Lyndon Public Works Director, CCNRCD	ERP	Spring 2016 - Fall 2018	Medium
Create a Capital Budget	Local Plans and Regulations	All Hazards	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Spring 2016 the budget will be created. It will be maintained through the life of the Plan.	Low
Community Rating System Participation	Education and Awareness Programs	Flood Hazards	Lyndon Zoning Administrator and Lyndon Planning Director, NVDA	Town of Lyndon	Begin participation in the CRS as soon as possible, hopefully Winter 2016 and maintain participation through the life of the Plan.	Low

Mitigation Action	FEMA's Mitigation Action	Hazards Mitigated	Responsible Organization(s)	Funding Source(s)	Implementation Timeline	Estimated Cost
Flooding ordinances and hazard zoning.	Local Plans and Regulations	Flood Hazards	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Winter 2016 the flooding ordinances and hazard zoning will be created. They will be maintained through the life of the Plan.	Low
Planned Unit Development Provisions	Local Plans and Regulations	All Hazards	DRB	Town of Lyndon	Winter 2016 - Spring 2017	Low
Goal 3 Regional Collaboration: Build capacity for hazard mitigation through regional collaboration.						
VTrans District 7 Transportation Advisory Meetings	Local Plans and Regulations	Flood Hazards	Lyndon Selectboard, TAC	Town of Lyndon	Winter 2016 - Winter 2021	Low
Watershed Collaboration for Stormwater Management	Local Plans and Regulations	Flood Hazards	Lyndon Planning Commission, State Floodplain Manager, NVDA	Town of Lyndon	Winter 2016 - Winter 2021	Low
Goal 4 Public Awareness: Increase public awareness of hazards by implementing outreach and education programs.						
Education for Business Owners and Homeowners.	Education and Awareness Programs	Flood Hazards	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, VTSBDC, ERP, FEMA	Spring 2016 - Spring 2021	Low
Floodproofing Education of Businesses on Broad Street	Education and Awareness Programs	All Hazards	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, VTSBDC, ERP, FEMA	Spring 2016 - Spring 2021	Low
Goal 5 Preservation: Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.						

Mitigation Action	FEMA's Mitigation Action	Hazards Mitigated	Responsible Organization(s)	Funding Source(s)	Implementation Timeline	Estimated Cost
FEMA Flood Maps	Local Plans and Regulations	Flood Hazards	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	Spring 2015 - Winter 2021	Low
Watershed Health and Water Quality	Natural Systems Protection	Flood Hazards	Lyndon Selectboard, CCRD, Valley Land Trust	Town of Lyndon	Spring 2016 - Fall 2018	Low

Evaluating and Prioritizing Mitigation Actions

Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? 44 CFR 201.6(c)(3)(iii) and 44 CFR (c)(3)(iv)

The Planning Team began using FEMA's Mitigation Action Evaluation Worksheet[22] to evaluate and prioritize the identified 2015 Mitigation Actions. After several meetings they revised evaluation criteria to better meet their needs.

Each of the mitigation actions was awarded a -1, 0 or 1 using the following scale:

1 = Highly effective or feasible
0 = Neutral
-1 = Ineffective or not feasible

The evaluation criteria categories are defined below

Life Safety	How effective with the mitigation action be at protecting lives and preventing injuries?
Property Protection	How significant will the action be at eliminating or reducing damage to structures and infrastructure?
Environmental Impact	Will the mitigation action positively protect the environment from natural hazards? Will the mitigation action comply with environmental regulations?
Grant Funding Needed	Does the community need grant funding support to implement the mitigation action?

20 Vermont Watershed Management Division, Ecosystem Restoration Program (ERP)
21 Vermont River Conservancy (VRC)
22 FEMA Local Mitigation Planning Handbook. (2013). Federal Emergency Management Agency. P. A-31.

Local Champion	Is there a strong local advocate to support the implementation of the mitigation action?
Other Community Objectives	Does the mitigation action advance and or support community objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of the Town Plan?

Table 9 was used to assign a value to each of the mitigation actions and then rank them in order of high, medium, or low priority. The mitigation actions are sorted based on their total score ranging from 6 to 1. These value characteristics directly relate to the overall benefit of each mitigation action.

Table 9 2015 Mitigation Actions Ranked

Mitigation Actions	Life Safety	Property Protection	Environmental Impact	Grant Funding Needed	Local Champion	Other Community Objectives	**Total Score**
Stormwater Master Planning	1	1	1	1	1	1	**6**
Rte. 114/5/122 Junction	1	1	1	1	1	1	**6**
Rte. 5 Dry Relief Culverts	1	1	1	1	1	1	**6**
Equipment Protection	1	1	0	1	1	1	**5**
Education for Business Owners and Homeowners.	1	1	0	1	1	1	**5**
Floodproofing Education of Businesses on Broad Street	1	1	0	1	1	1	**5**
Riverview Estates Mobile Home Park Elevation	1	1	0	1	1	1	**5**
Implement Recommendations from the Bridge and Culvert Assessments	1	1	1	0	1	1	**5**
Buyout repetitive loss structures	1	1	0	1	1	1	**5**
Flooding ordinances and hazard zoning.	1	1	1	0	1	1	**5**
Reconnect the river to existing floodplains upstream from the village by securing easements on private land.	1	1	1	0	1	1	**5**
Protect and Retrofit Covered Bridges	1	1	0	1	1	1	**5**
Mobile Home Park Community Preparedness and Response Plan	1	1	0	1	1	1	**5**
Implement repairs and continue to track status of stormwater system.	0	1	1	0	1	1	**4**
Continue to build to the snow load standard.	1	1	0	0	1	1	**4**
Planned Unit Development Provisions	0	1	1	0	1	1	**4**
VTrans District 7 Transportation Advisory Meetings	0	1	0	1	1	1	**4**
Centre Covered Bridge	1	1	0	0	1	1	**4**
Plan for Lyndon Town Garage Site	0	1	1	0	1	1	**4**
Railroad Flooding Around Broad Street	0	1	1	0	1	1	**4**
Elevate transportation corridors at problem locations	1	1	0	0	1	1	**4**
Install Stream Buffers	0	1	1	0	1	1	**4**

Mitigation Actions	Life Safety	Property Protection	Environmental Impact	Grant Funding Needed	Local Champion	Other Community Objectives	Total Score
Burrington Bridge (AKA Randall Bridge)	1	1	0	0	1	1	**4**
Regulate future development along river corridors to prevent erosion and property loss and implement recommendations from the River Corridor Studies	0	1	0	0	1	1	**3**
Watershed Collaboration for Stormwater Management	0	0	0	1	1	1	**3**
Connect Broad Street residences across Route 5 to stormwater system.	0	1	1	0	1	0	**3**
Create a Capital Budget	0	1	0	0	1	1	**3**
FEMA Flood Maps	0	1	0	0	1	1	**3**
Maintain data on cost to town related to flooding in repetitive loss areas.	0	0	0	0	1	1	**2**
Vail Dam	0	1	0	0	0	1	**2**
Watershed Health and Water Quality	-1	1	1	0	0	1	**2**
Community Rating System Participation	0	0	0	0	1	0	**1**

The next step for the Planning Team was to rank the mitigation actions in order of priority based on their evaluation scores. The mitigation actions with the highest ranking indicate the actions with the most potential benefit to the jurisdictions. This proved to be a difficult task and the Planning Team decided to group the mitigation actions in three categories, high priority, medium priority, and low priority. The Planning Team and the Hazard Mitigation Committee are acutely aware that mitigation actions get implemented based on funding and that funding rarely arrives in order of priorities.

Table 10 2015 Mitigation Actions in Priority Order

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
HIGH PRIORITY MITIGATION ACTIONS					
Stormwater Master Planning	Lyndon Public Works Director, CCNRCD	ERP	Medium	2016-2018	6
Rte. 114/5/122 Junction	Lyndon DPW, VTrans, CCNRCD, VT RMP	VTrans, FEMA	Medium	2016-2021	6
Rte. 5 Dry Relief Culverts	Lyndon DPW, VTrans, CCNRCD, VT RMP	FEMA, Ecosystem Restoration Program	High	2016-2021	6

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
Equipment Protection	Lyndon DPW, Lyndonville DPW,	Lyndon DPW, Lyndonville DPW	Low	2016-2017	5
Education for Business Owners and Homeowners.	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	Low	2016-2017	5
Floodproofing Education of Businesses on Broad Street	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	Low	2016-2017	5
Riverview Estates Mobile Home Park Elevation	Park Owner	Park Owner	High	2016-2017	5
Implement Recommendations from the Bridge and Culvert Assessments	Lyndon Selectboard, CCNRCD, NVDA, VTrans	Upper Connecticut Mitigation and Enhancement Fund – Current Funding for culvert assessment, V-Trans, FEMA	Low	2016-2017	5
Buyout repetitive loss structures	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	High	2016-2019	5
Flooding ordinances and hazard zoning.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low	2016-2017	5
Reconnect the river to existing floodplains upstream from the village by securing easements on private land.	CCNRCD, DEC	ERP, Easements or fee purchases by PVLT, VRC, VLT, State/Federal Partner Programs	Low	2016-2018	5

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
Protect and Retrofit Covered Bridges	Town of Lyndon and VTrans	Preservation Trust of Vermont, Vermont Division of Historic Preservation	High	2016-2021	5
Mobile Home Park Community Preparedness and Response Plan	Mobile Home Park Owner, LEPC District 9, Vermont Mobile Home Park Research Collaborative (CVOEO & UVM)	CVOEO	Low	2016-2017	5
MEDIUM PRIORITY MITIGATION ACTIONS					
Implement repairs and continue to track status of stormwater system.	Lyndon DPW	Town of Lyndon	Low	2016-2017	4
Build to the snow load standard.	Lyndon Zoning Administrator and Lyndon Planning Director, State Fire Marshall's Office	Town of Lyndon	Low	2016-2017	4
Planned Unit Development Provisions	DRB	Town of Lyndon	Low	2016-2017	4
VTrans District 7 Transportation Advisory Meetings	Lyndon Selectboard, TAC	Town of Lyndon	Low	2016-2017	4
Centre Covered Bridge	Chamber of Commerce, Property Owner, DEC RMP	VTrans	High	2016-2021	4
Plan for Lyndon Town Garage Site	Lyndon Selectboard, PVLT	FEMA, PVLT, VLT	High	2016-2018	4
Railroad Flooding Around Broad Street	Lyndon Selectboard, VTrans	Lyndon Selectboard, VTrans	Medium	2016-2021	4
Elevate transportation corridors at problem locations	Lyndon Selectboard, VTrans	VTrans, FEMA	Medium	2016-2021	4
Install Stream Buffers	CCNRCD, PVLT, DEC RMP	CCNRCD	Low	2016-2020	4

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
Burrington Bridge (AKA Randall Bridge)	Chamber of Commerce, DEC RMP	VTrans	High	2016-2021	4
Regulate future development along river corridors to prevent erosion and property loss and implement recommendations from the River Corridor Studies	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low	2016-2017	3
Watershed Collaboration for Stormwater Management	Lyndon Planning Commission, State Floodplain Manager, NVDA	Town of Lyndon	Low	2016-2017	3
Connect Broad Street residences across Route 5 to stormwater system.	Lyndon DPW, VTrans	VTrans	High	2016-2021	3
Create a Capital Budget	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low	2016-2017	3
FEMA Flood Maps	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	Low	2016-2017	3
LOW PRIORITY MITIGATION ACTIONS					
Maintain data on cost to town related to flooding in repetitive loss areas.	Lyndon Selectboard, Lyndon Municipal Administrator	Town of Lyndon	Low	2016-2017	2
Vail Dam	Lyndon Trustees, Lyndon Selectboard, LED	ERP	Low	2016-2021	2
Watershed Health and Water Quality	Lyndon Selectboard, CCRD, Valley Land Trust	Town of Lyndon	Low	2016-2018	2
Community Rating System Participation	Lyndon Zoning Administrator and Lyndon Planning Director, NVDA	Town of Lyndon	Low	2016-2017	1

Changing Priorities

Was the plan revised to reflect changes in priorities? 44 CFR 201.6(d)(3)

The plan was revised from the 2010 draft plan. The priorities have not changed. The list of hazards studied in the plan has increased but the highest risk hazards are consistent with previous studies. Most mitigation actions were developed in response to the flood risk.

FEMA Grant Funding Sources

The Federal Emergency Management Agency (FEMA) makes grant funding for mitigation available via several programs. Local jurisdictions such as Town of Lyndon and Village of Lyndonville are eligible to apply for funding through the Commonwealth of Massachusetts as subgrantees. Assistance with application development and project eligibility criteria are available online and through the State. The brief descriptions below provide an overview of the many grant opportunities available through FEMA.

Hazard Mitigation Assistance (HMA)
FEMA's Hazard Mitigation Assistance (HMA) grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs: Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA).

Hazard Mitigation Grant Program (HMGP)
The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Pre-Disaster Mitigation (PDM) Grant Program
The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event.

Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.

Flood Mitigation Assistance (FMA) Program
The Flood Mitigation Assistance (FMA) program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP).

FEMA provides FMA funds to assist States and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the NFIP.

Federal Funding Sources[23]

The table below is a summary of federal funding sources that primarily support hazard mitigation projects and planning in the State of Vermont. Many of the identified funding sources below have been available to Vermont in the 2010-2013 timeframe as a result of Tropical Storm Irene. FEMA's Community Rating System, HMGP, Individual and Household Program, National Flood Insurance Program, and Public Assistance funding programs assisted Vermont citizens in recovering from the disaster. These funds were utilized to replace and repair damaged homes and provide financial assistance to families and individuals for basic needs. The U.S. Department of Housing and Urban Development provided CDBG Disaster Recovery funds for long-term housing and economic recovery following the storm. Additionally, the Small Business Administration provided direct loans to home and business owners needing additional funding to repair or rebuild uninsured disaster damage. The U.S. Economic Development Association provided three grants for a total of $515,000 to assist in the economic recovery following Tropical Storm Irene. All funding sources provided are essential to Vermont remaining as resilient as possible.

Table 11 Federal Funding Sources

Funding Agency	Program	Type of Assistance	Availability	Managing Agency
FEMA	Community Assistance Program	Pre-disaster funding for States to provide technical assistance to communities in the NFIP and to evaluate community performance in implementing NFIP floodplain management activities	Pre-disaster	DEMHS
FEMA	Community Rating System	Flood insurance discounts	Pre- and post-disaster	ANR
FEMA	Disaster Preparedness Improvement Grants	Pre-disaster cost share grants for plan improvement and updates, as well as for implementing identified mitigation projects	Annual, pre-disaster	DEMHS
FEMA	FMA Program	Pre-disaster cost share grants for projects and planning	Annual, pre-disaster	DEMHS
FEMA	HMGP	Post-disaster cost share grants	Post-disaster only	DEMHS
FEMA	Individual and Household Program	Post-disaster grants	Post-disaster	DEMHS
FEMA	National Flood Insurance Program	Pre-disaster flood insurance	Pre- and post-disaster	ANR

23 State of Vermont Hazard Mitigation Plan. (2013). State of Vermont Mitigation Strategy. P. 5-47-5-48.

Funding Agency	Program	Type of Assistance	Availability	Managing Agency
FEMA	PDM Program	Grants provided on competitive basis to state and local jurisdictions for projects and planning	Annual, pre-disaster	DEMHS
FEMA	Public Assistance	Post-disaster aid to state and local jurisdictions	Post-disaster	DEMHS
U.S. Department of Agriculture, National Resources Conservation Services	Emergency Watershed Protection Program	Provides financial and technical assistance to remove debris from stream channels, road culverts, and bridges; reshape and protect eroded banks; correct damaged drainage facilities; establish cover on critically eroding lands; repair levees and structures; and repair conservation practices	Post-Disaster	ANR
U.S. Department of Housing and Urban Development	CDBG Disaster Recovery	Post-disaster aid to state and local jurisdictions for long-term housing and economic and community recovery	Post-disaster	ACCD
Small Business Administration	Disaster Assistance Programs	Direct loans to businesses to repair or replace uninsured disaster damage	Post-disaster	DEMHS
U.S. Army Corps of Engineers	Various programs, including the Silver Jackets Initiative	Large-scale infrastructure and watershed projects	Pre- and post-disaster	DEMHS, ANR
Economic Development Administration Department of Housing and Urban Development		Direct funding to RPCs	Annual, Post-disaster	RPCs

Emergency Relief Assistance Fund (ERAF)[24]

The Emergency Relief Assistance Fund (ERAF) helps Vermont municipalities repair damaged infrastructure after a presidentially-declared disaster. ERAF funding typically covers half the required 25% non-federal match for approved projects. (FEMA provides 75% of the total project costs).

After October 23, 2014 Towns must adopt four flood hazard mitigation measures in order to maintain level state funding in the event of such a disaster: 1) Flood Hazard Regulations that meet minimum standards for enrollment in the National Flood Insurance Program; 2) the most recent Agency of Transportation Road and Bridge Standards; 3) a Local Emergency Operations Plan (LEOP); and 4) a Local Hazard Mitigation Plan and submit to FEMA for approval. After approval of this plan, all measures will be in place.

24 Lyndon Town Plan. (2014). Town of Lyndon. P.79

CHAPTER VII

Plan Implementation

The Town of Lyndon and Village of Lyndonville and their Hazard Mitigation Committee will implement the strategies outlined in this mitigation plan and update and maintain the plan according to the guidelines below. They will use the plan's goals, as well as continued analysis of hazard risks and capabilities, to weigh the available resources against the costs and benefits for each mitigation action. The committee understands the value of this plan and its positive mitigation impact and intend to continue updating this plan and implementing the plan's strategies.

The Planning Director/Zoning Administrator and the Hazard Mitigation Committee have assumed responsibility to oversee the implementation of the mitigation plan. They recognize that future development in the planning area must coincide with the goals and objectives of this plan. Mitigation strategy updates will be shared at Planning Commission and Development Board meetings as well as at public Town meetings. They will also be published in the local paper as appropriate.

The Town of Lyndon and the Village of Lyndonville will comply with all applicable State and Federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend this plan whenever necessary to reflect changes in Tribal, State, or Federal laws and statutes as required in 44 CFR 13.11(d).

The 2015 Multi-Jurisdiction Hazard Mitigation Plan includes all actions and logistical issues deemed possible at the time of printing. The Hazard Mitigation Committee recognizes that unforeseen events may occur that alter the priorities or actions in the plan. For this reason the plan is reviewed and amended as needed.

Methods for Continued Public Involvement

FEMA Requirement ¨201.6(c)(4)(i) Is there discussion of how the community will continue public participation in the plan maintenance process?

Public participation was an integral part of this Plan's development. The Hazard Mitigation Committee is committed to continuing public outreach and public involvement. To this end, the public will remain involved in mitigation in the planning area and specifically in this Plan via several vehicles. Public involvement will be fostered through the strategies listed below.

- The Town's website (http://www.lyndonvt.org) will contain a copy of the plan and all updates.
- Public meetings will be advertised in the local newspaper and flyers will be posted in the Municipal Building, Public Library and other key locations.
- Hazard Mitigation Committee members will incorporate information regarding the implementation of mitigation actions in their regularly scheduled meetings and outreach activities. In this way, the Plan becomes incorporated in the business of the Town and Village.
- Copies of this plan will be available in the Municipal Building for public view.

Method and Schedule for Monitoring, Evaluating and Updating the Mitigation Plan

FEMA Requirement §201.6(c)(4)(i)
Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)?

The Hazard Mitigation Committee has agreed to meet annually at a minimum to review the Plan. Kaela Gray, Planning Director/Zoning Administrator, will schedule and host these meetings.

Three key methods to keeping the plan current are monitoring, evaluating, and updating the plan. FEMA defines these the following way[1]:

1. Monitoring: Tracking the implementation of the plan over time.
2. Evaluating: Assessing the effectiveness of the plan at achieving its stated purpose and goals.
3. Updating: Reviewing and revising the plan at least once every five years.

The Planning Director/Zoning Administrator and the Hazard Mitigation Committee will use the Mitigation Action Progress Report Form (shown in Figure 1) to monitor the plan's implementation. This form will be used by representatives from departments assigned with responsibility for action implementation to track and report on the progress of mitigation actions included in this Plan. Actions not included in this Plan will be added to the Plan via completion of the Mitigation Action Progress Report Form. Hazard Mitigation Committee members are responsible for identifying additional mitigation actions and completing the form as needed.

Beyond five-year updates, the Planning Director/Zoning Administrator will coordinate a Hazard Mitigation Committee meeting on an annual basis, at a minimum, to look at the plan and discuss possible updates and mitigation actions.

1 Local Mitigation Planning Handbook. (2013). Federal Emergency Management Agency. P.7-1.

Progress Report Period	**From Date:**	**To Date:**
Action/Project Title		
Responsible Agency		
Contact Name		
	Phone	E-mail
Project Status	☐ Project Completed ☐ Project Canceled ☐ Project on Schedule ☐ Anticipated Completion Date Project Delayed - Including Explanation ______________________________________ ______________________________________	
1. What was accomplished for this project during this reporting period?		
2. What obstacles, problems, or delays did the project encounter?		
3. If uncompleted, is the project still relevant? Should the project be changed or revised?		
4. Other comments		

Figure 1 Mitigation Action Progress Worksheet

Evaluating

The Planning Director/Zoning Administrator and Hazard Mitigation Committee will use the Plan Update Evaluation Worksheet (shown in Figure 2) to evaluate this Plan and make recommendations for future Plan updates and enhancements. The worksheet will be completed approximately three months after the town adopts this Plan. It will then be completed annually with any updates to the plan.

Plan Section	Considerations	Explanation
Planning Process	Should new jurisdictions and/or districts be invited to participate in future plan updates?	
	Have any internal or external agencies been invaluable to the mitigation strategy?	
	Can any procedures (e.g. meeting announcements, plan updates) be done differently or more efficiently?	
	Has the Hazard Mitigation Committee undertaken any public outreach activities?	
	How can public participation be improved?	
	Have there been any changes in public support and/or decision-maker priorities related to hazard mitigation?	
Capability Assessment	Have jurisdictions adopted new policies, plans, regulations, or reports that could be incorporated into this plan?	
	Are there different or additional administrative, human, technical, and financial resources available for mitigation planning?	
	Are there different or new education and outreach programs and resources available for mitigation activities?	
	Has NFIP participation changed in Town of Lyndon and Village of Lyndonville?	

Figure 2 Plan Update Evaluation Worksheet

Plan Section	Considerations	Explanation
Risk Assessment	Has a natural and/or technical or human-caused disaster occurred?	
	Should the list of hazards addressed in the plan be modified?	
	Are there new data sources and/or additional maps and studies available? If so, what are they and what have they revealed? Should the information be incorporated into future plan updates?	
	Do any new critical facilities or infrastructure need to be added to the asset lists?	
	Have any changes in development trends occurred that could create additional risks?	
	Are there repetitive losses and/or severe repetitive losses to document?	
Mitigation Strategy	Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimates accurate?	
	Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or eliminated from the plan?	
	Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update?	
	Are there new funding sources to consider?	
	Have elements of the plan been incorporated into other planning mechanisms?	
Plan Maintenance Procedures	Was the plan monitored and evaluated as anticipated?	
	What are needed improvements to the procedures?	

(Cont'd) Figure 2 Plan Update Evaluation Worksheet

Updating

The Planning Director/Zoning Administrator assumes responsibility for maintaining this plan by applying for funding toward plan updates. In the event of a large-scale disaster, the Hazard Mitigation Committee will review the plan to verify the plan's accuracy. A meeting will be convened and the plan will be updated as necessary.

Implementation of the Mitigation Plan

Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? 44 CFR 201.6(c)(4)(ii)

Integrating components of this Plan with other plans is the responsibility of each department in the planning area with oversight by the Hazard Mitigation Committee. The Planning Director, with support from Northeastern Vermont Development Association will guide the Selectboard, the Village Trustees, and the Planning Commission through a review of the 2015 Multi-Jurisdiction Hazard Mitigation Plan during the update of existing plans or the formation of new plans so the incorporation of mitigation actions may be considered in all municipal plans. The integration process and schedule of incorporating elements of this Plan will vary based on the particular plan's update cycle. The yearly mitigation meetings will provide an opportunity to track the progress on the integration of this Plan into other planning mechanisms.

CHAPTER VIII

Appendices

List of Acronyms

AMS	AMS American Meteorological Society
CAI	Community Anchor Institutions
CCNRCD	Caledonia County Natural Resources Conservation District
CRREL	Cold Region Research and Engineering Lab
CVOEO	Champlain Valley Office of Economic Opportunity
DEMHS	Division of Emergency Management and Homeland Security
Dept.	Department
Div.	Division
DRB	Development Review Board
EMS	Emergency Management System
EMT	Emergency Medical Technician
EOC	Emergency Operation Center
EPA	US Environmental Protection Agency
FEH	Fluvial Erosion Hazard
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FRRLZ	Forested Rural Residential Landscape Zone
LED	Lyndonville Electric Department
HAZMAT	Hazardous Materials
HAZUS-MH	Hazards Software
Inc.	Incorporated
ISAC	Invasive Species Advisory Committee
K	Thousand
Km	Kilometres
Kts	Knots
NFIP	National Flood Insurance Program
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmospheric Administration
NVDA	Northeastern Vermont Development Association
NWS	National Weather Service
PRI	Priority Risk Index
PVLT	Passumpsic Valley Land Trust
SFHA	Special Flood Hazard Area
TAC	Transportation Advisory Committee
USACE	US Army Corps of Engineers
USGS	US Geological Survey
VANR	Vermont Agency of Natural Resources
VLT	Vermont Land Trust
VT RMP	Vermont River Management Program
VTrans	Vermont Agency of Transportation
VTSBDC	Vermont Small Business Development Center

List of Resources

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Work Plan

Complete a FEMA-approved Multi-Jurisdictional Hazard Mitigation Plan for the Town of Lyndon and the Village of Lyndonville, Vermont.

1	Assemble planning team and meet with consultant(s) to review the planning process and confirm outreach strategy.
Roles	**Responsibilities**
Consulting Team	• Lead review of planning process.
NVDA	• Schedule the call and invite participants.
Town of Lyndon & Village of Lyndonville	• Participate in the meeting.
Deliverables	
• Assembled Planning Team with bi-monthly call schedule	

2	Establish work plan with deliverables, timelines for completion and confirmed roles and responsibilities.
Roles	**Responsibilities**
Consulting Team	• Draft Work Plan and Public Outreach Strategy.
NVDA	• Schedule conference calls and distribute call invites.
Town of Lyndon & Village of Lyndonville	• Draft list of potential Hazard Mitigation Committee members. • For the Outreach Strategy the Town must identify special populations such as the elderly, disabled, or non-English speaking. These must be brought to the attention of the Planning Team so they can be accommodated
Deliverables	
• Documented Work Plan agreed upon by Planning Team. • Documented public outreach strategy.	

3	Review information on natural hazards and on man-made hazards, based on best available data.
Roles	**Responsibilities**
Consulting Team	• Develop a "wish list" of data. • Lead a data collection conference call. • Gather all best-available data. • Assist Planning Team with identifying list of hazards and list of critical facilities. Develop a preliminary list to work from.
NVDA	• Facilitate data collection conference call. • Gather all studies and data sets that may assist with risk assessment. • Identify known hazards and critical facilities
Town of Lyndon & Village of Lyndonville	• Gather all studies and data sets that may assist with risk assessment. • Identify known hazards and critical facilities • Provide background information on the trailer park (number of vehicles, location, natural setting etc.).
Deliverables	
• List of natural hazards and man-made hazards to include in Mitigation Plan. • Collection of best-available data for study. • List of critical facilities.	

3	Review information on natural hazards and on man-made hazards, based on best available data.
Roles	**Responsibilities**
Consulting Team	• Develop a "wish list" of data. • Lead a data collection conference call. • Gather all best-available data. • Assist Planning Team with identifying list of hazards and list of critical facilities. Develop a preliminary list to work from.
NVDA	• Facilitate data collection conference call. • Gather all studies and data sets that may assist with risk assessment. • Identify known hazards and critical facilities
Town of Lyndon & Village of Lyndonville	• Gather all studies and data sets that may assist with risk assessment. • Identify known hazards and critical facilities • Provide background information on the trailer park (number of vehicles, location, natural setting etc.).
Deliverables	
• List of natural hazards and man-made hazards to include in Mitigation Plan. • Collection of best-available data for study. • List of critical facilities.	

4	Review hazard data in one public meeting.
Roles	**Responsibilities**
Consulting Team	• Develop outreach materials including Public Preparedness Survey, Press Release and Flyer. • Lead Public Meeting and Hazard Mitigation Committee meeting. Develop PowerPoint presentation for each. • Oversee data review and develop hazard profiles.
NVDA	• Conduct outreach for Public Meeting and Hazard Mitigation Committee Meeting. • Manage logistics for each meeting. • Collect a sign-in sheet at the meeting and take minutes. Distribute digital copies of each to the Planning Team.
Town of Lyndon & Village of Lyndonville	• Conduct outreach for Public Meeting and Hazard Mitigation Committee Meeting. • Participate in the Hazard Mitigation Committee and the public meeting.
Deliverables	
• Confirmed list of critical facilities. • Public Meeting and associated outreach materials. • Hazard Mitigation Committee Meeting.	

5	Complete a vulnerability assessment to quantify the extent of each hazard.
Roles	**Responsibilities**
Consulting Team	• Complete vulnerability assessment for all identified natural hazards. • Consider climate change, water contamination, the rail line and hazardous materials as extenuating circumstances to identified hazards. • Map the location of each area of concern.
NVDA	• Assist with identification of past hazards and identified mitigation actions. • Provide feedback on ranking of hazards and provide information on land use development trends.

Town of Lyndon & Village of Lyndonville	• Assist with the location and identification of past hazards or areas of issue.
	• Provide feedback on ranking of hazards and provide information on land use development trends. Identify implemented as well as desired mitigation actions and indicate which measures worked well and why.
	• Specify planned mitigation actions (according to Draft Mitigation Plan):
	  ○ For trailer park
	  ○ Provide information on past inspections (and results) on Institute Pond Dam
	  ○ Indicate whether a long-term cost benefit analysis for removal/maintenance for Vail Dam has occurred and if so what the outcome was.

Deliverables	
• Completed risk assessment that meets all state and FEMA requirements.	

6	Identify mitigation strategies and complete a cost-benefit review.
Roles	**Responsibilities**
Consulting Team	• Develop a list of potential mitigation actions using the risk assessment results. • Evaluate potential mitigation actions • Identify viable mitigation projects
NVDA	• Provide additional mitigation actions and feedback on those identified by the consulting team. • Work with local agencies to determine if a cost estimate is available. • Assist with mapping of mitigation actions.
Town of Lyndon & Village of Lyndonville	• Provide additional mitigation actions and feedback on those identified by the consulting team.
Deliverables	
• Mitigation actions identified and prioritized.	

7	Review mitigation strategies in a public meeting.
Roles	**Responsibilities**
Consulting Team	• Develop outreach materials including a flyer and press release for the public meeting. • Facilitate a public meeting as well as a Hazard Mitigation Committee meeting. Develop PowerPoint presentations for each. • Document the mitigation plan.
NVDA	• Coordinate all logistics and outreach for the Public Meeting. • Collect a sign-in sheet at the meeting and take minutes. Distribute digital copies of each to the Planning Team.
Town of Lyndon & Village of Lyndonville	• Assist with outreach and logistics for the public meeting. • Participate in the Hazard Mitigation Committee and public meeting.
Deliverables	
• Public Meeting and associated outreach materials. • Hazard Mitigation Committee Meeting.	

8	Submit plan to Vermont Emergency Management and Homeland Security and revise accordingly.
Roles	**Responsibilities**
Consulting Team	• Prepare the plan for review by the State and FEMA. Make sure the plan meets all requirements. • Make appropriate changes requested by VDEM and the Planning Team. The consulting team is prepared to make one round of changes.
NVDA	• Submit the plan for review.
Town of Lyndon & Village of Lyndonville	• Provide any support necessary toward plan review and adoption.
Deliverables	
• Draft final version of plan provided for review.	

9	Submit revised plan to FEMA; revise if necessary. Town and Village adopt plan.
Roles	**Responsibilities**
Consulting Team	• Prepare documents for submittal and make appropriate revisions. The consulting team is prepared to make one round of changes.
NVDA	• Submit documents as required by State and FEMA.
Town of Lyndon & Village of Lyndonville	• Coordinate and facilitate plan adoption.
Deliverables	
• Final version of plan delivered. The Consulting Team will provide a digital copy of the plan. In addition, three hard copies of the plan will be mailed to NVDA upon request.	

Appendix B: Planning Team Meetings

Multi-Jurisdictional Hazard Mitigation Plan
For the Town of Lyndon and the Village of Lyndonville

Committee:	Hazard Mitigation Planning Team
Date of Meeting:	January 30, 2015
Location	Conference call, 712-432-1212 passcode: 252-312-171#

Meeting Purpose
Project Kick-off Meeting

Meeting Attendees	
Jamie Caplan	Jamie Caplan Consulting LLC
Kaela Gray	Zoning Administrator
Frank Maloney	Northeastern Vermont Development Association, GIS
Patrick McLaughlin	Lyndon Planning Commission
Irene Nagle	Northeastern Vermont Development Association, Planner
Justin Smith	Town Administrator
David Dill	Town of Lyndon Selectboard

Meeting Notes

A great start for the project.

People introduced themselves and then Jamie led them through a discussion of the potential work plan based on the proposal her team prepared. In addition, a draft timeline was discussed. Jamie will share a draft work plan with the team prior to the next conference call.

The group on the phone considers themselves the Planning Team. They will meet approximately twice a month via conference call for the duration of the project.

In addition to the Planning Team a Hazard Mitigation Committee will be formed. The group will include Planning Team members as well as representatives from both the public and private sectors of both Lyndon and Lyndonville. Representatives from surrounding towns will be invited to participate. The Hazard Mitigation Committee will meet in person at least twice and will meet via conference call as needed. The in-person meetings will likely occur the same day as Public Meetings. Justin Smith is tasked with drafting a list of potential members for the Planning Team to review on their next call.

The draft timeline runs from February 2015 – September 2015. Public meetings are anticipated in March 2015 to review critical facilities and hazards and again in May/June 2015 to discuss mitigation strategy and specific mitigation actions.

1

Action Items
Jamie: Work Plan draft – distribute to Planning Team prior to next call
Justin: Hazard Mitigation Committee membership list
All participants: identify potential date in March for our first public meeting

Next Meeting	
Date:	Tuesday, February 10, 2015
Time:	11:30 am – 12:30 pm
Location:	Conference call, 712-432-1212 passcode: 252-312-171#
Agenda Items:	• Review Draft Work Plan • Review Membership List for Hazard Mitigation Committee • Determine Next Steps for Public Outreach • Schedule Data Collection Conference Call

Multi-Jurisdictional Hazard Mitigation Plan
For the Town of Lyndon and the Village of Lyndonville

Committee:	Hazard Mitigation Planning Team
Date of Meeting:	February 10, 2015
Location	Conference call, 712-432-1212 passcode: 252-312-171#

Meeting Purpose
Work Plan Review

Meeting Attendees	
Jamie Caplan	Jamie Caplan Consulting LLC
Ray Durocher	Trustee
Kaela Gray	Zoning Administrator
Patrick McLaughlin	Lyndon Planning Commission
Irene Nagle	Northeastern Vermont Development Association, Planner
Justin Smith	Town Administrator
David Dill	Town of Lyndon Select Board

Meeting Notes

1. Mitigation Committee
   - Discussed draft list and potential additional members
     a. Lyndonville Electric Department not represented – Ken Mason or Bill Humphrey, Jamie says adding a representative makes sense
     b. Local National Guard – Jamie doesn't think so their focus is primarily response and recovery not mitigation
     c. Lyndon Rescue – An ambulance service, Jamie thinks it's a good idea to add them, Pat will help identify someone or he can cover them
     d. No conservation commission in Lyndon

2. Work Plan
   - Task 2 – a number of elderly housing units identified as well as child care centers, low income housing
     - Multiple facilities mentioned during discussion of special populations, these will be added to the critical facility list for future discussion
       - Lyndon Terrace
       - The Cardinals Nest
       - Darling Inn
       - Marigold Apartments
       - Mobile Home Park
       - Mathewson Block
       - The Pines

1

        - Riverside Life Enrichment
        - Commerce Lane 4 Building Units
        - Trailer Park on 114
- Task 3 – GIS Data Collection call scheduled for following week
    - Discussed man-made hazards including rail line, hazardous materials and water contamination. Planning Team encouraged including 2 Superfund sites. Studies have been done for each.
- Task 4 – Public Meeting will be held in March
- Task 5 – Discussion triggered suggestion that Kerry O'Brien, Director Manager, Caledonia County NRCD and a Lyndon Electric Department representative be added to the Hazard Mitigation Committee
- Task 6 – Small discussion about cost estimates. Jamie assured Planning Team exact numbers are not required but are certainly helpful.

3. Public Outreach
    - We didn't have time to discuss this so it will lead our February 17th call.

4. GIS Call
    - Tuesday, February 17th 11:30 am
    - Consulting Team will distribute Data wish list prior to the call

5. March Public Meeting
    - Temporary date, March 12th 6pm for Public Meeting
    - Need to identify time and location for Hazard Mitigation Committee on the same day

Action Items
Consulting Team: Distribute data wish list and revise work plan based on call
Justin: Update Hazard Mitigation Committee List – add people identified on the call
All participants: Begin work on logistics for Hazard Mitigation Committee and Public Meeting temporarily identified for March 12, 2015

Next Meeting	
Date:	Tuesday, February 17, 2015
Time:	11:30 am – 12:30 pm
Location:	Conference call, 712-432-1212 passcode: 252-312-171#
Agenda Items:	• Public Outreach Plan • GIS Data Wish List • If Time – Potential Hazards List

Multi-Jurisdictional Hazard Mitigation Plan
For the Town of Lyndon and the Village of Lyndonville

Committee:	Hazard Mitigation Planning Team
Date of Meeting:	February 17, 2015
Location	Conference call, 712-432-1212 passcode: 252-312-171#

Meeting Purpose
Work Plan Review and Data Collection

Meeting Attendees	
Jamie Caplan	Jamie Caplan Consulting LLC
Damian Gomez	Gomez and Sullivan Engineers
Kaela Gray	Zoning Administrator
Isabel Kaubisch	Clarendon Hill Consulting LLC
Frank Maloney	Northeastern Vermont Development Association, GIS
Patrick McLaughlin	Lyndon Planning Commission
Irene Nagle	Northeastern Vermont Development Association, Planner
Justin Smith	Town Administrator

Meeting Notes

1. Mitigation Committee
    - Justin will update the list with names added since our last meeting
2. Dropbox
    - Jamie invited everyone from the Planning Team to the Dropbox folder. This gives Planning Team members the ability to upload and download documents related to the project. Subfolders were created for the Planning Team and for Risk Assessment Data. Please upload data requested here.
3. Public Outreach
    - Jamie very quickly reviewed the Public Outreach plan from the end of the Work Plan. The entire Work Plan will be added to the Dropbox folder.
4. GIS Data Collection
    - Damian Gomez introduced himself and reviewed data requests specific to the flood hazard.
    - Isabel Kaubisch introduced herself and reviewed data requests for all hazards.
    - Additional requests will be made regarding planning documents such as a Master Plan.
    - See the Data Request sheet for more information.

1

5. March Public Meeting
    - March 12th was confirmed for the in-person meetings. The Hazard Mitigation Committee will meet at 2pm at the Municipal Building in the Conference room and the Public Meeting will be at Public Safety at 6pm.
    - Jamie and the consulting team will put together PowerPoint presentations for each meeting. In addition, a press release and flyer will be created for the Public Meeting. An email invite will be created for the Hazard Mitigation Committee meeting.
    - The planning team is responsible for all logistics related to each meeting.

6. Public Preparedness Survey
    - A draft of the Public Preparedness Survey was distributed to the Planning Team.
    - The final version will be made available in hard copy and on the web. Distribution will begin the week of March 9th.

7. Next Meeting for the Planning Team
    - February 24, 2015 at 1:30pm
    - Conference call, 712-432-1212 passcode: 252-312-171#

Action Items
Consulting Team: Distribute Public Preparedness Survey, Flyer and Press Release, Email invitation for the Hazard Mitigation Committee
Justin: Update Hazard Mitigation Committee List – add people identified on the call
Irene: Confirm time for Planning Team call on February 24th
All participants: • Work on logistics for Hazard Mitigation Committee and Public Meeting for March 12, 2015 • Upload data to the Dropbox

Next Meeting	
Date:	Tuesday, February 24, 2015
Time:	1:30 pm – 2:30 pm
Location:	Conference call, 712-432-1212 passcode: 252-312-171#
Agenda Items:	• GIS Data Collection Progress • Preliminary Hazard List • Public Preparedness Survey • Flyer and Press Release for Public Meeting • Stakeholder Meetings

Multi-Jurisdictional Hazard Mitigation Plan
For the Town of Lyndon and the Village of Lyndonville

Committee:	Hazard Mitigation Planning Team
Date of Meeting:	February 26, 2015
Location	Conference call, 712-432-1212 passcode: 252-312-171#

Meeting Purpose
Data Collection, Public Outreach and March 12th Meetings

Meeting Attendees	
Jamie Caplan	Jamie Caplan Consulting LLC
Ray Durocher	Trustee
Kaela Gray	Zoning Administrator
Irene Nagle	Northeastern Vermont Development Association, Planner
Justin Smith	Town Administrator

Meeting Notes

1. Follow-up
    - Aerial photographs on the Dropbox are from a local balloonist who shares the pictures with the Town. Justin will share his name so we can credit him in the plan for the pictures.

2. Data Collection
    - Lyndonville Electric has paper maps. Do we want copies? Jamie will check with Isabel and Damian.

3. Public Outreach
    - Public Preparedness Survey
        - The Survey needs the Lyndon logo and an amendment to Question 1 for clarity when filling out a hard copy version.
        - The Town has a meeting on Tuesday next week and Justin will make copies of the survey for distribution at this meeting.
    - Flyer
        - Flyer looks good!
        - Kaela and Justin will add a tear-off part to the bottom so people can take away a link to the survey or info for the upcoming meeting.
    - Press Release
        - Irene will send this to the Caledonia for inclusion in the paper on March 9th. According to Justin, town folks are accustomed to looking at the paper on Monday for town events.

- Email Invite to Hazard Mitigation Committee
    - Irene will amend the draft invite to accurately reflect the location of the Hazard Mitigation Committee meeting.

4. Stakeholder Meetings
    - Jamie would like to meet with Kaela, Joe, Patrick, Justin and Irene on the 12th. These should be about half an hour-long meetings. The point is to gather additional information regarding their area of expertise including capabilities, areas of risk and mitigation actions.
    - Irene will schedule the meetings.

5. Next Meeting for the Planning Team
    - March 5, 2015 at 11:00 am
    - Conference call, 712-432-1212 passcode: 252-312-171#

Action Items
Consulting Team: Prepare PowerPoint presentations, sign-in sheets and other supporting docs for Hazard Mitigation Committee meeting and Public Meeting on March 12. Develop initial base maps for the region.
Justin: Continue to maintain Hazard Mitigation Committee list. Copy and distribute flyer and survey at Town Meeting.
Irene: Send press release to Caledonia. Send email invite to Hazard Mitigation Committee members. Schedule stakeholder meetings for March 12.
All participants: • Work on logistics for Hazard Mitigation Committee and Public Meeting for March 12, 2015 • Upload data to the Dropbox • Distribute copies of flyer and survey.

Next Meeting	
Date:	Thursday, March 5, 2015
Time:	11:00 am – 12:00 pm
Location:	Conference call, 712-432-1212 passcode: 252-312-171#
Agenda Items:	• Stakeholder Meetings • Logistics for March 12 • Critical Facilities

Multi-Jurisdictional Hazard Mitigation Plan
For the Town of Lyndon and the Village of Lyndonville

Committee:	Hazard Mitigation Planning Team
Date of Meeting:	March 5, 2015
Location	Conference call, 712-432-1212 passcode: 252-312-171#

Meeting Purpose
Critical Facility Identification, Logistics for March 12th Meetings

Meeting Attendees	
Jamie Caplan	Jamie Caplan Consulting LLC
Ray Durocher	Trustee
Kaela Gray	Zoning Administrator
Patrick McLaughlin	Fire Department
Irene Nagle	Northeastern Vermont Development Association, Planner
Justin Smith	Town Administrator

Meeting Notes

1. Public Meeting Outreach
    - Outreach has included sending the Press Release to the Caledonia Record, hanging flyers around town including in the supermarket, diner and library. The flyer was also distributed at the Town Meeting.
    - Facebook and Twitter were used to announce the public meeting and will be used to spread the word about the survey.
    - Someone mentioned sending a press release to the Radio Station, Magic 97.7 and Irene will investigate this.
    - Kaela will manage refreshments for both meetings on the 12th.
2. Hazard Mitigation Committee Outreach
    - The email invitation and Public Meeting flyer were sent to all potential Hazard Mitigation Committee members. Irene will send a reminder email on Wednesday, March 11th.
3. Survey
    - Distributed at the town meeting and have 25 completed. Hard copies will also be placed in other spots around town. For now, they are at the Town Cashier's desk and the Electric Cashier's desk.
4. Stakeholder Meetings
    - Irene will work on an itinerary for these meetings. She also suggested meeting with Robert Nutting the Road Foreman. The potential meeting list includes Kaela, Joe, Patrick and Justin.

1

5. Data Collection
    - Data collection is on target.
    - Patrick is working on adding addresses to the list of buildings that have sprinkler systems.
    - Robert Nutting may have additional information regarding culverts and bridges.
    - The Town does not have a stormwater management plan.
6. Critical Facilities
    - A draft list of Critical facilities was reviewed.
    - Based on conversation Kaela will update the list to include utilities, county airport and Northern VT Regional Hospital.
    - The E911 data set may have a complete list of facilities to review.
    - Jamie emphasized to the group that this is the first stage in determining the list of critical facilities. These facilities should include those that the Town relies upon for sustainability as well as during disaster response and recovery.

Action Items
Consulting Team: PowerPoint presentations for March 12th meetings. Prep for March 12 stakeholder meetings. Basemaps for discussion.
Justin: • Maintain Hazard Mitigation Committee list.
Irene: • Send reminder email to Hazard Mitigation Committee on March 11. • Develop a meeting itinerary for the stakeholder meetings. • Send a press release or contact the radio station.
Kaela: • Update critical facility list and share it with Jamie. • Put hard copies of the survey in more town facilities. • Manage refreshments for both meetings on March 12.
All participants: • Work on logistics for Hazard Mitigation Committee and Public Meeting for March 12, 2015 • Upload data to the Dropbox • Distribute copies of flyer and survey.

Next Meeting	
Date:	Tuesday, March 24, 2015
Time:	11:00 am – 12:00 pm
Location:	Conference call, 712-432-1212 passcode: 252-312-171#
Agenda Items:	• Critical Facilities and Hazards • Capability Assessment

From: **Irene Nagle** inagle@nvda.net
Subject: Meeting in Lyndon on Thursday March 12th
Date: March 2, 2015 at 5:23 PM
To: Greg Hopkins chiefhopkins@lyndonvillefire.com, Jack Harris jack.harris@state.vt.us, Jamie Caplan jamie@jamiecaplan.com, Joe Dauphin lyndonvillewater@yahoo.com, Justin Smith justin@lyndonvt.org, Kaela Gray kaela.gray@gmail.com, Ken Mason kmason@lyndonvilleelectric.com, Kerry O'Brien kerry.obrien@vt.nacdnet.net, Marty Feltus marty.feltus@yahoo.com, Patrick Mclaughlin Patrick.McLaughlin@state.vt.us, Raymond Durocher durocherraymond@gmail.com, Robert Nutting lyndonroads@myfairpoint.net, roger.dekett@vt.usda.gov, al@thedueys.com, willowburke@gmail.com, cherrysam@kingcon.com, Jeffrey Paquet jeffreypaquet@gmail.com, Paul Brouha paul.brouha@gmail.com

IN

To Lyndon Hazard Mitigation Committee Members:

The Northeastern Vermont Development Association (NVDA) has received a grant from the VT Emergency Management Agency (DEMHS) to prepare a Hazard Mitigation Plan for the Town of Lyndon and Village of Lyndonville. NVDA has hired a consulting team led by Jamie Caplan Consulting to work with Lyndon on the plan.

To prepare the best possible mitigation plan **we need your support as a member of the Hazard Mitigation Committee.** The Committee will meet about three times in the next several months. Your contributions during these meetings will help us to identify areas of risk in the Town of Lyndon and Village of Lyndonville as well as possible mitigation actions.

Having a FEMA approved Hazard Mitigation Plan allows the Town and Village to seek mitigation funding for projects such as structure and infrastructure projects, natural systems protection, education and awareness programs, and local planning and regulations.

A number of you have been asked to serve on the Committee in your role as an official from a neighboring municipality. Your contribution will be valuable in developing a collaborative, regional approach to hazard mitigation strategies.

Our first meeting is March 12, 2015 from 2:00 pm – 3:30 pm in the conference room at the Municipal Building, 119 Park Ave, Lyndonville. Please RSVP by return email at your earliest

Figure 1 Invitation to Hazard Mitigation Committee Meeting

Lyndonville. Please RSVP by return email at your earliest convenience.

That evening we are hosting a Public Meeting regarding the Hazard Mitigation Plan. We encourage you to attend this meeting as well and bring co-workers and family members. It will be held from 6:00 pm – 7:00 pm in the Public Safety Building, 316 Main Street, Lyndonville.

If you are unable to participate in these meetings, please consider sending a representative from your department in your place.

Attached for your convenience is a flyer advertising the Public Meeting. Please take a moment to distribute it.

If you have any questions regarding these meetings or the mitigation plan, please contact me at NVDA at 802-424-1423 or inagle@nvda.net.

--
Irene M. Nagle, AICP
Senior Planner
NVDA
Northeastern Vermont Development Association
36 Eastern Avenue, Suite 1
St. Johnsbury, VT 05819
(802) 424-1423
www.nvda.net

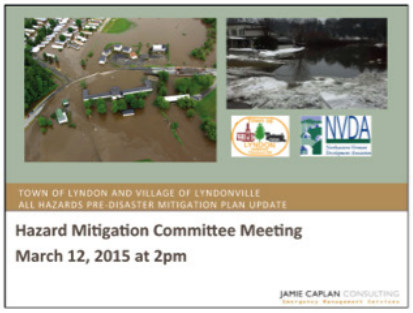
(Cont'd) Figure 1 Invitation to Hazard Mitigation Committee Meeting

HAZARD MITIGATION COMMITTEE MEETING SIGN-IN SHEET

Project: Town of Lyndon and Village of Lyndonville PDM		**Meeting Date:**	March 12, 2015
Facilitator:	Irene Nagle, NVDA	**Place/Room:**	Municipal Building Conference Room

Name	Title	Company	Phone	E-Mail
Jamie Caplan	Principal	JCC	413 586-0867	jamie@jamiecaplan.com
Isabel Kaubisch	Principal	Clarendon Hill Cons.	617-863-6573	isabel@chillcons.com
Ben Copans	VT DEC Watershed Coordinator	VT DEC	802-751 2610	Ben.copans@state.vt.us
Joe Dauphin	Superintendent Village of Lyndonville	Village of Lyndonville	802 535 9242	Lyndonvillewater@yahoo.com
Rob Nutting	Town Highway	Town of Lyndon	802 626 5877	lyndonroads@myfairpoint.net
George Gardner	Dir. of Maint	Lyndon Town School	626-3209	georgegardner@cnsuschools.org
Rob Heath	Assistant Head	Lyndon Institute	626-6172	rob.heath@lyndoninstitute.org
Ray Durocher	Trustee	Village of Lyndonville	626-6161	durocherraymond@gmail.com
Justin Smith	Municipal Administrator	Lyndon	626-5834	Justin@lyndonvt.org
Ken Mason	CEO Manager	Lyndonville Elec. Dept	626-3366	kmason@lyndonvilleelectric.com
Jack Harris	Chief Lyndonville PD	Lyndonville PD	626-1271	jack.harris@state.vt.us
George Hacking	Director of Pub. Safety ~~Lyndon State College~~	LSC	626-6452	george.hacking@lyndonstate.edu
Patrick McLaughlin	Planning Comm Lyndonville Twn	town of Lyndon	585-4468	Patrick.McLaughlin@state.vt.us
Byron Savoy	Planning Commission Sutton	Town of Sutton	535-5229	byronsavoy@yahoo.com
Kaela Gray	Planning Director	Village of Lyndonville town of Lyndon	626-1269	Kaela.gray@gmail.com
Kerry O'Brien	District Manager	Caledonia County NRCD	748-3885 x110	Kerry.obrien@vt.nacdnet.net
Irene Nagle	NVDA, Planner	NVDA		inagle@nvda.net

Page 1 of 1


NVDA
TOWN OF LYNDON AND VILLAGE OF LYNDONVILLE
ALL HAZARDS PRE-DISASTER MITIGATION PLAN UPDATE
Hazard Mitigation Committee Meeting
March 12, 2015 at 2pm
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Emergency Management Services


Purpose of Meeting
Project Kick-off
Question and Answers
Project Planning Process Described
Hazard List Reviewed
Critical Facilities Identified
Mitigation Actions Brainstorm
Next Steps
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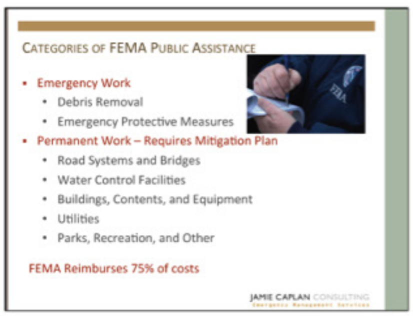
Categories of FEMA Public Assistance
Emergency Work
Debris Removal
Emergency Protective Measures
Permanent Work – Requires Mitigation Plan
Road Systems and Bridges
Water Control Facilities
Buildings, Contents, and Equipment
Utilities
Parks, Recreation, and Other
FEMA Reimburses 75% of costs
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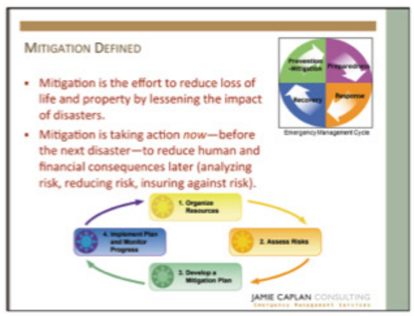
Mitigation Defined
Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters.
Mitigation is taking action now—before the next disaster—to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk).
Prevention Mitigation
Preparedness
Recovery
Response
Emergency Management Cycle
1. Organize Resources
2. Assess Risks
3. Develop a Mitigation Plan
4. Implement Plan and Monitor Progress
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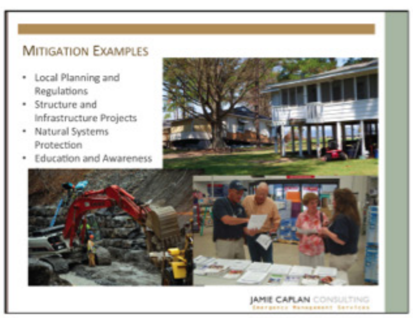
Mitigation Examples
Local Planning and Regulations
Structure and Infrastructure Projects
Natural Systems Protection
Education and Awareness
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Project Schedule
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TOWN OF LYNDON AND VILLAGE OF LYNDONVILLE
ALL HAZARDS PRE-DISASTER MITIGATION PLAN UPDATE

Hazard Mitigation Committee Meeting
March 12, 2015 at 2pm

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Purpose of Meeting

- Project Kick-off
- Question and Answers
- Project Planning Process Described
- Hazard List Reviewed
- Critical Facilities Identified
- Mitigation Actions Brainstorm
- Next Steps

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Categories of FEMA Public Assistance

- Emergency Work
  - Debris Removal
  - Emergency Protective Measures
- Permanent Work – Requires Mitigation Plan
  - Road Systems and Bridges
  - Water Control Facilities
  - Buildings, Contents, and Equipment
  - Utilities
  - Parks, Recreation, and Other

FEMA Reimburses 75% of costs

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Mitigation Defined

Emergency Management Cycle

- Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters.
- Mitigation is taking action *now*—before the next disaster—to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk).

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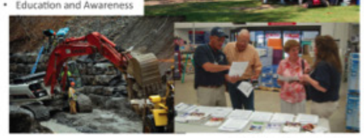
Mitigation Examples

- Local Planning and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness



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Project Schedule

Task	Description	Jan/Feb	Mar	Apr	May	Jun	July	Aug	Sep
1	Assemble planning team and meet with consultant(s) to review the planning process and confirm outreach strategy.	X							
2	Establish work plan with deliverables, timelines for completion and confirmed roles and responsibilities.	X							
3	Review information on natural hazards and on man-made hazards, based on best available data.	X	X						
4	Review Hazard Data Public Meeting #1	X	X						
5	Complete a vulnerability assessment to quantify the extent of each hazard.	X	X	X	X				
6	Identify Mitigation Strategies and complete a cost-benefit review.			X	X	X	X		
7	Review Mitigation Strategies Public Meeting #2				X	X	X		
8	Submit plan to Vermont Emergency Management and Homeland Security and revise accordingly.							X	X
9	Submit revised plan to FEMA, revise if necessary. Town and Village adopt plan.								X
Meetings									
Kick-Off Meeting		X							
Conference Calls Weekly		X	X	X	X	X	X	X	X
Public Meeting #1			X						
Public Meeting #2						X			

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Public Outreach

- "Ground-truthing" – Local Knowledge
- Consensus building
- Hazard Mitigation Committee
- Public Meetings
- Mitigation Plan Survey
- Stakeholder Meetings

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Hazard Mitigation Committee

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Current Hazards List

1. Floods
2. Hazardous Materials
3. Water Supply Contamination
4. Winter Storm/Ice
5. Fire

- Tornado
- Flood
- Flash Flood
- Hazardous Materials
- Radiological Incident
- Structural Fire
- Power Failure
- Winter Storm/Ice
- High Wind
- Air Crash
- Water Supply Contamination
- Hurricane
- Earthquake
- Dam Failures
- Drought
- Chemical or Biological Incident
- Highway Incident
- Wildfire/Forest Fire
- Landslide
- School Safety Issues
- Terrorism

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Proposed List of Hazards

Climate Change
Power Failure
Railway Incidents

1. Flood Hazards
   - Beaver Dams
   - Dam Breaches
   - Erosion
   - Floods and Flash Floods
   - Heavy Rainstorms and Thunderstorms
   - Snow Melt
2. Wind Hazards
   - Hurricanes
   - Microburst
   - Tornadoes
3. Winter Hazards
   - Blizzard
   - Hail
   - Ice Jams
   - Ice Storms
   - Nor'easter
   - Snow Events
   - Extreme Cold
4. Fire Hazards
   - Drought
   - Wildfire
5. Geologic Hazards
   - Earthquake
   - Landslide
6. Other Potential Hazards
   - Extreme Heat and Heat Wave
   - Lightening
   - Water Supply Contamination
   - Hazardous Materials
   - Invasive Species

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Risk Assessment

- Helps establish mitigation priorities
- Key Steps
  - ☑ Data Collection and Analysis
  - ☑ Hazard Identification
  - ☑ Hazard Profiles and Mapping
  - ☑ Inventory of Community Assets
  - ☑ Vulnerability Assessment

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Risk Assessment Approach

- Quantitative Analysis
  - Use of best available data and technology
  - Deterministic and probabilistic modeling
- Qualitative Analysis
  - Local knowledge and stakeholder collaboration
  - Priority Risk Index

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2


CRITICAL FACILITIES AND INFRASTRUCTURE
• Provide services essential for life safety and economic viability.
• Must continue to operate during and following a disaster.
Critical Facilities
Hospitals and medical facilities
Police and fire stations
Emergency operations centers
Evacuation shelters
Schools
Airports/heliports
High Potential Loss Facilities
Nuclear power plants
Dams
Military and civil defense installations
Locations housing hazardous materials
Infrastructure Systems
Water and wastewater
Power utilities
Transportation (roads, railways, waterways)
Communication systems/centers
Energy pipelines and storage
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CRITICAL FACILITIES: PROVIDE SERVICES ESSENTIAL FOR LIFE SAFETY AND ECONOMIC VIABILITY AND MUST CONTINUE TO OPERATE DURING AND FOLLOWING A DISASTER.
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RISK ASSESSMENT PROCESS
NATURAL HAZARD
RISK
The potential for damage, loss, or other impacts created by the interaction of natural hazards with critical facilities
CRITICAL FACILITIES
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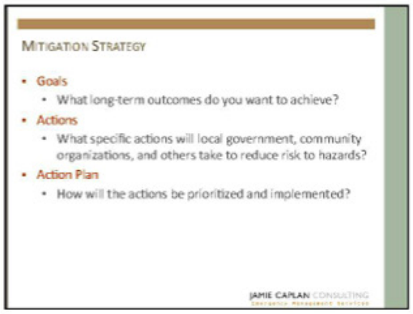
MITIGATION STRATEGY
• Goals
• What long-term outcomes do you want to achieve?
• Actions
• What specific actions will local government, community organizations, and others take to reduce risk to hazards?
• Action Plan
• How will the actions be prioritized and implemented?
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CURRENT HAZARD MITIGATION GOALS
1. Reduce the loss of life and injury resulting from all hazards.
2. Mitigate financial losses incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters.
3. Reduce the damage to public infrastructure resulting from all hazards.
4. Recognize the connections between land use, stormwater road design and maintenance and the effects from disasters.
5. Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.
6. Encourage all-hazard mitigation planning as a part of the municipal planning process.
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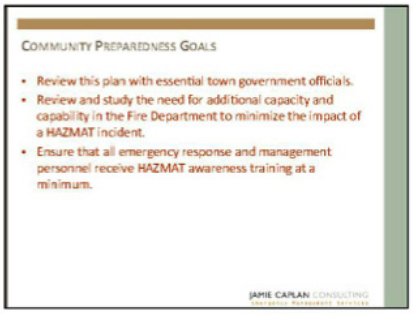
COMMUNITY PREPAREDNESS GOALS
• Review this plan with essential town government officials.
• Review and study the need for additional capacity and capability in the Fire Department to minimize the impact of a HAZMAT incident.
• Ensure that all emergency response and management personnel receive HAZMAT awareness training at a minimum.
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Proposed Goals

What long-term outcomes do you want to achieve?

1. Save Lives and Protect Property
   - Reduce or eliminate risk to people and property from natural and man-made hazards.
2. Community Planning
   - Integrate hazard mitigation policies and practices into local planning.
3. Regional Collaboration
   - Build capacity for hazard mitigation through regional collaboration.
4. Public Awareness
   - Increase public awareness of hazards by implementing outreach and education programs.
5. Preservation
   - Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.

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Mitigation Actions in 2010 Draft Plan

- Please refer to handout

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Mitigation Techniques

- Local Planning and Regulations
  - Land use plans, building codes, open space preservation, and stormwater management
- Structure and Infrastructure Projects
  - Utility undergrounding, structural retrofits, culverts and detention structures
- Natural Systems Protection
  - Stream corridor restoration, wetland restoration, erosion control
- Education and Awareness Programs

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Community Rating System (CRS)

- The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements.
- As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:
  - Reduce flood damage to insurable property;
  - Strengthen and support the insurance aspects of the NFIP, and
  - Encourage a comprehensive approach to floodplain management.
- 19 Activities in 4 Categories to accrue points
  - Public Information
  - Mapping and Regulations
  - Flood Damage Reduction
  - Warning and Response

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Proposed Mitigation Actions

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Discussion with Questions and Answers

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Plan Adoption and Implementation
Write and Review Plan
Hazard Mitigation Committee has the opportunity to review the plan.
Recommendations are incorporated.
Plan Adoption and Implementation
MEMA Reviews Plan
FEMA Reviews Plan
FEMA Approval every 5 years
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Next Steps
Stakeholder Meetings
Public Meetings
Survey Participation and Distribution
https://www.surveymonkey.com/r/LyndonVT
Continued Participation in Planning Meetings
Review of Draft Plan
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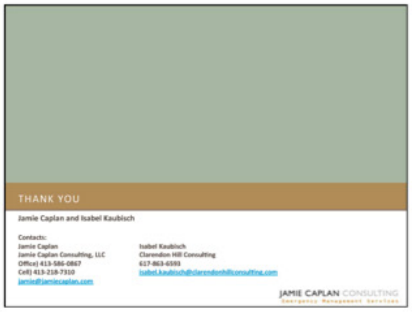

THANK YOU
Jamie Caplan and Isabel Kaubisch
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Jamie Caplan
Jamie Caplan Consulting, LLC
Office) 413-586-0867
Cell) 413-218-7310
jamie@jamiecaplan.com
Isabel Kaubisch
Clarendon Hill Consulting
617-863-6593
isabel.kaubisch@clarendonhillconsulting.com
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5

HAZARD MITIGATION COMMITTEE MEETING SIGN-IN SHEET

Project: Town of Lyndon and Village of Lyndonville PDM	**Meeting Date:** June 10, 2015
Facilitator: Irene Nagle, NVDA	**Place/Room:** Municipal Building Conference Room

Name	Title	Company	Phone	E-Mail
Marty Feltus	Selectman	Town of Lyndon	626 9516	marty.feltus @yahoo.com
Joe Dauphin	Superintendent	Village of Lyndonville	535-9242	Lyndonvillewater @Yahoo.Com
Rob Nutting	Foreman	Town of Lyndon	626 5877	Lyndon Roads @ myfairpoint.net
Justin Smith	Municipal Adm.	Town + Village Lyndon(ville)	626-5834	Justin@lyndonvt.org
Kaela Gray	Zoning/Planning	Town & Village	626-1269	Kaelagray@gmail.com
Jack Berube	Planning	Town of Lyndon	626 4154	Jackmanut@aol.com
Kelly Harris	Lister	Town of Lyndon	626-1270	LynLister@lyndonvt.org
Greg Hopkins	Fire Chief	Town of Lyndon	249 1886	chiefhopkins@lyndonvillefire.com
Irene Nagle	NVDA	NVDA		
Ben Copans	Watershed planner	VT DEC	802-751 2610	Ben.copans@state.vt.us
Patrick McLaughlin	Planning + Fire Dept	Town of Lyndon	802 585 4468	Patrick.McLaughlin@state.vt.us
Paul Brouha	DRB & Planning	Town of Sutton	802-467-3460	Paul.brouha@gmail.com
Jamie Caplan	Consultant	Jamie Caplan Consulting	413 586-0867	jamie@jamiecaplan.com

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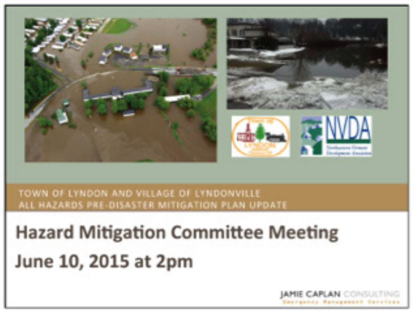
NVDA
TOWN OF LYNDON AND VILLAGE OF LYNDONVILLE
ALL HAZARDS PRE-DISASTER MITIGATION PLAN UPDATE
Hazard Mitigation Committee Meeting
June 10, 2015 at 2pm
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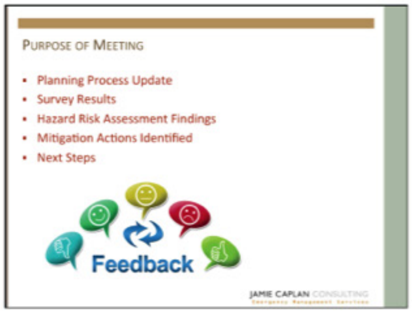
PURPOSE OF MEETING
Planning Process Update
Survey Results
Hazard Risk Assessment Findings
Mitigation Actions Identified
Next Steps
Feedback
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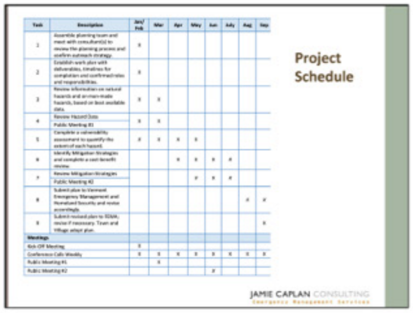
Project Schedule
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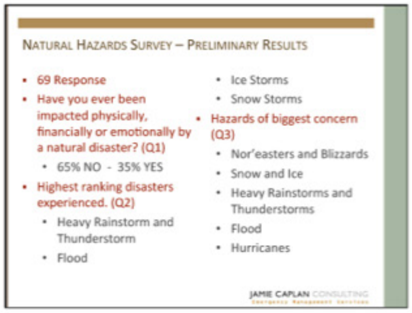
NATURAL HAZARDS SURVEY – PRELIMINARY RESULTS
69 Response
Have you ever been impacted physically, financially or emotionally by a natural disaster? (Q1)
65% NO - 35% YES
Highest ranking disasters experienced. (Q2)
Heavy Rainstorm and Thunderstorm
Flood
Ice Storms
Snow Storms
Hazards of biggest concern (Q3)
Nor'easters and Blizzards
Snow and Ice
Heavy Rainstorms and Thunderstorms
Flood
Hurricanes
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SURVEY RESULTS CONTINUED
Priority Assets (Q5)
1. Fire Stations
2. Bridges
3. Electrical Distribution System and Substation
4. Water Treatment Plant
5. Police Station
6. Wells
7. Gas Stations
8. Schools
9. Elderly Housing
10. Nursing Homes
11. Town Hall
12. Assisted Living Centers
13. Daycare Centers
14. Water Towers
Priorities for Planning (Q6)
1. Protecting emergency services
2. Protecting and reducing damage to utilities
3. Protecting water treatment plant
4. Promoting cooperation among public agencies, citizens, nonprofit organizations, and businesses
5. Preventing new development in high hazard areas
6. Enhancing the function of the natural environment
7. Protecting private property
8. Protecting historical properties
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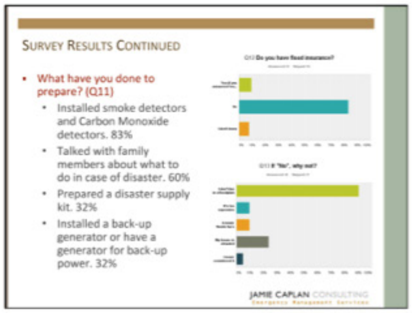
SURVEY RESULTS CONTINUED
What have you done to prepare? (Q11)
Installed smoke detectors and Carbon Monoxide detectors. 83%
Talked with family members about what to do in case of disaster. 60%
Prepared a disaster supply kit. 32%
Installed a back-up generator or have a generator for back-up power. 32%
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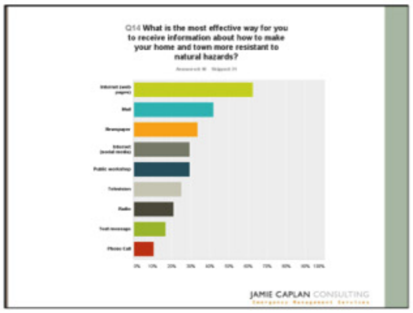
Q14 What is the most effective way for you to receive information about how to make your home and town more resistant to natural hazards?
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
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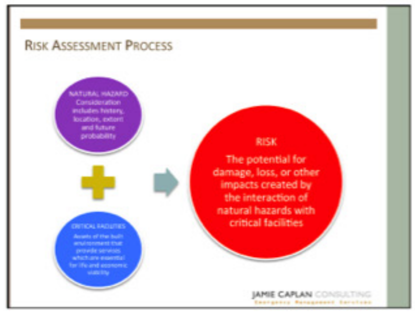
Risk Assessment Process
NATURAL HAZARD
Consideration includes history, location, extent and future probability
CRITICAL FACILITIES
RISK
The potential for damage, loss, or other impacts created by the interaction of natural hazards with critical facilities
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Risk Assessment Approach
Quantitative Analysis
Use of best available data and technology
Deterministic and probabilistic modeling
Qualitative Analysis
Local knowledge and stakeholder collaboration
Priority Risk Index
Hazard Characteristic
Describing Possible Impacts
Determining Most Vulnerable Areas
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Critical Facilities: Provide services essential for life safety and Economic viability and Must continue to operate during and following a disaster.
Municipal Building
Public Safety Building
Lyndonville Electric Department Garage
Town Garage
Village Garage
Lyndon Town School
Lyndon Institute
Lyndon State College
Riverside School
Thaddeus Stevens School
Cobleigh Public Library
Darling Inn
Riverside Enrichment Center
The Pines
Armory Building
St. Elizabeth's Church
Methodist Church
1st Congregational Church
Episcopal Church
Church of Later Day Saints
Kingdom Hall Jehovah's Witness
Lyndon Center Free Baptist Church
Lyndon Bible Church
VFW
Cell Towers
Wastewater Treatment Center
VELCO Substation
LED Substation
Pudding Hill Substation
Great Falls Substation & Hydro Dam
Vail Dam
Caledonia County Airport
Lyndon Rescue
Northeast Kingdom Waste Management
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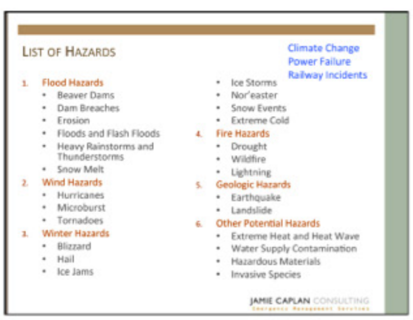
List of Hazards
1. Flood Hazards
Beaver Dams
Dam Breaches
Erosion
Floods and Flash Floods
Heavy Rainstorms and Thunderstorms
Snow Melt
2. Wind Hazards
Hurricanes
Microburst
Tornadoes
3. Winter Hazards
Blizzard
Hail
Ice Jams
Ice Storms
Nor'easter
Snow Events
Extreme Cold
4. Fire Hazards
Drought
Wildfire
Lightning
5. Geologic Hazards
Earthquake
Landslide
6. Other Potential Hazards
Extreme Heat and Heat Wave
Water Supply Contamination
Hazardous Materials
Invasive Species
Climate Change
Power Failure
Railway Incidents
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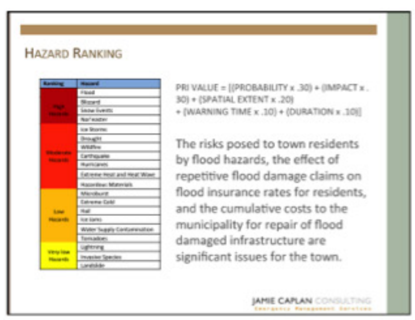
Hazard Ranking
PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]
The risks posed to town residents by flood hazards, the effect of repetitive flood damage claims on flood insurance rates for residents, and the cumulative costs to the municipality for repair of flood damaged infrastructure are significant issues for the town.
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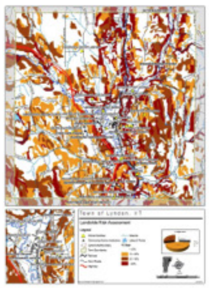

Landslide Risk

- Hazard description
- Location
- Previous occurrences
- Extent (magnitude)
- Probability of future events
- Vulnerability assessment
- Potential losses

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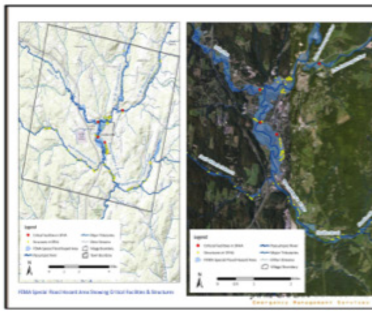

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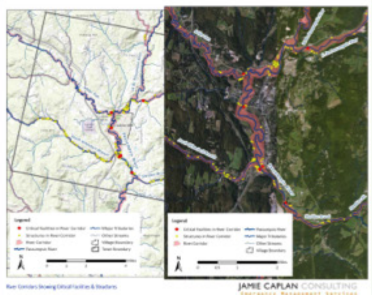

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Areas of particular concern

- The Sanborn Bridge, which poses a potential hazard for ice and debris jams
- The Bridge at the intersection of Lily Pond Road and Route 114, where the channel of the East Branch Passumpsic River is constrained and ice jams and flooding has occurred
- The area of the Millers Run near the covered bridge at the Park & Ride where the river is disconnected from its floodplain
- The ineffectiveness of the series of culverts under Route 5 south of the intersection with Route 114 at conveying flood flows

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Areas of particular concern continued

- Flooding at the major intersection of Routes 5, 114 and 122, which hampers emergency response during disasters
- The Town garage, which is located within the river corridor
- Ice jam potential at sharp bends in the river, such as those near Powers Park and along Stevens Loop
- Ineffective (disconnected) storm drainage on Pleasant Street and Passumpsic Street
- A bank slide along Hawkins Brook

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Hazard Mitigation Goals

- Save Lives and Protect Property
  - Reduce or eliminate risk to people and property from natural and man-made hazards.
- Community Planning
  - Integrate hazard mitigation policies and practices into local planning.
- Regional Collaboration
  - Build capacity for hazard mitigation through regional collaboration.
- Public Awareness
  - Increase public awareness of hazards by implementing outreach and education programs.
- Preservation
  - Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.

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Goal 1 – Save Lives and Property

1. Rte 114/5/122 Junction
2. Rte 5 Dry Relief Culverts
3. Maintain data on cost to town related to flooding in repetitive loss areas.
4. Mobile Home Park Community Preparedness and Response Plan
5. Mobile Home Park Elevation
6. North Main Street Covered Bridge
7. Lyndon Town Garage Site Plan
8. Railroad Flooding Around Broad Street
9. Center Street Bridge Area Buyouts
10. Explore elevation of transportation corridors at problem locations

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Building Resilience Through Community-Based Action Research
Identifying Vulnerabilities And Facilitating Change In Rural Mobile Home Parks

Approximately 19 homes in the Flood Hazard Area

Approximate number of mobile home locations that have any portion located within any flood hazard zone (Floodway, 100-Year Flood Plain, 500-Year Flood Plain). The mobile home location is obtained from a 60 foot buffer around the E911 point for each mobile home

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Goal 1 – Save Lives and Property

11. Reconnect the river to existing floodplain upstream from the village by securing easements on private land.
12. Implement Recommendations from the Bridge and Culvert Assessments
13. Regulate future development along river corridors to prevent erosion and property loss
14. Implement Recommendations from the River Corridor Studies
15. Buyout repetitive loss structures
16. Vail Dam
17. Install Stream Buffers
18. Equipment Protection
19. Connect Broad Street residences across Route 5 to stormwater system.
20. Implement repairs and continue to track status of stormwater system.
21. Covered Bridges

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Goal 2 – Community Planning

22. Continue to build to the snow load standard.
23. Stormwater Master Planning
24. Create a Capital Budget
25. Community Rating System Participation
26. Flooding ordinances and hazard zoning.
27. Planned Unit Development Provisions

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Goal 3 – Regional Collaboration

28. Watershed Collaboration for Stormwater Management

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Goal 4 – Public Awareness

29. VTrans District 7 Transportation Advisory Meetings
30. Floodproofing Education for Business Owners and Homeowners.
31. Education of Businesses on Broad Street

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Goal 5 - Preservation

32. FEMA Flood Maps
33. Watershed Health and Water Quality

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Plan Adoption and Implementation

- Write and Review Plan
  - Hazard Mitigation Committee has the opportunity to review the plan.
  - Recommendations are incorporated.
- Plan Adoption and Implementation
  - DEMHS Reviews Plan
  - FEMA Reviews Plan
- FEMA Approval every 5 years

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Next Steps

- Public Meeting Tonight
- Review of Draft Plan

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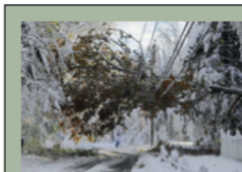

THANK YOU

Jamie Caplan

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jamie@jamiecaplan.com

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Lyndon and Lyndonville Public Preparedness Survey

Thank You for Your Assistance

The Town of Lyndon and the Village of Lyndonville are currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards, and your participation is important to us!

The Hazard Mitigation Committee is working on developing a Hazard Mitigation Plan. The purpose of this plan is to identify and assess each jurisdiction's natural hazard risks (such as flooding, winter storms, hurricanes and earthquakes) and determine how to best minimize or manage those risks. Upon completion, this plan will be presented to each jurisdiction for adoption and submitted to the Vermont Division of Emergency Management and Homeland Security (DEMHS) and Federal Emergency Management Agency (FEMA) for review and approval.

This survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impacts of future disasters. Participation in this survey is voluntary and none of the information you provide will be attributed to you directly.

If you have any questions regarding this survey, or would like to learn about more ways you can participate in the development of the Hazard Mitigation Plan, please contact Irene Nagle, Northeastern Vermont Development Association at 802-424-1423 or ingle@nvda.net.

Page 1

Lyndon and Lyndonville Public Preparedness Survey

1. Have you ever been impacted physically, financially or emotionally by a natural disaster?

- ◯ Yes
- ◯ No (If you answer No, please move to Question 3)

2. Which of these disasters have you experienced?

- ☐ Flood
- ☐ Heavy Rainstorms and Thunderstorms
- ☐ Hurricanes
- ☐ Tornadoes
- ☐ Nor'easter
- ☐ Snow Storms
- ☐ Ice Storms
- ☐ Drought
- ☐ Wildfire
- ☐ Earthquake
- ☐ Landslide
- ☐ Extreme Cold
- ☐ Extreme Heat

Other (please specify)

Page 2

Lyndon and Lyndonville Public Preparedness Survey

3. How concerned are you about the following hazards?

	Very Concerned	Neutral	Not Concerned
Flood	○	○	○
Heavy Rainstorms and Thunderstorms	○	○	○
Hurricanes	○	○	○
Tornadoes	○	○	○
Nor'easter	○	○	○
Snow Storms	○	○	○
Ice Storms	○	○	○
Drought	○	○	○
Wildfire	○	○	○
Earthquake	○	○	○
Landslide	○	○	○
Extreme Cold	○	○	○
Extreme Heat	○	○	○

4. In terms of vulnerability to natural hazards, how concerned are you about the the following categories?

	Very	Moderately	Not at all
People (Loss of life and/or injuries)	○	○	○
Economic (Business interruptions/closures, job losses, etc.)	○	○	○
Infrastructure (Damage/loss or roads, bridges, utilities, schools, etc.)	○	○	○
Cultural/Historic (Damage or loss of libraries, museums, historic properties, etc.)	○	○	○
Environmental (Damage, contamination or loss of forests, trees, etc.)	○	○	○
Governance (Ability to maintain order and/or provide public amenities and services.)	○	○	○

Page 3

Lyndon and Lyndonville Public Preparedness Survey

5. How important are the following community assets to you?

	Very Important	Neutral	Not Important
Assisted Living Centers	○	○	○
Bridges	○	○	○
Daycare Centers	○	○	○
Elderly Housing	○	○	○
Electrical Distribution System and Substation	○	○	○
Fire Stations	○	○	○
Gas Stations	○	○	○
Nursing Homes	○	○	○
Police Station	○	○	○
Schools (K-12)	○	○	○
Town Hall	○	○	○
Water Treatment Plant	○	○	○
Wells	○	○	○
Water Towers	○	○	○

Other (please specify)

Page 4

Lyndon and Lyndonville Public Preparedness Survey

6. Let us know your priorities regarding planning for natural hazards in your community.

	Very Important	Neutral	Not Important
Protecting private property	◯	◯	◯
Preventing new development in high hazard areas	◯	◯	◯
Enhancing the function of natural environment	◯	◯	◯
Protecting historical properties	◯	◯	◯
Protecting and reducing damage to utilities	◯	◯	◯
Protecting water treatment plant	◯	◯	◯
Protecting emergency services (fire, police, and ambulance.)	◯	◯	◯
Promoting cooperation among public agencies, citizens, non-profit organizations, and businesses	◯	◯	◯

7. In your opinion, what are some actions your community could take to reduce or eliminate the risk of future natural hazard damages?

Page 5

Lyndon and Lyndonville Public Preparedness Survey

8. How important are each of these mitigation categories to you?

	Very Important	Neutral	Not Important
Local Plans and Regulations (For instance, stormwater management regulations, building codes or open space preservation.)	○	○	○
Structure and Infrastructure Projects	○	○	○
Natural Systems Protection	○	○	○
Education and Awareness Programs	○	○	○

9. Is your home at risk to the following hazards? (Check all that apply.)

- [ ] Flood
- [ ] Hurricanes
- [ ] Tornadoes
- [ ] Wildfire
- [ ] Earthquake
- [ ] Landslide
- [ ] I don't know

10. Do you know what to do in the event of these emergencies?

	YES	NO
Flood	○	○
Hurricanes	○	○
Tornadoes	○	○
Wildfire	○	○
Earthquake	○	○
Landslide	○	○

Lyndon and Lyndonville Public Preparedness Survey

11. What have you done to prepare for a disaster?

	Have Done	Plan to Do	Not Done	Unable to Do
Gathered information on natural disasters or emergency preparedness.	◯	◯	◯	◯
Talked with family members about what to do in case of a natural disaster.	◯	◯	◯	◯
Developed a "Household/Family Emergency Plan."	◯	◯	◯	◯
Prepared a "Disaster Supply Kit."	◯	◯	◯	◯
Been trained in first aid or CPR in the last year.	◯	◯	◯	◯
Installed smoke detectors and carbon monoxide detectors on each level of our house.	◯	◯	◯	◯
Discussed a utility shutoff procedure in the event of a natural disaster.	◯	◯	◯	◯
Installed a back-up generator or have a generator for temporary power.	◯	◯	◯	◯

12. Do you have flood insurance?

◯ Yes (if you answered Yes, please go to Question 14 next)

◯ No

◯ I don't know

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Lyndon and Lyndonville Public Preparedness Survey

13. If "No", why not?

- [ ] I don't live in a floodplain
- [ ] It's too expensive
- [ ] It never floods here
- [ ] My house is elevated
- [ ] I never considered it

Other (please specify)

14. What is the most effective way for you to receive information about how to make your home and town more resistant to natural hazards?

- [ ] Phone Call
- [ ] Newspaper
- [ ] Television
- [ ] Radio
- [ ] Internet (web pages)
- [ ] Internet (social media)
- [ ] Text message
- [ ] Mail
- [ ] Public workshop

Other (please specify)

15. Where do you live?

- ○ Town of Lyndon
- ○ Village of Lyndonville
- ○ Other

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Lyndon and Lyndonville Public Preparedness Survey

16. Please add any comments you would like to make regarding hazard mitigation and disaster preparedness.

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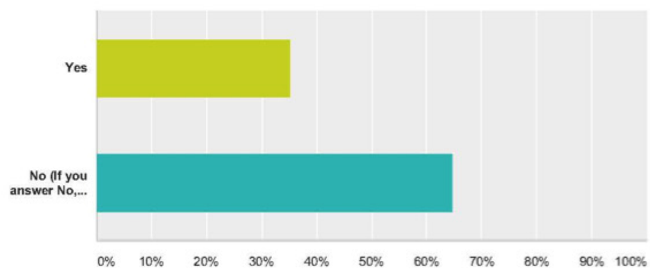
Q1 Have you ever been impacted physically, financially or emotionally by a natural disaster?

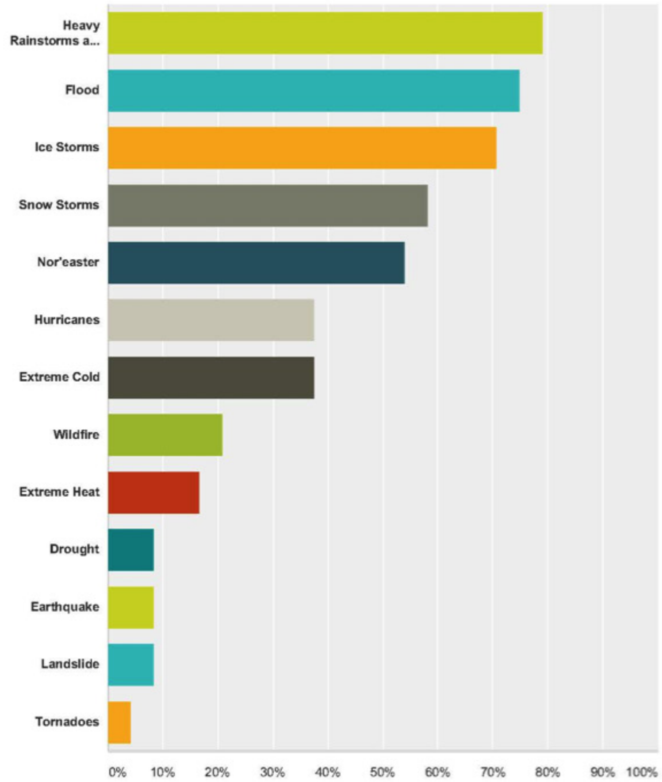
Answered: 68 Skipped: 1



Answer Choices	Responses	
Yes	35.29%	24
No (If you answer No, please move to Question 3)	64.71%	44
Total		68

Q2 Which of these disasters have you experienced?

Answered: 24 Skipped: 45



Answer Choices	Responses	
Heavy Rainstorms and Thunderstorms	79.17%	19
Flood	75.00%	18
Ice Storms	70.83%	17
Snow Storms	58.33%	14
Nor'easter	54.17%	13

Hurricanes	37.50%	9
Extreme Cold	37.50%	9
Wildfire	20.83%	5
Extreme Heat	16.67%	4
Drought	8.33%	2
Earthquake	8.33%	2
Landslide	8.33%	2
Tornadoes	4.17%	1
Total Respondents: 24		

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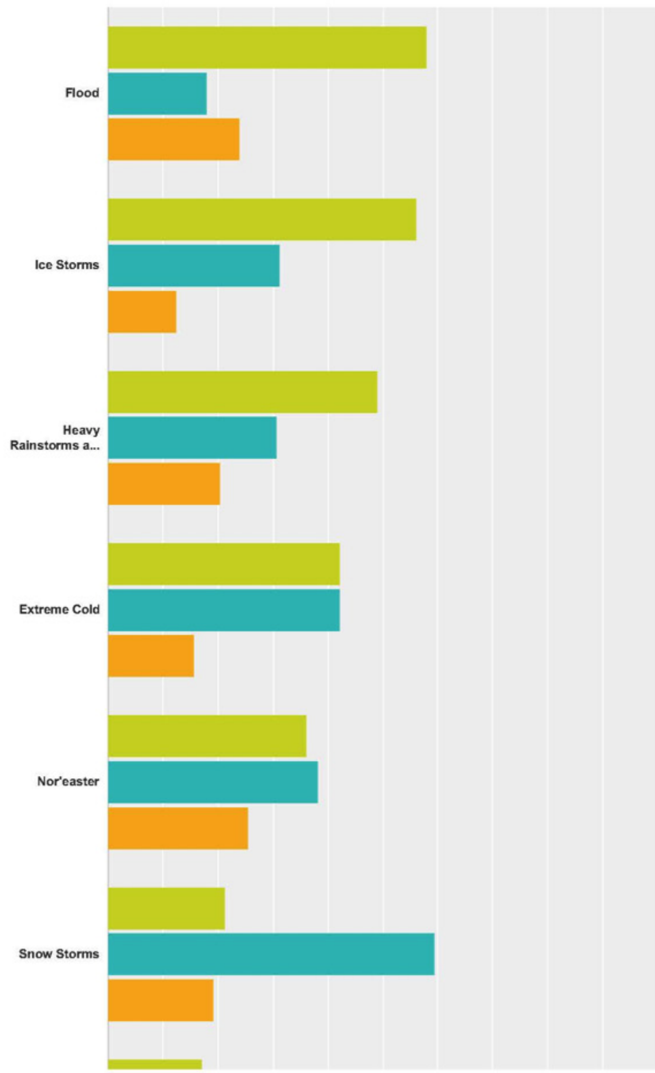
Q3 How concerned are you about the following hazards?

Answered: 50 Skipped: 19



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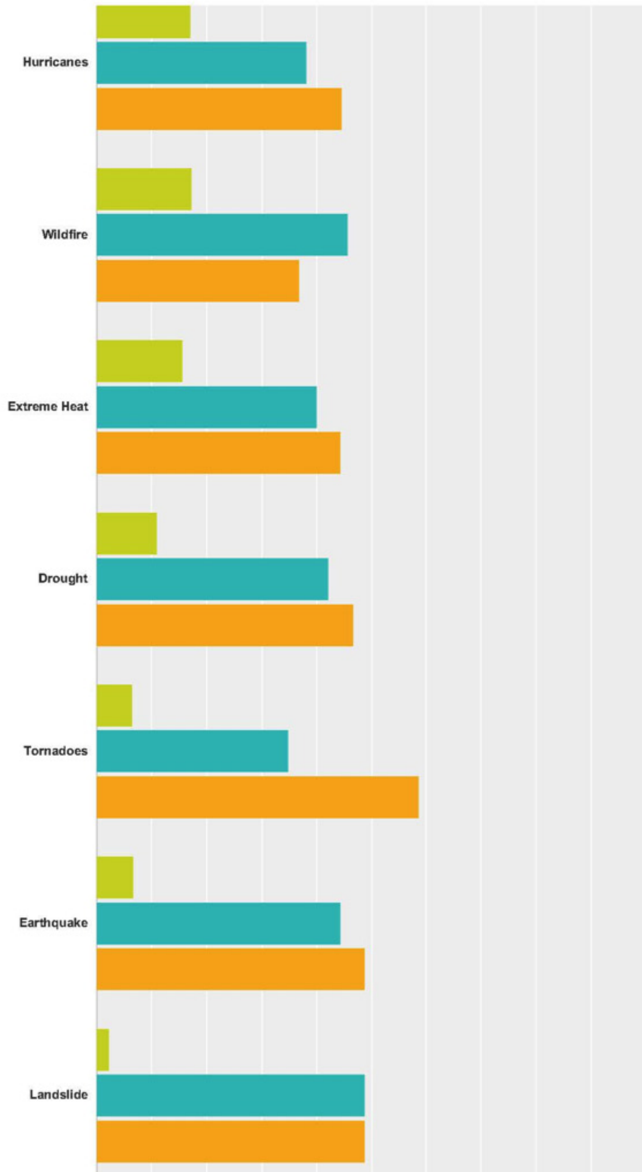
Lyndon and Lyndonville Public Preparedness Survey SurveyMonkey



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0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Very Concerned Neutral Not Concerned

	Very Concerned	Neutral	Not Concerned	Total
Flood	58.00% 29	18.00% 9	24.00% 12	50
Ice Storms	56.25% 27	31.25% 15	12.50% 6	48
Heavy Rainstorms and Thunderstorms	48.98% 24	30.61% 15	20.41% 10	49
Extreme Cold	42.22% 19	42.22% 19	15.56% 7	45
Nor'easter	36.17% 17	38.30% 18	25.53% 12	47
Snow Storms	21.28% 10	59.57% 28	19.15% 9	47
Hurricanes	17.02% 8	38.30% 18	44.68% 21	47
Wildfire	17.39% 8	45.65% 21	36.96% 17	46
Extreme Heat	15.56% 7	40.00% 18	44.44% 20	45
Drought	11.11% 5	42.22% 19	46.67% 21	45
Tornadoes	6.52% 3	34.78% 16	58.70% 27	46
Earthquake	6.67% 3	44.44% 20	48.89% 22	45
Landslide	2.22% 1	48.89% 22	48.89% 22	45

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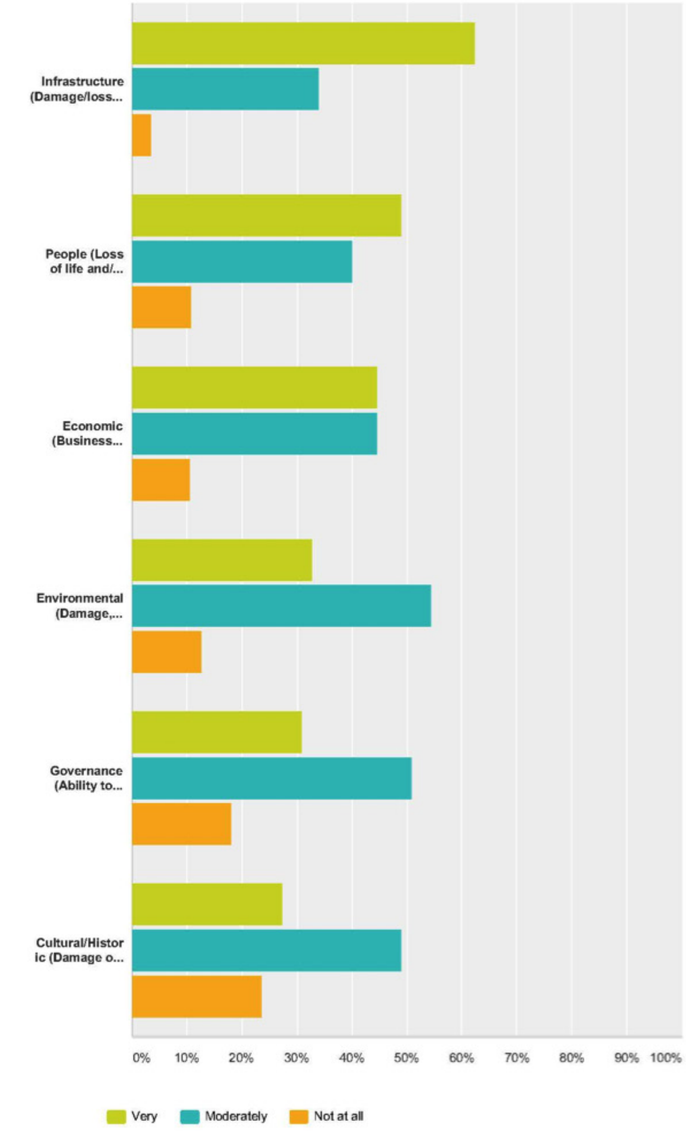
Q4 In terms of vulnerability to natural hazards, how concerned are you about the the following categories?

Answered: 56 Skipped: 13

Lyndon and Lyndonville Public Preparedness Survey

SurveyMonkey



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	Very	Moderately	Not at all	Total
Infrastructure (Damage/loss or roads, bridges, utilities, schools, etc.)	**62.50%** 35	**33.93%** 19	**3.57%** 2	56
People (Loss of life and/or injuries)	**49.09%** 27	**40.00%** 22	**10.91%** 6	55
Economic (Business interruptions/closures, job losses, etc.)	**44.64%** 25	**44.64%** 25	**10.71%** 6	56
Environmental (Damage, contamination or loss of forests, trees, etc.)	**32.73%** 18	**54.55%** 30	**12.73%** 7	55
Governance (Ability to maintain order and/or provide public amenities and services.)	**30.91%** 17	**50.91%** 28	**18.18%** 10	55
Cultural/Historic (Damage or loss of libraries, museums, historic properties, etc.)	**27.27%** 15	**49.09%** 27	**23.64%** 13	55

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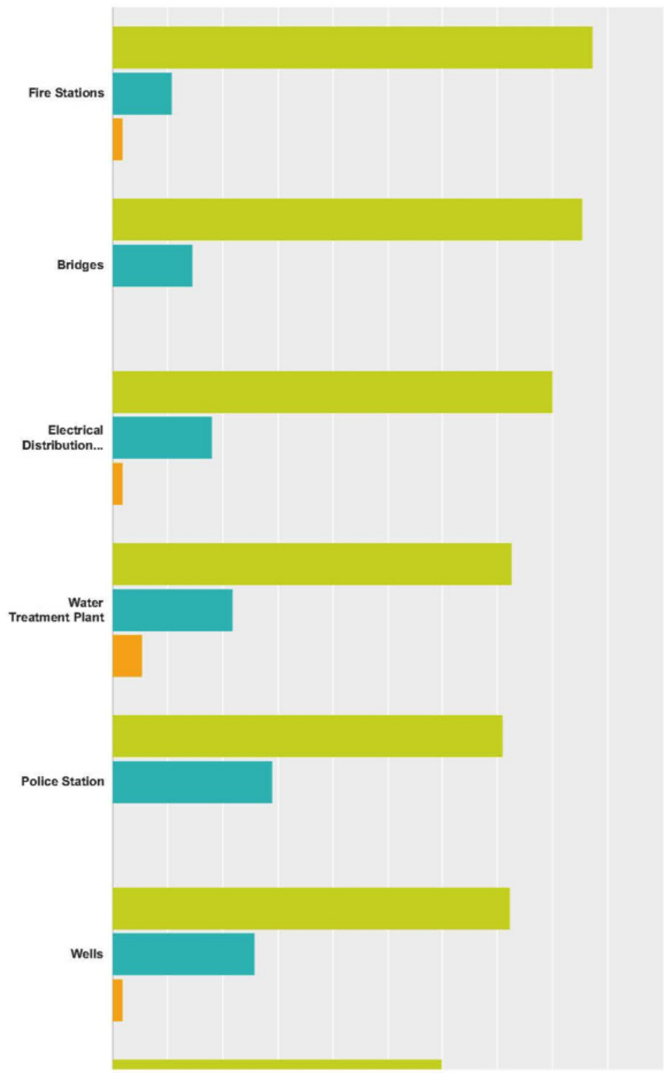
Q5 How important are the following community assets to you?

Answered: 55 Skipped: 14



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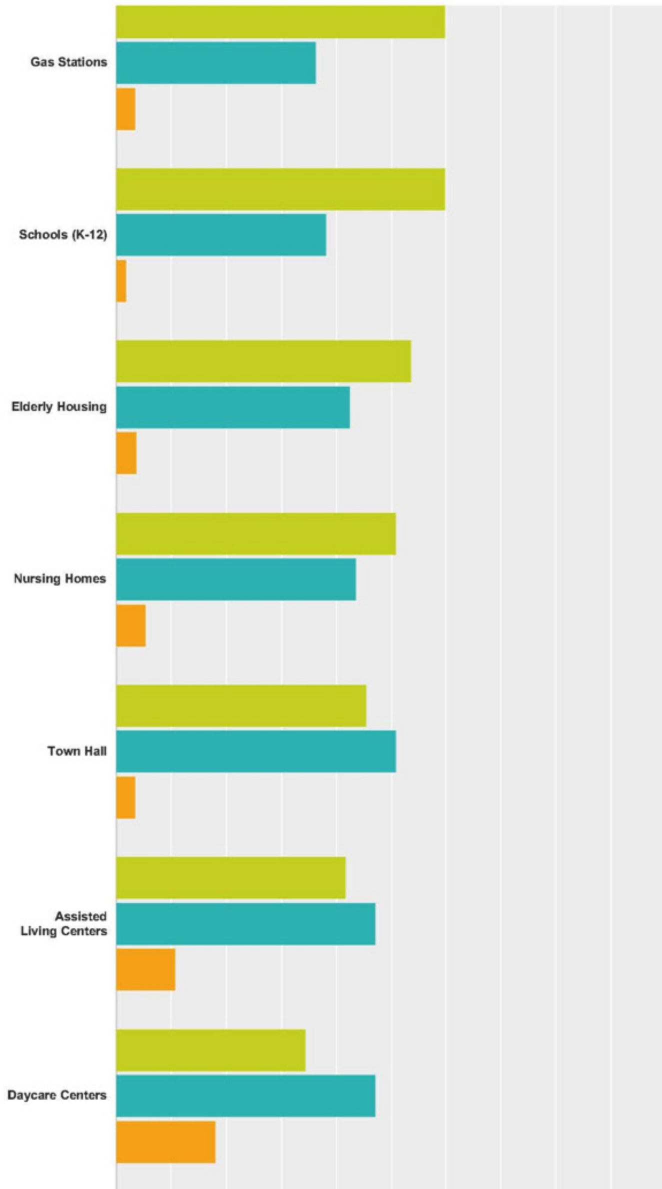

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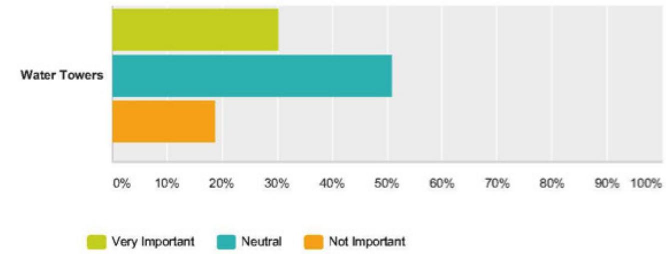

	Very Important	Neutral	Not Important	Total
Fire Stations	87.27% 48	10.91% 6	1.82% 1	55
Bridges	85.45% 47	14.55% 8	0.00% 0	55
Electrical Distribution System and Substation	80.00% 44	18.18% 10	1.82% 1	55
Water Treatment Plant	72.73% 40	21.82% 12	5.45% 3	55
Police Station	70.91% 39	29.09% 16	0.00% 0	55
Wells	72.22% 39	25.93% 14	1.85% 1	54
Gas Stations	60.00% 33	36.36% 20	3.64% 2	55
Schools (K-12)	60.00% 33	38.18% 21	1.82% 1	55
Elderly Housing	53.70% 29	42.59% 23	3.70% 2	54
Nursing Homes	50.91% 28	43.64% 24	5.45% 3	55
Town Hall	45.45% 25	50.91% 28	3.64% 2	55
Assisted Living Centers	41.82% 23	47.27% 26	10.91% 6	55
Daycare Centers	34.55% 19	47.27% 26	18.18% 10	55
Water Towers	30.19% 16	50.94% 27	18.87% 10	53

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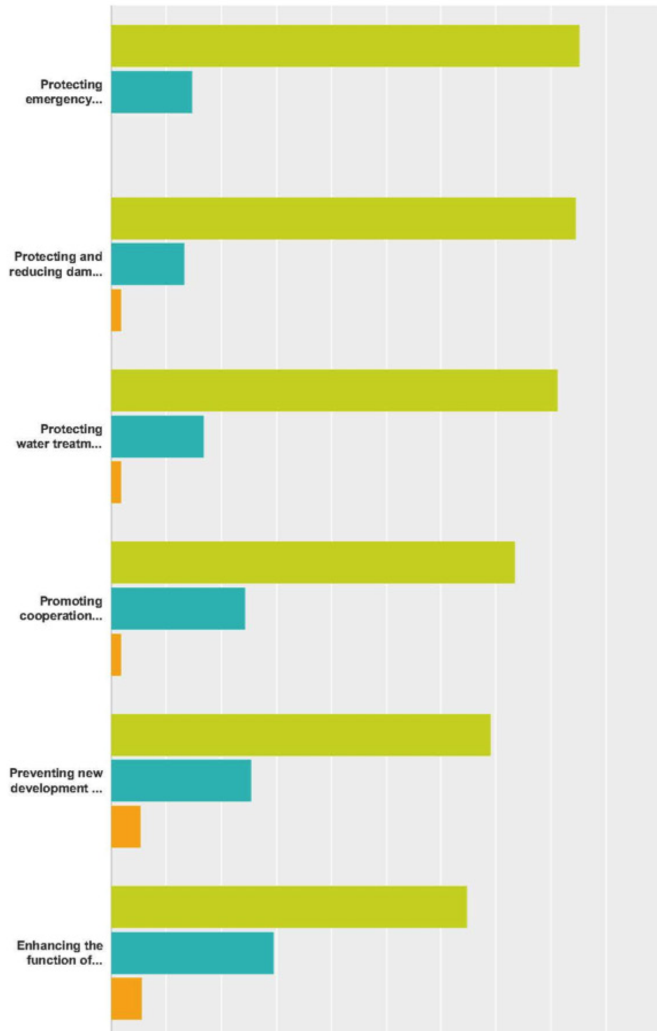
Lyndon and Lyndonville Public Preparedness Survey SurveyMonkey

Q6 Let us know your priorities regarding planning for natural hazards in your community.

Answered: 55 Skipped: 14



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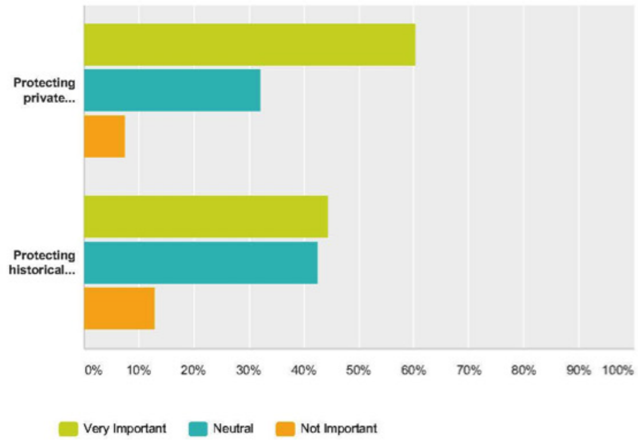

	Very Important	Neutral	Not Important	Total
Protecting emergency services (fire, police, and ambulance.)	85.19% 46	14.81% 8	0.00% 0	54
Protecting and reducing damage to utilities	84.62% 44	13.46% 7	1.92% 1	52
Protecting water treatment plant	81.13% 43	16.98% 9	1.89% 1	53
Promoting cooperation among public agencies, citizens, non-profit organizations, and businesses	73.58% 39	24.53% 13	1.89% 1	53
Preventing new development in high hazard areas	69.09% 38	25.45% 14	5.45% 3	55
Enhancing the function of natural environment	64.81% 35	29.63% 16	5.56% 3	54
Protecting private property	60.38% 32	32.08% 17	7.55% 4	53
Protecting historical properties	44.44% 24	42.59% 23	12.96% 7	54

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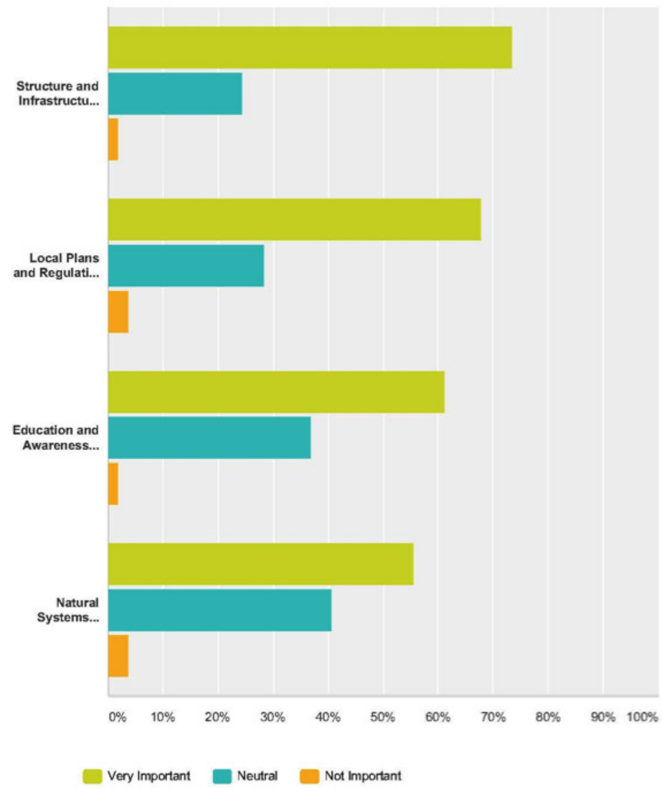
Q7 In your opinion, what are some actions your community could take to reduce or eliminate the risk of future natural hazard damages?

Answered: 23 Skipped: 46

Lyndon and Lyndonville Public Preparedness Survey | SurveyMonkey

Q8 How important are each of these mitigation categories to you?

Answered: 54 Skipped: 15



	Very Important	Neutral	Not Important	Total
Structure and Infrastructure Projects	73.58% 39	24.53% 13	1.89% 1	53
Local Plans and Regulations (For instance, stormwater management regulations, building codes or open space preservation.)	67.92% 36	28.30% 15	3.77% 2	53
Education and Awareness Programs	61.11% 33	37.04% 20	1.85% 1	54

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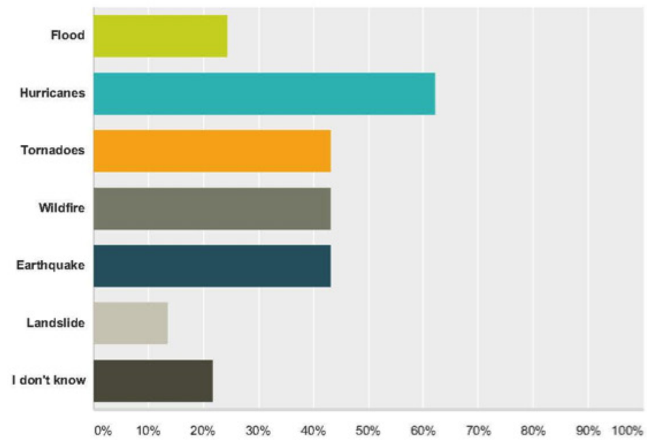
Natural Systems Protection	**55.56%** 30	**40.74%** 22	**3.70%** 2	54

Lyndon and Lyndonville Public Preparedness Survey SurveyMonkey

Q9 Is your home at risk to the following hazards? (Check all that apply.)

Answered: 37 Skipped: 32

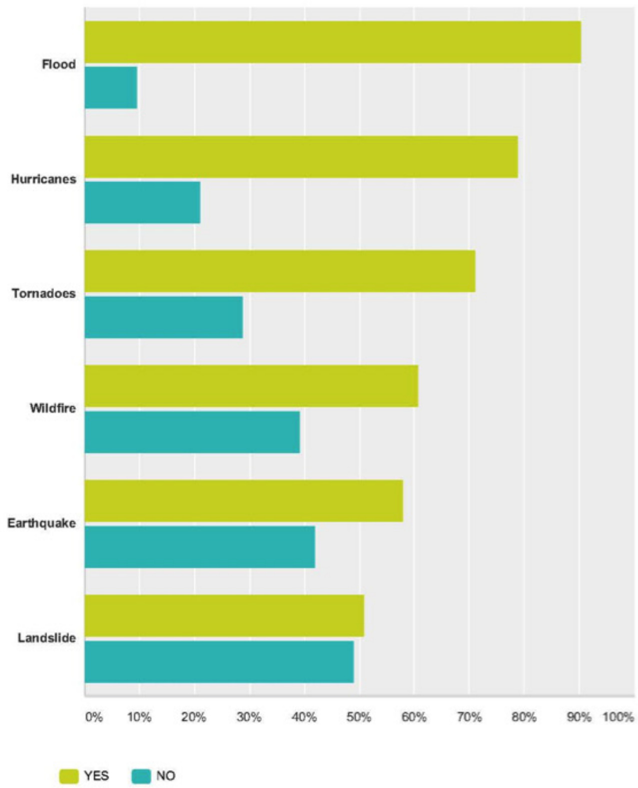


Answer Choices	Responses	
Flood	24.32%	9
Hurricanes	62.16%	23
Tornadoes	43.24%	16
Wildfire	43.24%	16
Earthquake	43.24%	16
Landslide	13.51%	5
I don't know	21.62%	8
Total Respondents: 37		

18 / 29

Q10 Do you know what to do in the event of these emergencies?

Answered: 53 Skipped: 16



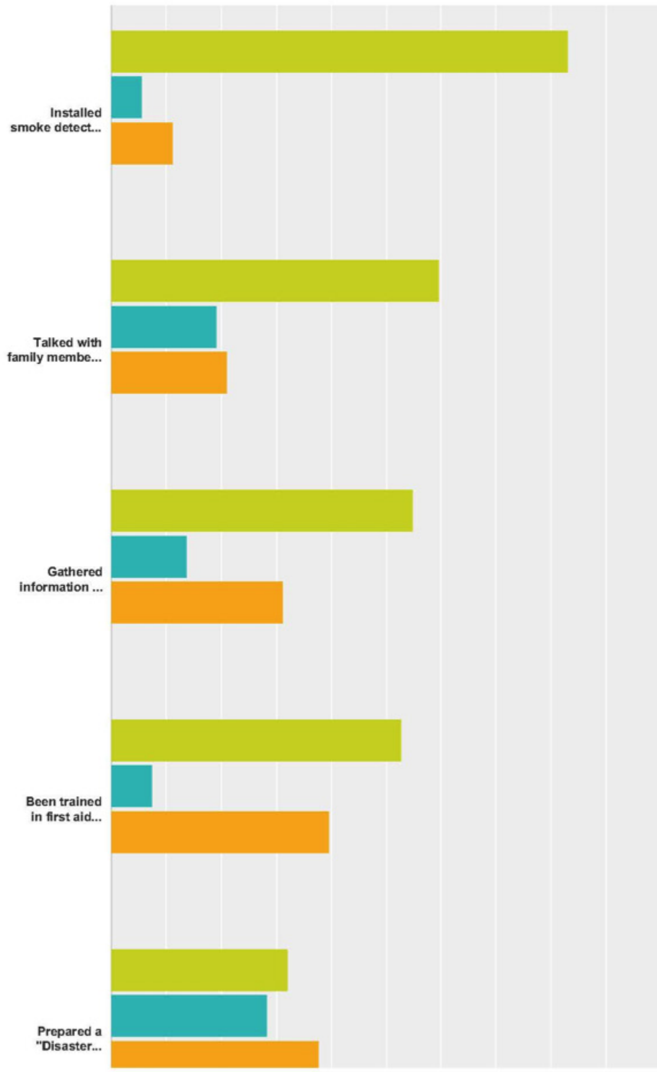
	YES	NO	Total
Flood	**90.38%** 47	**9.62%** 5	52
Hurricanes	**78.85%** 41	**21.15%** 11	52
Tornadoes	**71.15%** 37	**28.85%** 15	52
Wildfire	**60.78%** 31	**39.22%** 20	51

Earthquake	58.00% 29	42.00% 21	50
Landslide	51.02% 25	48.98% 24	49

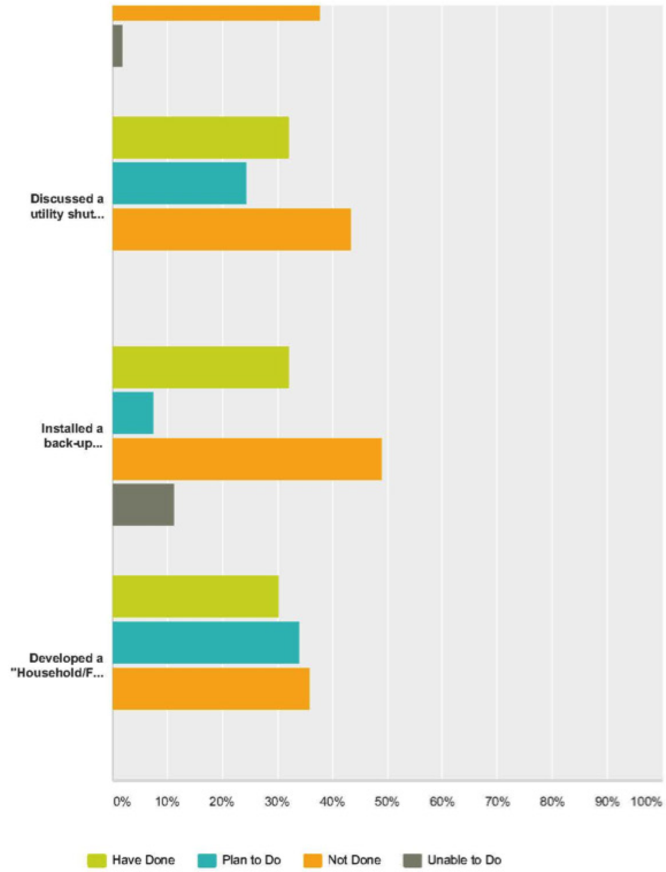
Lyndon and Lyndonville Public Preparedness Survey SurveyMonkey

Q11 What have you done to prepare for a disaster?

Answered: 53 Skipped: 16



21 / 29



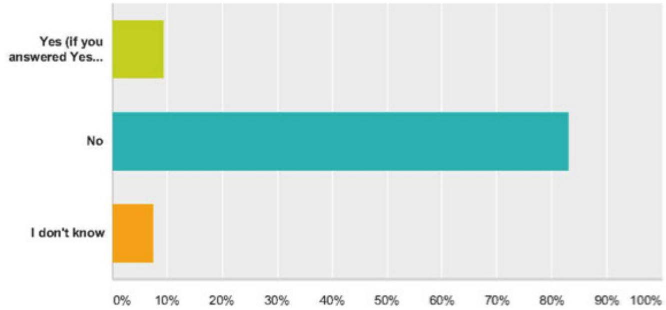
	Have Done	Plan to Do	Not Done	Unable to Do	Total
Installed smoke detectors and carbon monoxide detectors on each level of our house.	**83.02%** 44	**5.66%** 3	**11.32%** 6	**0.00%** 0	53
Talked with family members about what to do in case of a natural disaster.	**59.62%** 31	**19.23%** 10	**21.15%** 11	**0.00%** 0	52
Gathered information on natural disasters or emergency preparedness.	**54.90%** 28	**13.73%** 7	**31.37%** 16	**0.00%** 0	51
Been trained in first aid or CPR in the last year.	**52.83%** 28	**7.55%** 4	**39.62%** 21	**0.00%** 0	53

Prepared a "Disaster Supply Kit."	**32.08%** 17	**28.30%** 15	**37.74%** 20	**1.89%** 1	53
Discussed a utility shutoff procedure in the event of a natural disaster.	**32.08%** 17	**24.53%** 13	**43.40%** 23	**0.00%** 0	53
Installed a back-up generator or have a generator for temporary power.	**32.08%** 17	**7.55%** 4	**49.06%** 26	**11.32%** 6	53
Developed a "Household/Family Emergency Plan."	**30.19%** 16	**33.96%** 18	**35.85%** 19	**0.00%** 0	53

Lyndon and Lyndonville Public Preparedness Survey SurveyMonkey

Q12 Do you have flood insurance?

Answered: 53 Skipped: 16

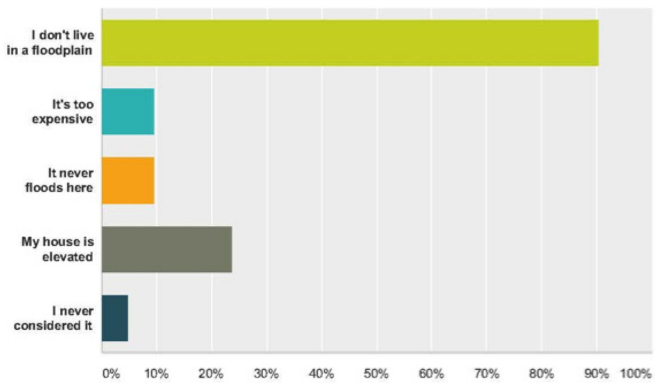


Answer Choices	Responses	
Yes (if you answered Yes, please go to Question 14 next)	9.43%	5
No	83.02%	44
I don't know	7.55%	4
Total		**53**

24 / 29

Q13 If "No", why not?

Answered: 42 Skipped: 27

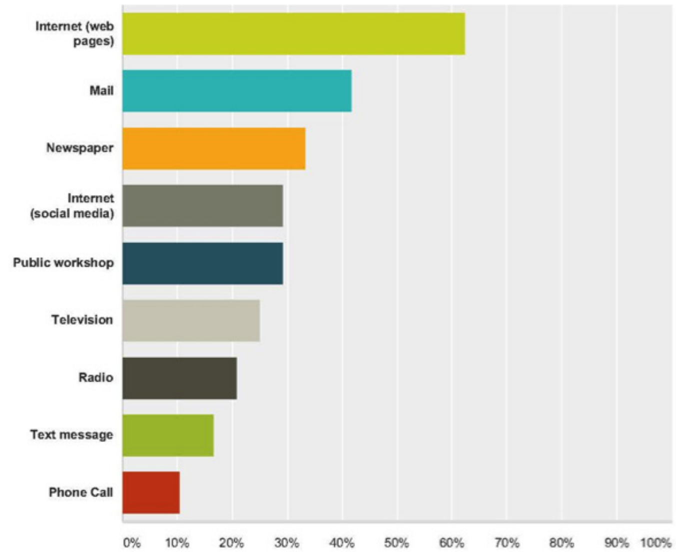


Answer Choices	Responses	
I don't live in a floodplain	90.48%	38
It's too expensive	9.52%	4
It never floods here	9.52%	4
My house is elevated	23.81%	10
I never considered it	4.76%	2
Total Respondents: 42		

Lyndon and Lyndonville Public Preparedness Survey SurveyMonkey

Q14 What is the most effective way for you to receive information about how to make your home and town more resistant to natural hazards?

Answered: 48 Skipped: 21



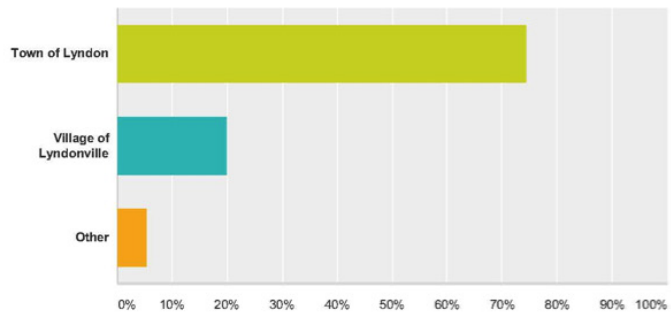
Answer Choices	Responses	
Internet (web pages)	62.50%	30
Mail	41.67%	20
Newspaper	33.33%	16
Internet (social media)	29.17%	14
Public workshop	29.17%	14
Television	25.00%	12
Radio	20.83%	10
Text message	16.67%	8
Phone Call	10.42%	5

26 / 29

Total Respondents: 48	

Q15 Where do you live?

Answered: 55 Skipped: 14



Answer Choices	Responses	
Town of Lyndon	74.55%	41
Village of Lyndonville	20.00%	11
Other	5.45%	3
Total		55

Q16 Please add any comments you would like to make regarding hazard mitigation and disaster preparedness.

Answered: 5 Skipped: 64

Public Safety Building
316 Main Street
Lyndon, VT

3/12/15 at 6:00 pm

Fires, Floods and Winter Storms

Share Your Ideas for Reducing Risk

Preparing a Hazard Mitigation Plan For FEMA Approval

MARCH 12, 2015

DISASTER PLANNING MEETING

The Town of Lyndon and Village of Lyndonville are currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards, and your participation is important to them!

MORE INFORMATION CONTACT

Irene Nagle

Senior Planner, NVDA

802-424-1423

inagle@nvda.net

Disaster Planning Meeting
Th. 3/12 at 6 PM, Public Safety Building
https://www.surveymonkey.com/r/LyndonVT

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https://www.surveymonkey.com/r/LyndonVT

Disaster Planning Survey and Public Meeting

Town of Lyndon and Village of Lyndonville, Vermont

The Town of Lyndon and Village of Lyndonville are currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards, and public participation is essential!

Join the Hazard Mitigation Committee on March 12, 2015 from 6:00 pm – 7:00 pm to share your ideas for reducing risk and becoming less vulnerable to natural hazards such as floods, hurricanes and winter storms. The meeting will be held at the Public Safety Building, 316 Main Street, Lyndon, Vermont.

The public is also encouraged to complete the Public Preparedness Survey. It is online at https://www.surveymonkey.com/r/LyndonVT. The survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impacts of future disasters.

The purpose of the Multi-Jurisdiction Hazard Mitigation Plan Update is to identify and assess the community's natural hazard risks and determine how to best minimize and manage those risks. Upon completion, the plan will be presented to the Town of Lyndon and Village of Lyndonville for adoption and submitted to Vermont Division of Emergency Management and Homeland Security (DEMHS) and Federal Emergency Management Agency (FEMA) for review and approval. A FEMA approved plan makes these communities eligible for federal and state mitigation grant funding.

The Northeastern Vermont Development Association (NVDA) was awarded a grant from the DEMHS to develop the Multi-Jurisdiction Hazard Mitigation Plan Update; the previous plan was developed in 2005. The NVDA hired Jamie Caplan Consulting LLC to work with them and the Town and Village to develop the Multi-Jurisdiction Hazard Mitigation Plan Update.

If you have any questions regarding the meeting or the survey, or would like to learn about more ways you can participate in the development of the Hazard Mitigation Plan, please contact Irene Nagle, Senior Planner, Northeastern Vermont Development Association at 802-424-1423 or inagle@nvda.net.

Hazard Mitigation Public Meeting Sign-In Sheet

Project: Town of Lyndon and Village of Lyndonville PDM		**Meeting Date:**	March 12, 2015
Facilitator:	Irene Nagle, NVDA	**Place/Room:**	Public Safety Building

Name	Company/Resident	Phone	E-Mail
Dan Daley	Lyndon Planning Commission	793-6292	don.daley@charter.net
Amy Gale	Lyndon Town School	626 3209	agale@cnsuschools.org
Kaela Gray	Town of Lyndon	626-1269	Kaela.gray@gmail.com.
Ron Aiken	Village of Lyndonville	427-3149	raikens1@charter.net
Mike Schlesinger	Village of Lyndonville	427 3221	MJSTOPPELHAGAR@AOL.COM
Ben Copans	VT DEC/ ST J planning c.	751-2610	Ben.copans@state.vt.us
Justin Smith	Municipal Administrator	626-5834	Justin@lyndonvt.org
Al Dilley	Lyndon Planning	626-9028	aldilley@myfairpoint.net
Patrick McLaughlin	Lyndon Planning	585-4468	Patrick.McLaughlin@Stdvdus
Ken Burchesky	Town Energy Coordinator	626-3235	
Sarah Houghton	Lyndon Rescue	626 3061	Sarah.c.Houghton@gmail.com
Irene Nagle	NVDA		inagle@nvda.net

3/22/15


TOWN OF LYNDON AND VILLAGE OF LYNDONVILLE
ALL HAZARDS PRE-DISASTER MITIGATION PLAN UPDATE

Hazard Mitigation Public Meeting
March 12, 2015 at 6pm

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Purpose of Meeting

- Why Mitigation Planning?
- Project Planning Process
- Question and Answers
- Next Steps

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Categories of FEMA Public Assistance

- Emergency Work
  - Debris Removal
  - Emergency Protective Measures
- Permanent Work – Requires Mitigation Plan
  - Road Systems and Bridges
  - Water Control Facilities
  - Buildings, Contents, and Equipment
  - Utilities
  - Parks, Recreation, and Other

FEMA Reimburses 75% of costs

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Mitigation Defined

- Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters.
- Mitigation is taking action *now*—before the next disaster—to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk).

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Mitigation Examples

- Local Planning and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness

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Getting Started Exercise

1. Who lives in Lyndon and Lyndonville?
2. What buildings, organizations and infrastructure do the people here rely on?
3. What weather related hazards impact these people and/or the buildings, organizations and infrastructure?
4. What can be done to lessen the impact of these hazards and to protect people and property?

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1

3/22/15

Public Outreach

- "Ground-truthing" – Local Knowledge
- Consensus building
- Hazard Mitigation Committee
- Public Meetings
- Mitigation Plan Survey
  - https://www.surveymonkey.com/r/LyndonVT
- Stakeholder Meetings
- Review Draft Plan

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Emergency Management Services

Hazard Mitigation Committee

NAME	TITLE
Jamie Caplan	Consultant
Irene Nagle	Planner, NVDA
Barry O'Brien	NRCS
Ron Allen	Trustee
Marty Feltus	Selectboard
Ray Dunscher	Trustee
Justin Smith	Municipal Administrator
Kaela Gray	Planning Director/Zoning Adm.
Patrick McLaughlin	FC, Fire Dept., Fire Marshall, Lyndon Rescue
Jack Harris	Police Chief
Greg Hopkins	Fire Chief
Robert Nutting	Town Road Foreman
Ben Mason	Lyndonville Electric Manager
Joe Dauphin	Public Works
LTI Rep.	Amy Gale
LI Rep.	Bob Heath
LSC Rep.	George Hacking
Wheelock Rep.	Roger DeKett
Burke Rep.	Al Dusty
Kirby Rep.	Brad Libbey
St. J Rep.	Ben Copans
Danville Rep.	Jeffrey Paquet
Sutton Rep.	Paul Brouha

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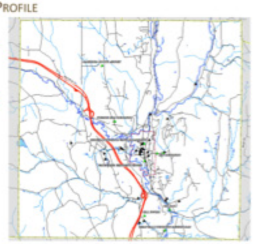
Emergency Management Services

Planning Area Profile

- Demographics
- Geography
- Climate
- Transportation Network
- Land Use & Development Patterns



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Emergency Management Services

Current Hazards List

1. Floods
2. Hazardous Materials
3. Water Supply Contamination
4. Winter Storm/Ice
5. Fire

- Tornado
- Flood
- Flash Flood
- Hazardous Materials
- Radiological Incident
- Structural Fire
- Power Failure
- Winter Storm/Ice
- High Wind
- Air Crash
- Water Supply Contamination
- Hurricane
- Earthquake
- Dam Failures
- Drought
- Chemical or Biological Incident
- Highway Incident
- Wildfire/Forest Fire
- Landslide
- School Safety Issues
- Terrorism

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Emergency Management Services

Proposed List of Hazards

Climate Change
Power Failure
Railway Incidents

1. Flood Hazards
   - Beaver Dams
   - Dam Breaches
   - Erosion
   - Floods and Flash Floods
   - Heavy Rainstorms and Thunderstorms
   - Snow Melt
2. Wind Hazards
   - Hurricanes
   - Microburst
   - Tornadoes
3. Winter Hazards
   - Blizzard
   - Hail
   - Ice Jams
   - Ice Storms
   - Nor'easter
   - Snow Events
   - Extreme Cold
4. Fire Hazards
   - Drought
   - Wildfire
5. Geologic Hazards
   - Earthquake
   - Landslide
6. Other Potential Hazards
   - Extreme Heat and Heat Wave
   - Lightening
   - Water Supply Contamination
   - Hazardous Materials
   - Invasive Species

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Emergency Management Services

Critical Facilities and Infrastructure

- Provide services essential for life safety and economic viability.
- Must continue to operate during and following a disaster.

Critical Facilities	High Potential Loss Facilities	Infrastructure Systems
Hospitals and medical facilities	Nuclear power plants	Water and wastewater
Police and fire stations	Dams	Power utilities
Emergency operations centers	Military and civil defense installations	Transportation (roads, railways, waterways)
Evacuation shelters	Locations housing hazardous materials	Communication systems/centers
Schools		Energy pipelines and storage
Airports/heliports		

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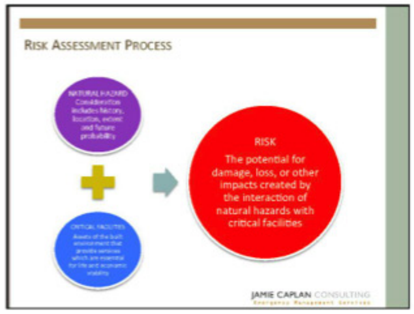
Emergency Management Services

2


CRITICAL FACILITIES: Provide services essential for life safety and economic viability and must continue to operate during and following a disaster.
JAMIE CAPLAN CONSULTING
Emergency Management Services


RISK ASSESSMENT PROCESS
NATURAL HAZARD
CRITICAL FACILITIES
RISK
The potential for damage, loss, or other impacts created by the interaction of natural hazards with critical facilities
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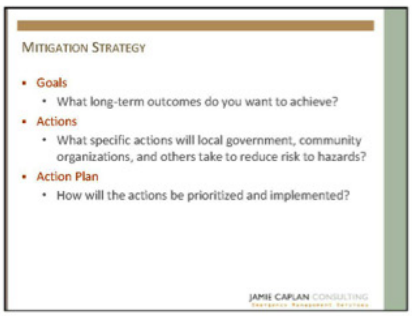
Emergency Management Services


MITIGATION STRATEGY
Goals
What long-term outcomes do you want to achieve?
Actions
What specific actions will local government, community organizations, and others take to reduce risk to hazards?
Action Plan
How will the actions be prioritized and implemented?
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Emergency Management Services


PROPOSED GOALS
What long-term outcomes do you want to achieve?
1. Save Lives and Protect Property
Reduce or eliminate risk to people and property from natural and man-made hazards.
2. Community Planning
Integrate hazard mitigation policies and practices into local planning.
3. Regional Collaboration
Build capacity for hazard mitigation through regional collaboration.
4. Public Awareness
Increase public awareness of hazards by implementing outreach and education programs.
5. Preservation
Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.
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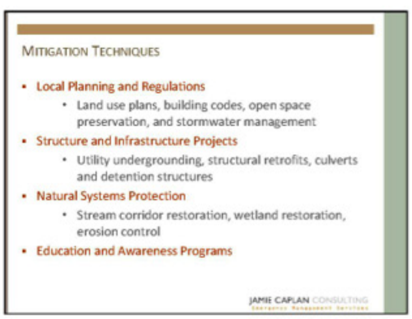
MITIGATION TECHNIQUES
Local Planning and Regulations
Land use plans, building codes, open space preservation, and stormwater management
Structure and Infrastructure Projects
Utility undergrounding, structural retrofits, culverts and detention structures
Natural Systems Protection
Stream corridor restoration, wetland restoration, erosion control
Education and Awareness Programs
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DISCUSSION WITH QUESTIONS AND ANSWERS
Questions
Answers
JAMIE CAPLAN CONSULTING
Emergency Management Services

3

3/22/15

Next Steps
• Stakeholder Meetings
• Public Meetings
• Survey Participation and Distribution
• https://www.surveymonkey.com/r/LyndonVT
• Continued Participation in Planning Meetings
• Review of Draft Plan
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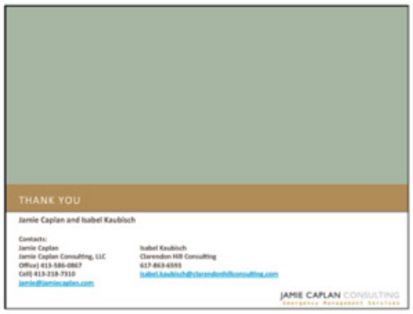

THANK YOU
Jamie Caplan and Isabel Kaubisch
Contacts:
Jamie Caplan
Jamie Caplan Consulting, LLC
Office) 413-586-0867
Cell) 413-218-7310
jamie@jamiecaplan.com
Isabel Kaubisch
Clarendon Hill Consulting
617-863-6593
isabel.kaubisch@clarendonhillconsulting.com
JAMIE CAPLAN CONSULTING
Emergency Management Services

4

Municipal Building
Conference Room
119 Park Avenue
Lyndonville, VT

6/10/15 at 6:00 pm

Fires, Floods and
Winter Storms

Share Your Ideas for
Reducing Risk

Preparing a Hazard
Mitigation Plan For
FEMA Approval

PUBLIC DISASTER MEETING

SHARE YOUR IDEAS FOR REDUCING RISK!

The Town of Lyndon and Village of Lyndonville are working on a FEMA Approved Hazard Mitigation Plan. Join us for a brief presentation followed by a conversation to gather your feedback.

MORE INFORMATION CONTACT

Irene Nagle

Senior Planner, NVDA

802-424-1423

inagle@nvda.net

Town of Lyndon Vermont Chartered 1781

NVDA
Northeastern Vermont Development Association

Public Disaster Planning Meeting
June 10, 2015 6:00 pm -7:00 pm
Town of Lyndon and Village of Lyndonville, Vermont

The Town of Lyndon and Village of Lyndonville have nearly completed a draft of their 2015 Hazard Mitigation Plan. The purpose of the Hazard Mitigation Plan is to identify and assess the Town's natural hazard risks (such as flooding, winter storms and hurricanes) and determine how to best minimize or manage those risks.

Join the Hazard Mitigation Committee on June 10, 2015 from 6:00 pm – 7:00 pm to hear a brief presentation about the plan and to participate in a conversation aimed at gathering your feedback. Public participation is essential to a successful planning process. The meeting will be held at the Public Safety Building, 119 Park Avenue, Lyndonville, Vermont.

The public is also encouraged to complete the Public Preparedness Survey. It is online at https://www.surveymonkey.com/r/LyndonVT. The survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impacts of future disasters.

Upon completion, the plan will be presented to the Town of Lyndon and Village of Lyndonville for adoption and submitted to Vermont Division of Emergency Management and Homeland Security (DEMHS) and Federal Emergency Management Agency (FEMA) for review and approval. A FEMA approved plan makes these communities eligible for federal and state mitigation grant funding.

The Northeastern Vermont Development Association (NVDA) was awarded a grant from the DEMHS to develop the Multi-Jurisdiction Hazard Mitigation Plan Update; the previous plan was developed in 2005. The NVDA hired Jamie Caplan Consulting LLC to work with them and the Town and Village to develop the Multi-Jurisdiction Hazard Mitigation Plan Update.

If you have any questions regarding the meeting or the survey, or would like to learn about more ways you can participate in the development of the Hazard Mitigation Plan, please contact Irene Nagle, Senior Planner, Northeastern Vermont Development Association at 802-424-1423 or inagle@nvda.net.

HAZARD MITIGATION PUBLIC MEETING SIGN-IN SHEET

Project: Town of Lyndon and Village of Lyndonville PDM		**Meeting Date:**	June 10, 2015
Facilitator:	Irene Nagle, NVDA	**Place/Room:**	Municipal Building Conference Room

Name	Company/Resident	Phone	E-Mail
Jordan Patoine	Boy Scout		
Irene Nagle	NVDA		
Kaela Gray	town of Lyndon	626-1269	kaela.gray@gmail.com
[illegible]	Town of Lyndon	6-8430	nekjazz@yahoo.com
Andrea Day	Lyndon Planning Commission	274-5516	adaye dufresnegrap.com
Chris Thompson	Lyndon Planning Comm.	6-3976	christian.thompson05850@gmail.com
JACK Berube	Lyndon Planning	626 4154	JAckmanvt.@aol.com
Mike Schlesinger	Lyndon Planning	427 3221	MJSTOPPER4HAGAN@AOL
RUSS BLAKE	LYNDON	626 3715	RUSTY@VTLINK.NET
Marty Feltus	Lyndon selectman	626 9516	marty.feltus@yahoo.com
Susan Mills	Lyndon Planning Comm	626-5771	millsgrp@myfairpoint.net
Jamie Caplan	JCC	413 586-0867	jamie@jamiecaplan.com

TOWN OF LYNDON AND VILLAGE OF LYNDONVILLE
ALL HAZARDS PRE-DISASTER MITIGATION PLAN UPDATE

Hazard Mitigation Public Meeting
June 10, 2015 at 6pm

JAMIE CAPLAN CONSULTING

Getting Started Exercise

1. Who lives in Lyndon and Lyndonville?
2. What buildings, organizations and infrastructure do the people here rely on?
3. What weather related hazards impact these people and/or the buildings, organizations and infrastructure?
4. What can be done to lessen the impact of these hazards and to protect people and property?

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Purpose of Meeting

- Planning Process Update
- Survey Results
- Hazard Risk Assessment Findings
- Mitigation Actions Identified

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What are Multi-Hazard Mitigation Plans?

- **Hazard mitigation** is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards.
- **Hazard Mitigation Plans** form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. **The planning process is as important as the plan itself.** It creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters.

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Project Schedule

Task	Description	Jan/Feb	Mar	Apr	May	Jun	July	Aug	Sep
1	Assemble planning team and meet with consultant(s) to review the planning process and confirm outreach strategy.	x							
2	Establish work plan with deliverables, timelines for completion and confirmed roles and responsibilities.	x							
3	Review information on natural hazards and on man-made hazards, based on best available data.	x	x						
4	Review Hazard Data / Public Meeting #1	x	x						
5	Complete a vulnerability assessment to quantify the extent of each hazard.	x	x	x	x				
6	Identify Mitigation Strategies and complete a cost-benefit review.			x	x	x	x		
7	Review Mitigation Strategies / Public Meeting #2				x	x	x		
8	Submit plan to Vermont Emergency Management and Homeland Security and revise accordingly.							x	x
9	Submit revised plan to FEMA, revise if necessary. Town and Village adopt plan.								x
Meetings									
Kick-Off Meeting		x							
Conference Calls Weekly		x	x	x	x	x	x	x	x
Public Meeting #1			x						
Public Meeting #2						x			

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Natural Hazards Survey – Preliminary Results

- 69 Response
- Have you ever been impacted physically, financially or emotionally by a natural disaster? (Q1)
  - 65% NO - 35% YES
- Highest ranking disasters experienced. (Q2)
  - Heavy Rainstorm and Thunderstorm
  - Flood
  - Ice Storms
  - Snow Storms
- Hazards of biggest concern (Q3)
  - Nor'easters and Blizzards
  - Snow and Ice
  - Heavy Rainstorms and Thunderstorms
  - Flood
  - Hurricanes

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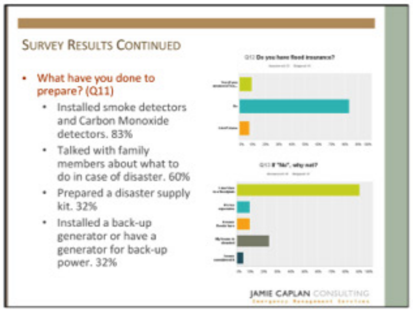
1


Survey Results Continued
• What have you done to prepare? (Q11)
• Installed smoke detectors and Carbon Monoxide detectors. 83%
• Talked with family members about what to do in case of disaster. 60%
• Prepared a disaster supply kit. 32%
• Installed a back-up generator or have a generator for back-up power. 32%
Q12 Do you have flood insurance?
Q13 If "No", why not?
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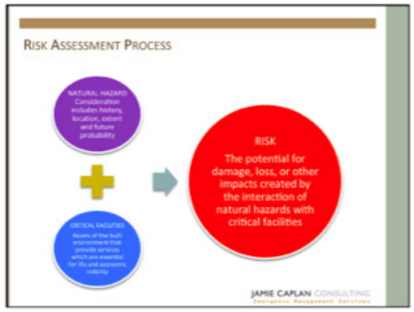
Risk Assessment Process
NATURAL HAZARD
Consideration includes history, location, extent and future probability
CRITICAL FACILITIES
RISK
The potential for damage, loss, or other impacts created by the interaction of natural hazards with critical facilities
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Critical Facilities: Provide services essential for life safety and Economic viability and Must continue to operate during and following a disaster.
• Municipal Building
• Public Safety Building
• Lyndonville Electric Department Garage
• Town Garage
• Village Garage
• Lyndon Town School
• Lyndon Institute
• Lyndon State College
• Riverside School
• Thaddeus Stevens School
• Cobleigh Public Library
• Darling Inn
• Riverside Enrichment Center
• The Pines
• Armory Building
• St. Elizabeth's Church
• Methodist Church
• 1st Congregational Church
• Episcopal Church
• Church of Later Day Saints
• Kingdom Hall Jehovah's Witness
• Lyndon Center Free Baptist Church
• Lyndon Bible Church
• VFW
• Cell Towers
• Wastewater Treatment Center
• VELCO Substation
• LED Substation
• Pudding Hill Substation
• Great Falls Substation & Hydro Dam
• Vail Dam
• Caledonia County Airport
• Lyndon Rescue
• Northeast Kingdom Waste Management
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List of Hazards
1. Flood Hazards
• Beaver Dams
• Dam Breaches
• Erosion
• Floods and Flash Floods
• Heavy Rainstorms and Thunderstorms
• Snow Melt
2. Wind Hazards
• Hurricanes
• Microburst
• Tornadoes
3. Winter Hazards
• Blizzard
• Hail
• Ice Jams
• Ice Storms
• Nor'easter
• Snow Events
• Extreme Cold
4. Fire Hazards
• Drought
• Wildfire
• Lightning
5. Geologic Hazards
• Earthquake
• Landslide
6. Other Potential Hazards
• Extreme Heat and Heat Wave
• Water Supply Contamination
• Hazardous Materials
• Invasive Species
Climate Change
Power Failure
Railway Incidents
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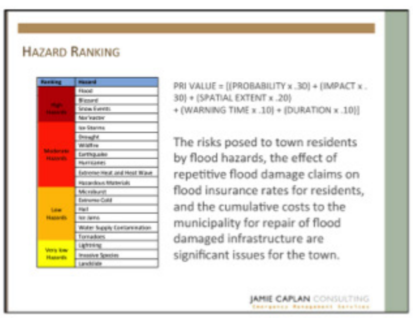
Hazard Ranking
Ranking
Hazard
Flood
Blizzard
Snow Events
Nor'easter
Ice Storms
Drought
Wildfire
Earthquake
Hurricanes
Extreme Heat and Heat Wave
Hazardous Materials
Microburst
Extreme Cold
Hail
Ice Jams
Water Supply Contamination
Tornadoes
Lightning
Invasive Species
Landslide
PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]
The risks posed to town residents by flood hazards, the effect of repetitive flood damage claims on flood insurance rates for residents, and the cumulative costs to the municipality for repair of flood damaged infrastructure are significant issues for the town.
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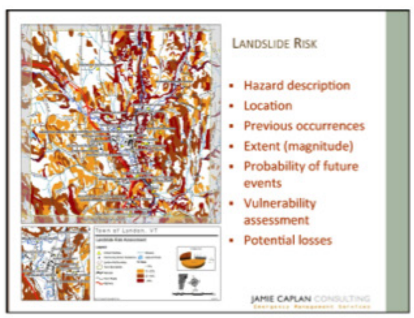
Landslide Risk
• Hazard description
• Location
• Previous occurrences
• Extent (magnitude)
• Probability of future events
• Vulnerability assessment
• Potential losses
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2

Flood Risk

FEMA Special Flood Hazard Area Showing Critical Facilities & Structures

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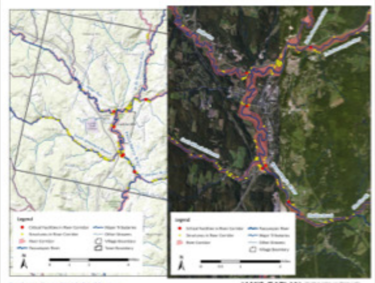

River Corridors Showing Critical Facilities & Structures

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Areas of Particular Concern Related to Flooding

- The Sanborn Bridge, which poses a potential hazard for ice and debris jams
- The Bridge at the intersection of Lily Pond Road and Route 114, where the channel of the East Branch Passumpsic River is constrained and ice jams and flooding has occurred
- The area of the Millers Run near the covered bridge at the Park & Ride where the river is disconnected from its floodplain
- The ineffectiveness of the series of culverts under Route 5 south of the intersection with Route 114 at conveying flood flows

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Areas of Particular Concern Related to Flooding Continued

- Flooding at the major intersection of Routes 5, 114 and 122, which hampers emergency response during disasters
- The Town garage, which is located within the river corridor
- Ice jam potential at sharp bends in the river, such as those near Powers Park and along Stevens Loop
- Ineffective (disconnected) storm drainage on Pleasant Street and Passumpsic Street
- A bank slide along Hawkins Brook

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Hazard Mitigation Goals

- Save Lives and Protect Property
  - Reduce or eliminate risk to people and property from natural and man-made hazards.
- Community Planning
  - Integrate hazard mitigation policies and practices into local planning.
- Regional Collaboration
  - Build capacity for hazard mitigation through regional collaboration.
- Public Awareness
  - Increase public awareness of hazards by implementing outreach and education programs.
- Preservation
  - Ensure that mitigation measures are compatible with the natural features of community rivers, streams and other surface waters; historic resources; character of neighborhoods; and the capacity of the community to implement them.

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Goal 1 – Save Lives and Property

1. Rte 114/5/122 Junction
2. Rte 5 Dry Relief Culverts
3. Maintain data on cost to town related to flooding in repetitive loss areas.
4. Mobile Home Park Community Preparedness and Response Plan
5. Mobile Home Park Elevation
6. North Main Street Covered Bridge
7. Lyndon Town Garage Site Plan
8. Railroad Flooding Around Broad Street
9. Center Street Bridge Area Buyouts
10. Explore elevation of transportation corridors at problem locations

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3

Building Resilience Through Community-Based Action Research
Identifying Vulnerabilities And Facilitating Change In Rural Mobile Home Parks

Approximately 19 homes in the Flood Hazard Area
Approximate number of mobile home locations that have any portion located within any flood hazard zone (Floodway, 100-Year Flood Plain, 500-Year Flood Plain). The mobile home location is obtained from a 60 foot buffer around the E911 point for each mobile home

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Goal 1 – Save Lives and Property

11. Reconnect the river to existing floodplain upstream from the village by securing easements on private land.
12. Implement Recommendations from the Bridge and Culvert Assessments
13. Regulate future development along river corridors to prevent erosion and property loss
14. Implement Recommendations from the River Corridor Studies
15. Buyout repetitive loss structures
16. Vail Dam
17. Install Stream Buffers
18. Equipment Protection
19. Connect Broad Street residences across Route 5 to stormwater system.
20. Implement repairs and continue to track status of stormwater system.
21. Covered Bridges

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Goal 2 – Community Planning

22. Continue to build to the snow load standard.
23. Stormwater Master Planning
24. Create a Capital Budget
25. Community Rating System Participation
26. Flooding ordinances and hazard zoning.
27. Planned Unit Development Provisions

Goal 3 – Regional Collaboration

28. Watershed Collaboration for Stormwater Management

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Goal 4 – Public Awareness

29. VTrans District 7 Transportation Advisory Meetings
30. Floodproofing Education for Business Owners and Homeowners.
31. Education of Businesses on Broad Street

Goal 5 – Preservation

32. FEMA Flood Maps
33. Watershed Health and Water Quality

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Plan Adoption and Implementation

- Write and Review Plan
  - Hazard Mitigation Committee has the opportunity to review the plan.
  - Recommendations are incorporated.
- Plan Adoption and Implementation
  - DEMHS Reviews Plan
  - FEMA Reviews Plan
- FEMA Approval every 5 years

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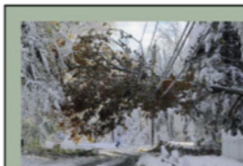

THANK YOU

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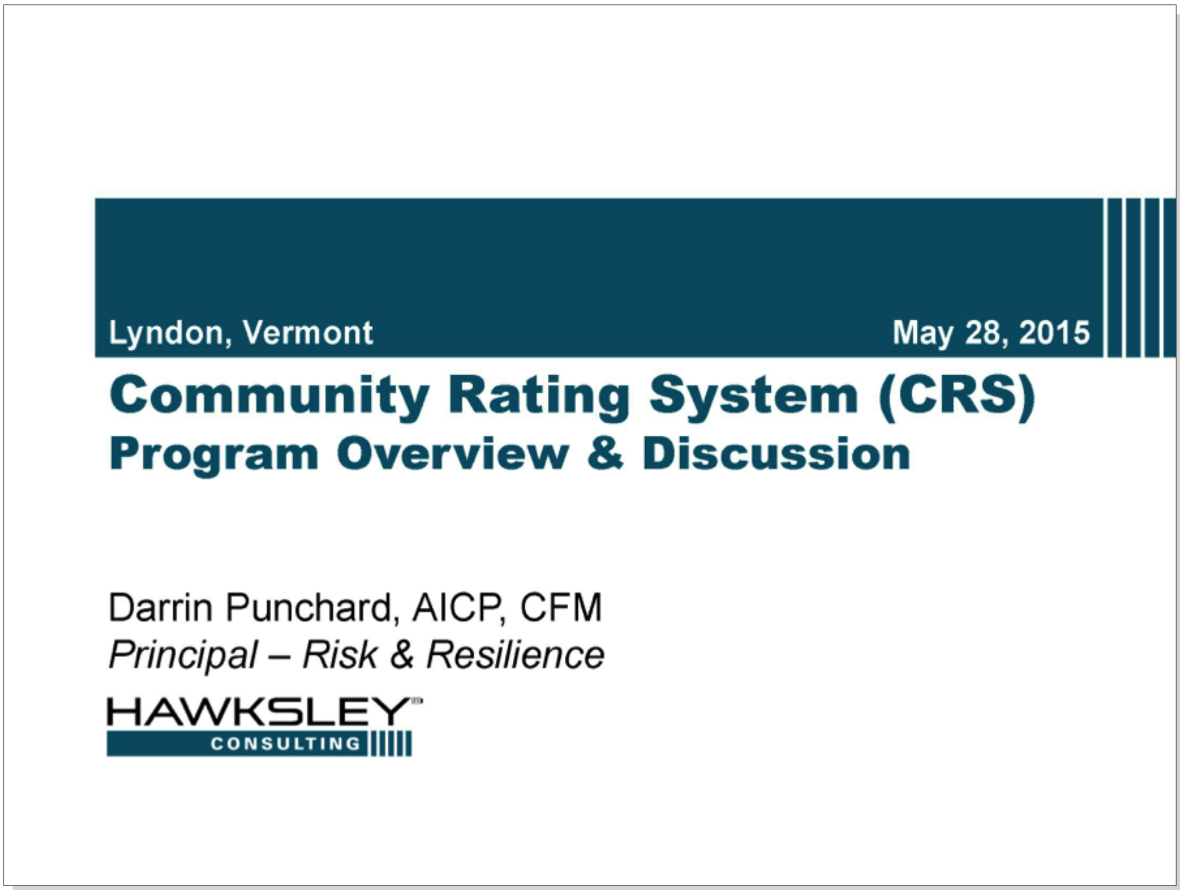
Lyndon, Vermont
May 28, 2015
Community Rating System (CRS)
Program Overview & Discussion
Darrin Punchard, AICP, CFM
Principal – Risk & Resilience
HAWKSLEY
CONSULTING

CRS Program Overview

Launched by FEMA in 1990

Voluntary, *incentive-based* program that recognizes, encourages and rewards community floodplain management activities that *exceed* minimum standards of the National Flood Insurance Program (NFIP)

Flood insurance rates for private properties are *discounted* to reflect the reduced flood risk resulting from community actions

Nearly 1,300 communities participate nationwide

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CRS Program Overview

CRS Goals

- Reduce and avoid flood damage to insurable property
- Strengthen and support the insurance aspects of the NFIP
- Foster comprehensive floodplain management

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CRS Program Overview

CRS Credit Points, Classes, and Discounts

Credit Points	CRS Class	Premium Discount *
4,500+	1	45%
4,000–4,499	2	40%
3,500–3,999	3	35%
3,000–3,499	4	30%
2,500–2,999	5	25%
2,000–2,499	6	20%
1,500–1,999	7	15%
1,000–1,499	8	10%
500–999	9	5%
0–499	10	0%

* *In Special Flood Hazard Areas*

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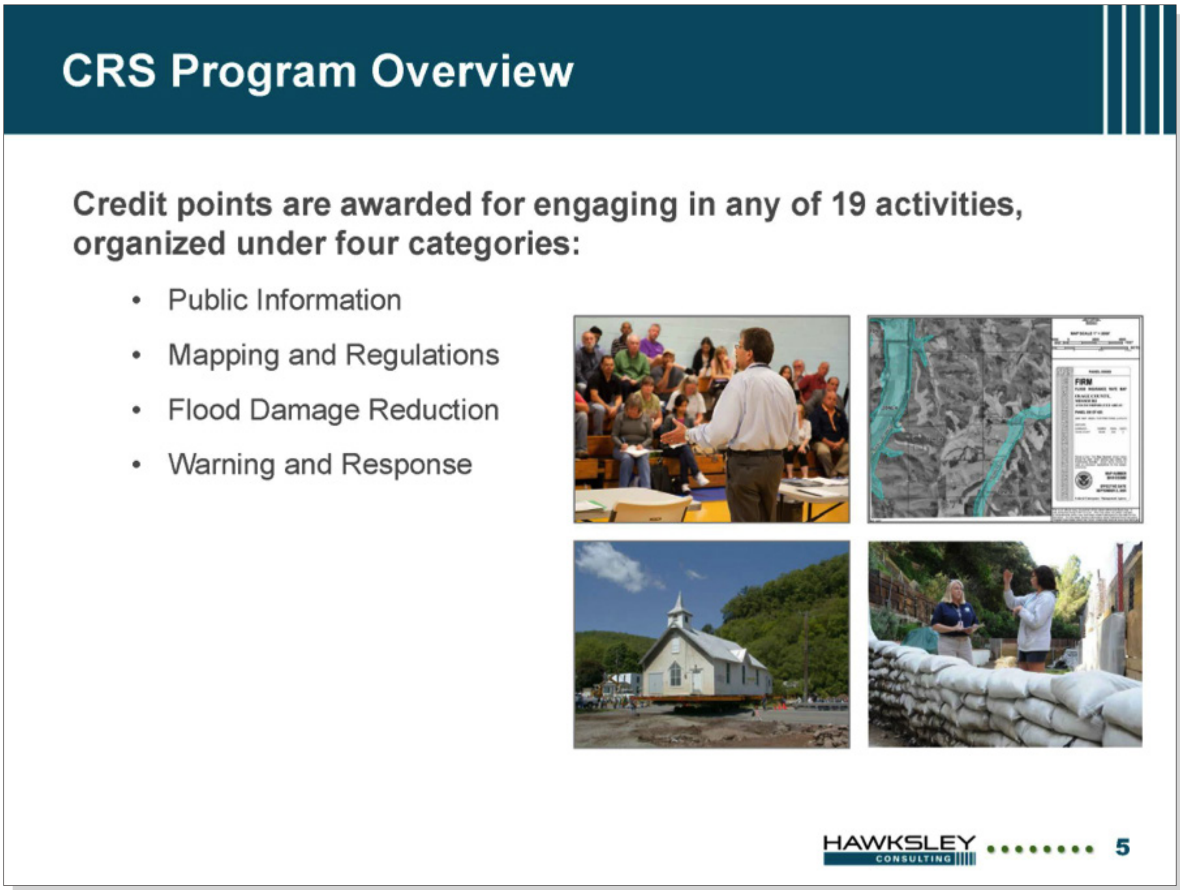
CRS Program Overview
Credit points are awarded for engaging in any of 19 activities, organized under four categories:
• Public Information
• Mapping and Regulations
• Flood Damage Reduction
• Warning and Response
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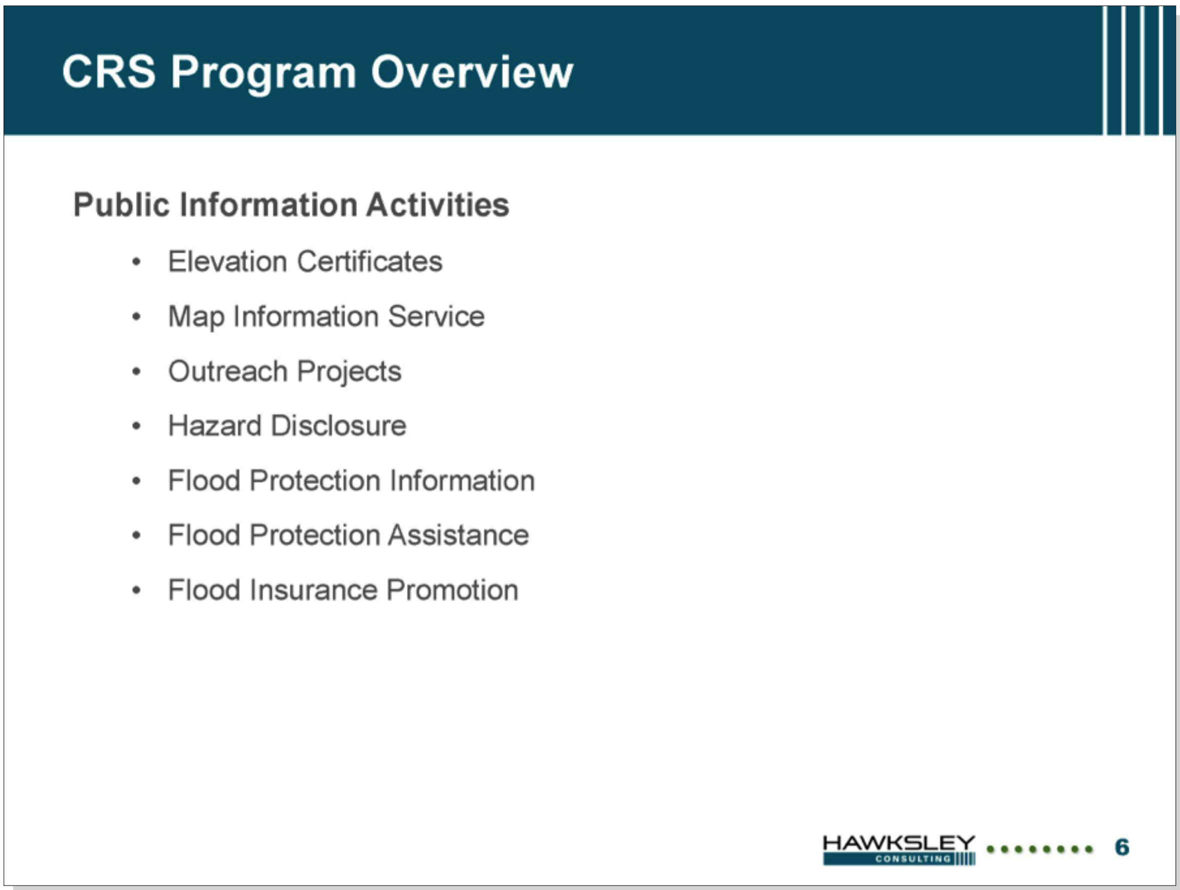
CRS Program Overview
Public Information Activities
• Elevation Certificates
• Map Information Service
• Outreach Projects
• Hazard Disclosure
• Flood Protection Information
• Flood Protection Assistance
• Flood Insurance Promotion
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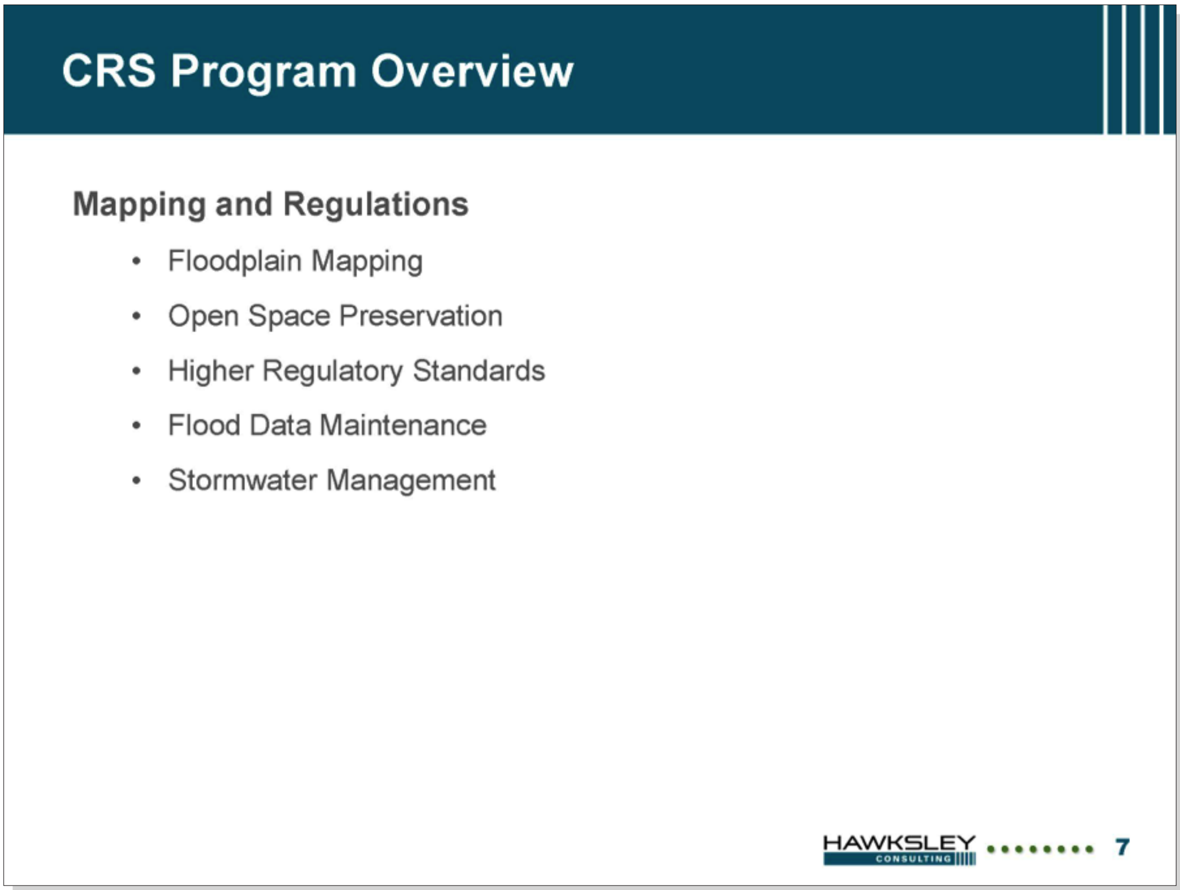
CRS Program Overview
Mapping and Regulations
• Floodplain Mapping
• Open Space Preservation
• Higher Regulatory Standards
• Flood Data Maintenance
• Stormwater Management
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CRS Program Overview

Flood Damage Reduction

- Floodplain Management Planning
- Acquisition and Relocation
- Flood Protection
- Drainage System Maintenance

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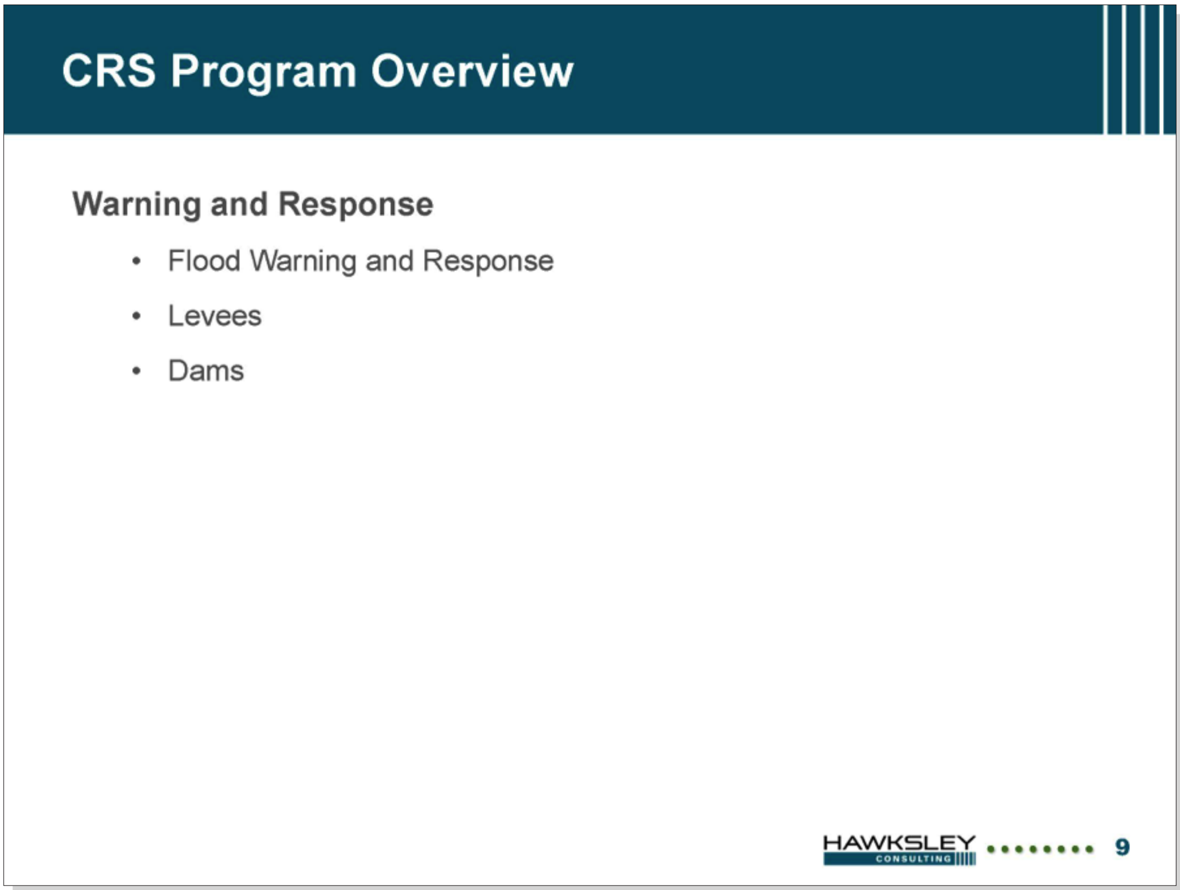
CRS Program Overview
Warning and Response
• Flood Warning and Response
• Levees
• Dams
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CRS Program Overview

New CRS Coordinator's Manual

- Adopted August 1, 2014
- Required for all new CRS applications and new renewal cycles

www.crsresources.org

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CRS Program Overview

Current CRS participation

- 1,296 communities (5% of all NFIP communities)
- 3.8 million policies (67% of all NFIP policies)

Primary Motivators and benefits:

- Reduction in flood insurance premiums for policyholders ($ savings!)
- Enhanced public safety and reduction in flood damage/disruption
- Training, technical assistance, and the ability to evaluate local programs and activities against state and nationally recognized benchmarks
- Recognition for strong local floodplain management programs

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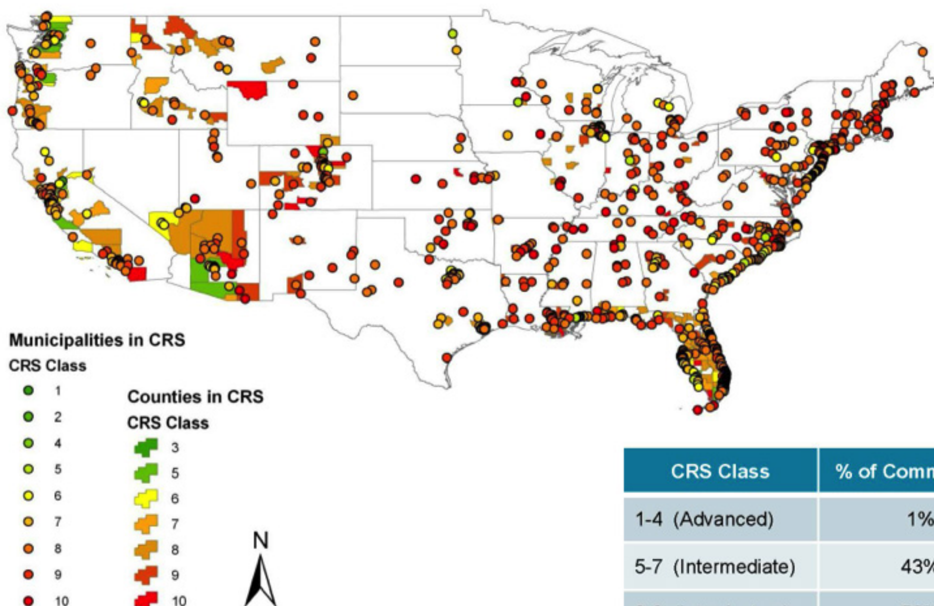
CRS Program Overview

Nationwide CRS Participation

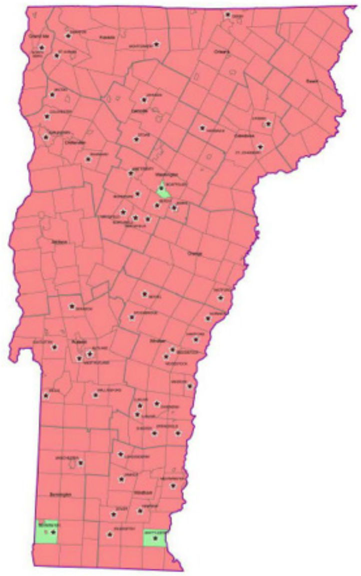


CRS Class	% of Communities
1-4 (Advanced)	1%
5-7 (Intermediate)	43%
8-9 (Introductory)	56%

CRS Program Overview

CRS Participation in Vermont

- Bennington (Class 9)
- Brattleboro (Class 9)
- Montpelier (Class 9)



Community	NFIP Policies	NFIP Premium	CRS Discount
Bennington	235	$249,672	$11,538
Brattleboro	120	$162,398	$8,068
Montpelier	304	$542,991	$27,598
CRS Communities	659	$955,061	$47,204
Non-CRS Communities	3,147	$3,093,328	$0
All Communities	3,806	$4,048,389	$47,204

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Potential Savings in Lyndon, VT

Policies In-Force: 42

Annual Premiums: $51,206

CRS Class	Discount	~Annual Savings	~Annual Savings/Policy
10	0%	$0	$0
9	5%	$2,560	$61
8	10%	$5,121	$122
7	15%	$7,681	$183
6	20%	$10,241	$244
5	25%	$12,802	$305
4	30%	$15,362	$366
3	35%	$17,922	$427
2	40%	$20,482	$488
1	45%	$23,043	$549

** ~Annual Savings are estimates. Actual figures may be lower due to some non-SFHA or Preferred Risk Policies, which already receive a favorable rate. CRS discounts are also not applied to federal surcharges tacked on to each NFIP policy.*

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Lyndon, Vermont

May 28, 2015

Thank You!

dpunchard@hawksley.com
857-373-9683

Appendix G: Mitigation Actions Sorted By Multiple Criteria

Table 1 Mitigation Actions sorted by priority and cost

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
HIGH PRIORITY MITIGATION ACTIONS					
Equipment Protection	Lyndon DPW, Lyndonville DPW,	Lyndon DPW, Lyndonville DPW	Low	2016-2017	5
Education for Business Owners and Homeowners.	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	Low	2016-2017	5
Floodproofing Education of Businesses on Broad Street	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	Low	2016-2017	5
Implement Recommendations from the Bridge and Culvert Assessments	Lyndon Selectboard, CCNRCD, NVDA, VTrans	Upper Connecticut Mitigation and Enhancement Fund – Current Funding for culvert assessment, V-Trans, FEMA	Low	2016-2017	5
Flooding ordinances and hazard zoning.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low	2016-2017	5
Mobile Home Park Community Preparedness and Response Plan	Mobile Home Park Owner, LEPC District 9, Vermont Mobile Home Park Research Collaborative (CVOEO & UVM)	CVOEO	Low	2016-2017	5
Reconnect the river to existing floodplains upstream from the village by securing easements on private land.	CCNRCD, DEC	ERP, Easements or fee purchases by PVLT, VRC, VLT, State/ Federal Partner Programs	Low	2016-2018	5

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
Stormwater Master Planning	Lyndon Public Works Director, CCNRCD	ERP	Medium	2016-2018	6
Rte. 114/5/122 Junction	Lyndon DPW, VTrans, CCNRCD, VT RMP	VTrans, FEMA	Medium	2016-2021	6
Riverview Estates Mobile Home Park Elevation	Park Owner	Park Owner	High	2016-2017	5
Buyout repetitive loss structures	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	High	2016-2019	5
Rte. 5 Dry Relief Culverts	Lyndon DPW, VTrans, CCNRCD, VT RMP	FEMA, Ecosystem Restoration Program	High	2016-2021	6
Protect and Retrofit Covered Bridges	Town of Lyndon and VTrans	Preservation Trust of Vermont, Vermont Division of Historic Preservation	High	2016-2021	5
MEDIUM PRIORITY MITIGATION ACTIONS					
Implement repairs and continue to track status of stormwater system.	Lyndon DPW	Town of Lyndon	Low	2016-2017	4
Build to the snow load standard.	Lyndon Zoning Administrator and Lyndon Planning Director, State Fire Marshall's Office	Town of Lyndon	Low	2016-2017	4
Planned Unit Development Provisions	DRB	Town of Lyndon	Low	2016-2017	4
VTrans District 7 Transportation Advisory Meetings	Lyndon Selectboard, TAC	Town of Lyndon	Low	2016-2017	4

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
Regulate future development along river corridors to prevent erosion and property loss and implement recommendations from the River Corridor Studies	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low	2016-2017	3
Watershed Collaboration for Stormwater Management	Lyndon Planning Commission, State Floodplain Manager, NVDA	Town of Lyndon	Low	2016-2017	3
Create a Capital Budget	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	Low	2016-2017	3
FEMA Flood Maps	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	Low	2016-2017	3
Install Stream Buffers	CCNRCD, PVLT, DEC RMP	CCNRCD	Low	2016-2020	4
Railroad Flooding Around Broad Street	Lyndon Selectboard, VTrans	Lyndon Selectboard, VTrans	Medium	2016-2021	4
Elevate transportation corridors at problem locations	Lyndon Selectboard, VTrans	VTrans, FEMA	Medium	2016-2021	4
Plan for Lyndon Town Garage Site	Lyndon Selectboard, PVLT	FEMA, PVLT, VLT	High	2016-2018	4
Centre Covered Bridge	Chamber of Commerce, Property Owner, DEC RMP	VTrans	High	2016-2021	4
Connect Broad Street residences across Route 5 to stormwater system.	Lyndon DPW, VTrans	VTrans	High	2016-2021	3
Burrington Bridge (AKA Randall Bridge)	Chamber of Commerce, DEC RMP	VTrans	High	2016-2021	4
LOW PRIORITY MITIGATION ACTIONS					

Mitigation Action	Responsible Organizations	Funding Source(s)	Estimated Cost	Implementation Timeframe	Evaluation Score
Maintain data on cost to town related to flooding in repetitive loss areas.	Lyndon Selectboard, Lyndon Municipal Administrator	Town of Lyndon	Low	2016-2017	2
Community Rating System Participation	Lyndon Zoning Administrator and Lyndon Planning Director, NVDA	Town of Lyndon	Low	2016-2017	1
Watershed Health and Water Quality	Lyndon Selectboard, CCRD, Valley Land Trust	Town of Lyndon	Low	2016-2018	2
Vail Dam	Lyndon Trustees, Lyndon Selectboard, LED	ERP	Low	2016-2021	2

Table 2 Mitigation actions sorted by priority and timeframe

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Implementation Timeframe
HIGH PRIORITY MITIGATION ACTIONS				
Equipment Protection	Pre-position DPW equipment away from high hazard flood areas.	Lyndon DPW, Lyndonville DPW,	Lyndon DPW, Lyndonville DPW	2016-2017
Education for Business Owners and Homeowners.	Implement workshops for business owners and homeowners.	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	2016-2017
Floodproofing Education of Businesses on Broad Street	Implement workshops for business owners and homeowners.	Lyndon Fire Department, CCNRCD, VTSBDC	Lyndon Fire Department, CCNRCD, VTSBDC, ERP, FEMA	2016-2017
Riverview Estates Mobile Home Park Elevation	Raise the lots of each structurally sound mobile home within two-years.	Park Owner	Park Owner	2016-2017
Mobile Home Park Community Preparedness and Response Plan	Develop and document strategies for increasing the resilience of the Mobile Home Parks in Lyndon.	Mobile Home Park Owner, LEPC District 9, Vermont Mobile Home Park Research Collaborative (CVOEO & UVM)	CVOEO	2016-2017
Implement Recommendations from the Bridge and Culvert Assessments	Implement the retrofit or replacement of undersized structures.	Lyndon Selectboard, CCNRCD, NVDA, VTrans	Upper Connecticut Mitigation and Enhancement Fund – Current Funding for culvert assessment, V-Trans, FEMA	2016-2017

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Implementation Timeframe
Flooding ordinances and hazard zoning.	Implement stormwater management, erosion prevention, and sediment control ordinances. Implement fluvial erosion hazard zoning. Amend the Town's Flood Hazard Regulations to include restriction of development within River Corridors, and minimize impacts to wetlands and steep slopes.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	2016-2017
Reconnect the river to existing floodplains upstream from the village by securing easements on private land.	Pursue acquiring river corridor easements to allow the river to reconnect with its natural floodplain, using the locations identified in the River Corridor studies as a guide. In some cases, berms need to be removed to restore connectivity to floodplain.	CCNRCD, DEC	ERP, Easements or fee purchases by PVLT, VRC, VLT, State/ Federal Partner Programs	2016-2018
Stormwater Master Planning	Develop a Stormwater Master Plan.	Lyndon Public Works Director, CCNRCD	ERP	2016-2018
Buyout repetitive loss structures	Identify list of structures that may be appropriate for buyout and conversion to active floodplain.	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	2016-2019
Rte. 114/5/122 Junction	Intersection study to determine causes of flooding and cost effective mitigation measures. Look specifically at the stormwater drain at the intersection as well as elevating the roadway.	Lyndon DPW, VTrans, CCNRCD, VT RMP	VTrans, FEMA	2016-2021
Rte. 5 Dry Relief Culverts	Replace the culvert with a dry bridge.	Lyndon DPW, VTrans, CCNRCD, VT RMP	FEMA, Ecosystem Restoration Program	2016-2021

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Implementation Timeframe
Protect and Retrofit Covered Bridges	Maintain covered bridges in the jurisdiction.	Town of Lyndon and VTrans	Preservation Trust of Vermont, Vermont Division of Historic Preservation	2016-2021
MEDIUM PRIORITY MITIGATION ACTIONS				
Implement repairs and continue to track status of stormwater system.	Continue to chart and repair the stormwater system.	Lyndon DPW	Town of Lyndon	2016-2017
Build to the snow load standard.	Lyndon Zoning Administrator will coordinate with the State Building Safety Engineer to evaluate the integrity of all new structures.	Lyndon Zoning Administrator and Lyndon Planning Director, State Fire Marshall's Office	Town of Lyndon	2016-2017
Planned Unit Development Provisions	Encourage property owners seeking to develop their land to utilize the existing Planned Unit Development provisions in the Town's bylaws as a means to minimize impervious coverage and clearing.	DRB	Town of Lyndon	2016-2017
Regulate future development along river corridors to prevent erosion and property loss and implement recommendations from the River Corridor Studies	Review studies and implement recommendations related to erosion prevention and property loss along river corridors.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	2016-2017
Watershed Collaboration for Stormwater Management	Collaborate with upstream towns to address control of stormwater runoff and actions that will allow rivers and streams to regain access to floodplains.	Lyndon Planning Commission, State Floodplain Manager, NVDA	Town of Lyndon	2016-2017

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Implementation Timeframe
Create a Capital Budget	Create a capital budget for funding maintenance and capital improvements.	Lyndon Planning Commission, Lyndon Selectboard	Town of Lyndon	2016-2017
FEMA Flood Maps	Encourage FEMA to update and digitize floodplain maps.	Lyndon Zoning Administrator and Lyndon Planning Director	FEMA	2016-2017
VTrans District 7 Transportation Advisory Meetings	Participate in VTrans Advisory Meetings.	Lyndon Selectboard, TAC	Town of Lyndon	2016-2017
Plan for Lyndon Town Garage Site	Remove structures at this site, as it contains hazardous materials that could get into the river, and protect the area as green space.	Lyndon Selectboard, PVLT	FEMA, PVLT, VLT	2016-2018
Install Stream Buffers	Implement recommendations for planting and preservation of stream buffers, as outlined in River Corridor Plans	CCNRCD, PVLT, DEC RMP	CCNRCD	2016-2020
Centre Covered Bridge	Retrofit the bridge span to ease the "pinching" of the river at this location.	Chamber of Commerce, Property Owner, DEC RMP	VTrans	2016-2021
Railroad Flooding Around Broad Street	Coordinate with VTrans about causes and remediation measures of flooding on either side of the railroad tracks.	Lyndon Selectboard, VTrans	Lyndon Selectboard, VTrans	2016-2021
Elevate transportation corridors at problem locations	Conduct an engineering study of flooding along transportation corridors.	Lyndon Selectboard, VTrans	VTrans, FEMA	2016-2021
Burrington Bridge (AKA Randall Bridge)	Examine bridge structures	Chamber of Commerce, DEC RMP	VTrans	2016-2021
Connect Broad Street residences across Route 5 to stormwater system.	Connect stormwater runoff from residences across Rte. 5 to stormwater system.	Lyndon DPW, VTrans	VTrans	2016-2021

Mitigation Action	Description	Responsible Organizations	Funding Source(s)	Implementation Timeframe
LOW PRIORITY MITIGATION ACTIONS				
Community Rating System Participation	Participate in the NFIP CRS if a regional body shares the responsibility of participation requirements.	Lyndon Zoning Administrator and Lyndon Planning Director, NVDA	Town of Lyndon	2016-2017
Maintain data on cost to town related to flooding in repetitive loss areas.	Document costs incurred by Town and Village departments impacted by flooding and flood remediation.	Lyndon Selectboard, Lyndon Municipal Administrator	Town of Lyndon	2016-2017
Watershed Health and Water Quality	Encourage water quality and watershed health through the implementation of wooded vegetative buffers along rivers and streams.	Lyndon Selectboard, CCRD, Valley Land Trust	Town of Lyndon	2016-2018
Vail Dam	Review past engineering study to determine if removal of Vail Dam would decrease flooding upstream. If necessary conduct an updated study.	Lyndon Trustees, Lyndon Selectboard, LED	ERP	2016-2021

Flood Hazard Summary Report

3/23/2015 Summary of Flood Hazard Mitigation Actions for: County =

Region =

Community = Lyndon

Show All = N

Community	ERAF Rate	(1) NFIP	(2) Rd Stds	(3) LEOP	(4) LHMP	(5) RC	(a) # In SFHA	(b) % Insured	(c) # critical or public	(d) % of all
Lyndon	7.5%	Yes	Yes	Yes	No	No	87	30%	1	5%

(1) National Flood Insurance Program access
(2) Municipal Road Standards Meet or Exceed 2013 Standards
(3) Local Emergency Operations Plan Valid (updated annually after Town Meeting and before May 1)
(4) Local Hazard Mitigation Plan (valid within five years of FEMA approval or in review by FEMA)
(5) River Corridors (protects Statewide River Corridors or Interim Protections (valid to 2016)
(a) E911 Structures in the Special Flood Hazard Area (SFHA)
(b) Percentage of structures in SFHA with flood insurance
(c) Number of critical or public structures in mapped flood hazard areas
(d) Percentage of community structures in SFHA

FLOOD READY VERMONT

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Flood Hazard Summary Report

3/23/2015 Summary of Flood Hazard Mitigation Actions for: County =

Region =

Community = Lyndonville Village

Show All = N

Community	ERAF Rate	(1) NFIP	(2) Rd Stds	(3) LEOP	(4) LHMP	(5) RC	(a) # In SFHA	(b) % Insured	(c) # critical or public	(d) % of all
Lyndonville Village	7.5%	Yes	Yes	Yes	No	No	26	?	1	6%

(1) National Flood Insurance Program access
(2) Municipal Road Standards Meet or Exceed 2013 Standards
(3) Local Emergency Operations Plan Valid (updated annually after Town Meeting and before May 1)
(4) Local Hazard Mitigation Plan (valid within five years of FEMA approval or in review by FEMA)
(5) River Corridors (protects Statewide River Corridors or Interim Protections (valid to 2016)
(a) E911 Structures in the Special Flood Hazard Area (SFHA)
(b) Percentage of structures in SFHA with flood insurance
(c) Number of critical or public structures in mapped flood hazard areas
(d) Percentage of community structures in SFHA

FLOOD READY VERMONT

1

ERAF Summary Report

3/23/2015

Summary of Flood Hazard Mitigations Actions for:

County =
Region =
Community= Lyndon
Show All = N

Community	ERAF Rate	(1) NFIP	(2) Rd Stds	(3) LEOP	(4) LHMP	(5) RC	RC Interim	NFIP Enrolled	2013 Road Stds	LEOP (Current)	LHMP (Approved)	RC Bylaw
Lyndon	7.5%	Yes	Yes	Yes	No	No		06/18/1980	02/25/2013	06/02/2014	Expired	

ERAF Criteria For State Post-Disaster Funding

12.5% Mitigation Actions 1 through 4:

17.5% Mitigation Actions 1 through 5:

For More Information on ERAF Criteria

Emergency Relief And Assistance Fund (ERAF)	Local Emergency Operations Plan (LEOP)
National Flood Insurance Program (NFIP)	Local Hazard Mitigation Plan (LHMP)
Road And Bridge Standards 2013	River Corridor Protection

FLOOD READY VERMONT

1

ERAF Summary Report

3/23/2015

Summary of Flood Hazard Mitigations Actions for:

County =
Region =
Community= Lyndonville Village
Show All = N

Community	ERAF Rate	(1) NFIP	(2) Rd Stds	(3) LEOP	(4) LHMP	(5) RC	RC Interim	NFIP Enrolled	2013 Road Stds	LEOP (Current)	LHMP (Approved)	RC Bylaw
Lyndonville Village	7.5%	Yes	Yes	Yes	No	No			02/25/2013	06/02/2014	Expired	

ERAF Criteria For State Post-Disaster Funding

12.5% Mitigation Actions 1 through 4:

17.5% Mitigation Actions 1 through 5:

For More Information on ERAF Criteria

Emergency Relief And Assistance Fund (ERAF)	Local Emergency Operations Plan (LEOP)
National Flood Insurance Program (NFIP)	Local Hazard Mitigation Plan (LHMP)
Road And Bridge Standards 2013	River Corridor Protection

FLOOD READY VERMONT

1

Expanded Community Report for Lyndon

3/23/2015
4:45:40 PM

Emergency Relief and Assistance Fund (ERAF) - State Post-Disaster Funding

Flood Hazard Mitigation Actions	Action Dates		Responsible	ERAF Status
1. 2013 Road and Bridge Standards	02/25/2013		Lyndon	Yes
2. Local Emergency Operations Plan	06/02/2014		Lyndon	Yes
3. National Flood Insurance Program	06/18/1980		Lyndon	Yes
4. Local Hazard Mitigation Plan	Expired		Lyndon	No
5. River Corridor Protection				No
ERAF Rate for Actions 1 - 4:12.5%,	Actions 1 - 5: 17.5%	**ERAF Rate for:**	**Lyndon**	**7.5%**

87	Buildings in the Special Flood Hazard Area (SFHA) (estimated from e911 sites).
26	Flood Insurance Policies in SFHA (Zone A, AE, AO, A 1- 30)
30%	Percent of buildings in the SFHA with flood insurance in force.
1	Critical or public structures in SFHA or 0.2% flood hazard area (est. from e911 sites.)
5%	Percent of buildings in the SFHA.
06/18/1980	National Flood Insurance Program (NFIP) (Enrollment Date)
Vector	Flood Insurance Rate Map Standard (Digital FIRM (DFIRM), Rough Digital, Paper)
Lyndon	NFIP Status: Regular Program
	Community Rating System (CRS)
Yes	Local Emergency Operations Plan (LEOP) ERAF Status valid for Lyndon?
06/02/2014	LEOP - annual update after Town Meeting and before May 1.
No	Local Hazard Mitigation Plan (LHMP) ERAF Status valid for Lyndon?
05/27/2005	LHMP - Valid for 5 years from FEMA final approval date
	LHMP - Status of review (Plans currently in review are valid for ERAF).
No	River Corridor Protection in Lyndon?
	River Corridor Interim Protection Status for ERAF valid for Lyndon?
12/22/2008	Municipal Plan - Valid for 5 years from adoption date
06/10/2013	Zoning Adoption / Amendment Date
	Hazard Area Regulation Adoption / Amendment Date
Yes	2013 Road and Bridge Standards
88.539	Town Highway Mileage in Lyndon
02/25/2013	Lyndon_Road and Bridge Standards and Adoption Date
2/24/2014	Lyndon_Certificate of Compliance with Road and Bridge Standards and Date
	Town Highway Network Inventory Date
80%	Town Highway Structures Grant Rate (State match 80% or 90%)
70%	Class 2 Roadways Grant Rate (State match 70% or 80%)
District 7	Project Manager email for VTrans Maintenance District 7

Note: if you have updated information - please let us know:

1. Road Standards and Certificates - contact your VTrans District Project Manager: District 7
2. Local Emergency Operations Plans or Local Hazard Mitigation Plans contact your Regional Planner
3. For other questions please contact VT DEC **Flood Ready Atlas**- River Corridor and Flood Hazard Maps

FLOOD READY VERMONT

Expanded Community Report for Lyndonville Village

3/23/2015
4:46:01 PM

Emergency Relief and Assistance Fund (ERAF) - State Post-Disaster Funding

Flood Hazard Mitigation Actions	Action Dates		Responsible	ERAF Status
1. 2013 Road and Bridge Standards	02/25/2013		Lyndonville Village	Yes
2. Local Emergency Operations Plan	06/02/2014		Lyndonville Village	Yes
3. National Flood Insurance Program			Lyndon	Yes
4. Local Hazard Mitigation Plan	Expired		Lyndonville Village	No
5. River Corridor Protection			Lyndonville Village	No
ERAF Rate for Actions 1 - 4:12.5%,	Actions 1 - 5: 17.5%	**ERAF Rate for:**	**Lyndonville Village**	**7.5%**

26	Buildings in the Special Flood Hazard Area (SFHA) (estimated from e911 sites).
0	Flood Insurance Policies in SFHA (Zone A, AE, AO, A 1- 30)
?	Percent of buildings in the SFHA with flood insurance in force.
1	Critical or public structures in SFHA or 0.2% flood hazard area (est. from e911 sites.)
6%	Percent of buildings in the SFHA.
	National Flood Insurance Program (NFIP) (Enrollment Date)
Vector	Flood Insurance Rate Map Standard (Digital FIRM (DFIRM), Rough Digital, Paper)
Lyndon	NFIP Status:
	Community Rating System (CRS)
Yes	Local Emergency Operations Plan (LEOP) ERAF Status valid for Lyndonville Village?
06/02/2014	LEOP - annual update after Town Meeting and before May 1.
No	Local Hazard Mitigation Plan (LHMP) ERAF Status valid for Lyndonville Village?
05/27/2005	LHMP - Valid for 5 years from FEMA final approval date
	LHMP - Status of review (Plans currently in review are valid for ERAF).
No	River Corridor Protection in Lyndonville Village?
	River Corridor Interim Protection Status for ERAF valid for Lyndonville Village?
12/22/2008	Municipal Plan - Valid for 5 years from adoption date
06/10/2013	Zoning Adoption / Amendment Date
	Hazard Area Regulation Adoption / Amendment Date
Yes	2013 Road and Bridge Standards
6.607	Town Highway Mileage in Lyndonville Village
02/25/2013	Lyndonville Village_Road and Bridge Standards and Adoption Date
3/3/2014	Lyndonville Village_Certificate of Compliance with Road and Bridge Standards and Date
	Town Highway Network Inventory Date
80%	Town Highway Structures Grant Rate (State match 80% or 90%)
70%	Class 2 Roadways Grant Rate (State match 70% or 80%)
District 7	Project Manager email for VTrans Maintenance District 7

Note: if you have updated information - please let us know:

1. Road Standards and Certificates - contact your VTrans District Project Manager: District 7
2. Local Emergency Operations Plans or Local Hazard Mitigation Plans contact your Regional Planner
3. For other questions please contact VT DEC **Flood Ready Atlas**- River Corridor and Flood Hazard Maps

FLOOD READY VERMONT

Debris Summary Report: 10 - year Event

May 31, 2015 *All values are in tons.*

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Vermont					
Caledonia	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**
Study Region Total	**0**	**0**	**0**	**0**	**0**

Study Region : Lyndon Hurrican 1938
Scenario : Probabilistic

Direct Economic Losses For Buildings: Annualized Losses

May 31, 2015

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Vermont									
Caledonia	30	13	0	0.00	1	0	0	0	44
Total	**30**	**13**	**0**	**0.00**	**1**	**0**	**0**	**0**	**44**
Study Region Total	**30**	**13**	**0**	**0.00**	**1**	**0**	**0**	**0**	**44**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Page : 1 of 8

Quick Assessment Report

May 31, 2015

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	658
Number of Census Tracts	10
Number of People in the Region	31,227

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ K)*
Residential	13,855	2,607,965
Commercial	845	527,510
Other	524	316,004
Total	15,224	3,451,479

Scenario Results

Number of Residential Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	6	0	0	0	6
200	8	0	0	0	8
500	35	1	0	0	36
1000	124	5	0	0	129

Number of Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	9	0	0	0	9
200	12	0	0	0	12
500	42	1	0	0	43
1000	136	5	0	0	142

Shelter Requirements

Return Period	*Displaced Households (#Households)*	*Short Term Shelter (#People)*
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

Economic Loss (x 1000)

	Property Damage (Capital Stock) Losses		*Business Interruption*
ReturnPeriod	*Residential*	*Total*	*(Income) Losses*
10	0	0	0
20	0	0	0
50	0	0	0
100	426	426	0
200	1,380	1,392	0
500	4,548	4,631	16
1000	9,266	9,430	111
Annualized	41	43	1

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Shelter Summary Report: 10 - year Event

May 31, 2015

	# of Displaced Households	# of People Needing Short Term Shelter
Vermont		
Caledonia	0	0
Total	**0**	**0**
Study Region Total	**0**	**0**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Page : 1 of 7

Building Damage by Building Type: 10 - year Event

June 04, 2015

	Average Damage State (%)				
	None	**Minor**	**Moderate**	**Severe**	**Destruction**
Vermont					
Caledonia					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Study Region Average	100.00	0.00	0.00	0.00	0.00

Study Region : Lyndon Hurrican 1938
Scenario : Probabilistic

Page : 1 of 7

Building Damage by Count by Building Type: 10 - year Event

June 04, 2015

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Vermont						
Caledonia						
Concrete	406	0	0	0	0	406
Masonry	857	0	0	0	0	857
Manufactured Homes	1,317	0	0	0	0	1,317
Steel	659	0	0	0	0	659
Wood	11,978	0	0	0	0	11,978
Total	**15,217**	**0**	**0**	**0**	**0**	**15,217**
Total	**15,217**	**0**	**0**	**0**	**0**	**15,217**
Study Region Total	**15,217**	**0**	**0**	**0**	**0**	**15,217**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Building Damage by Count by General Occupancy 10 - year Event

June 04, 2015

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Vermont						
Caledonia						
Agriculture	89	0	0	0	0	89
Commercial	845	0	0	0	0	845
Education	43	0	0	0	0	43
Government	60	0	0	0	0	60
Industrial	271	0	0	0	0	271
Religion	61	0	0	0	0	61
Residential	13,855	0	0	0	0	13,855
Total	**15,224**	**0**	**0**	**0**	**0**	**15,224**
Total	**15,224**	**0**	**0**	**0**	**0**	**15,224**
Study Region Total	**15,224**	**0**	**0**	**0**	**0**	**15,224**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Page : 1 of 7

Building Damage by General Occupancy: 10 - year Event

June 04, 2015

	Square Footage (Thousand. sq.ft)	Damage State Probability (%) None	Minor	Moderate	Severe	Destruction
Vermont						
Caledonia						
Agriculture	199.26	100.00	0.00	0.00	0.00	0.00
Commercial	3,807.13	100.00	0.00	0.00	0.00	0.00
Education	271.20	100.00	0.00	0.00	0.00	0.00
Government	272.65	100.00	0.00	0.00	0.00	0.00
Industrial	1,448.72	100.00	0.00	0.00	0.00	0.00
Religion	324.22	100.00	0.00	0.00	0.00	0.00
Residential	20,776.43	100.00	0.00	0.00	0.00	0.00
Total	27,099.62	100.00	0.00	0.00	0.00	0.00
Total	27,099.62	100.00	0.00	0.00	0.00	0.00
Study Region Average	27,099.62	100.00	0.00	0.00	0.00	0.00

Study Region : Lyndon Hurrican 1938
Scenario : Probabilistic

Debris Summary Report: 10 - year Event

June 04, 2015 *All values are in tons.*

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Vermont					
Caledonia	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**
Study Region Total	**0**	**0**	**0**	**0**	**0**

Study Region : Lyndon Hurrican 1938
Scenario : Probabilistic

Direct Economic Losses For Buildings: Annualized Losses

June 4, 2015

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Vermont									
Caledonia	30	13	0	0.00	1	0	0	0	44
Total	**30**	**13**	**0**	**0.00**	**1**	**0**	**0**	**0**	**44**
Study Region Total	**30**	**13**	**0**	**0.00**	**1**	**0**	**0**	**0**	**44**

Study Region : Lyndon Hurricane 1938

Scenario : Probabilistic

Page : 1 of 8

Building Stock Exposure by Building Type

June 04, 2015 *All values are in thousands of dollars*

	Wood	Masonry	Concrete	Steel	MH	Total
Vermont						
Caledonia	2,292,782	442,736	205,304	444,462	66,191	3,451,475
Total	**2,292,782**	**442,736**	**205,304**	**444,462**	**66,191**	**3,451,475**
Study Region Total	**2,292,782**	**442,736**	**205,304**	**444,462**	**66,191**	**3,451,475**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : Lyndon Hurrican 1938
Scenario : Probabilistic

Page : 1 of 1

Building Stock Exposure By General Occupancy

June 04, 2015 *All values are in thousands of dollars*

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Vermont								
Caledonia	2,607,965	527,510	163,531	19,087	52,331	37,910	43,145	3,451,479
Total	**2,607,965**	**527,510**	**163,531**	**19,087**	**52,331**	**37,910**	**43,145**	**3,451,479**
Study Region Total	**2,607,965**	**527,510**	**163,531**	**19,087**	**52,331**	**37,910**	**43,145**	**3,451,479**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : Lyndon Hurrican 1938 Page :1 of 1
Scenario : Probabilistic

Emergency Response Center Facility Functionality:

June 04, 2015

	Count	Functionality (%)
Total		
Study Region Total		

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Page : 1 of 1

Fire Station Facility Functionality: 10 - year Event

June 04, 2015

	Count	Functionality (%)
Vermont		
Caledonia	12	100.00
Total	**12**	**100.00**
Study Region Total	**12**	**100.00**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Hazus-MH: Hurricane Event Report

Region Name: Lyndon Hurrican 1938

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, June 04, 2015

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Lyndon Hurrican 1938

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, June 04, 2015

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Lyndon Hurrican 1938

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, June 04, 2015

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Lyndon Hurrican 1938

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, June 04, 2015

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Lyndon Hurrican 1938

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, June 04, 2015

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Lyndon Hurrican 1938

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, June 04, 2015

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Lyndon Hurrican 1938

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, June 04, 2015

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Hospital Functionality: 10 - year Event

June 4, 2015

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Vermont											
Caledonia											
Small Hospital (less than 50 Beds)	49	49	100.0	49	100.0	49	100.0	49	100.0	49	100.0
Total	**49**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**
Total	**49**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**
Study RegionTotal	**49**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**	**49**	**100.0**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Page : 1 of 7

Police Station Facility Functionality: 10 - year Event

June 04, 2015

	Count	Functionality (%)
Vermont		
Caledonia	5	100.00
Total	**5**	**100.00**
Study Region Total	**5**	**100.00**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Quick Assessment Report

June 4, 2015

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	658
Number of Census Tracts	10
Number of People in the Region	31,227

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ K)*
Residential	13,855	2,607,965
Commercial	845	527,510
Other	524	316,004
Total	15,224	3,451,479

Scenario Results

Number of Residential Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	6	0	0	0	6
200	8	0	0	0	8
500	35	1	0	0	36
1000	124	5	0	0	129

Number of Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	9	0	0	0	9
200	12	0	0	0	12
500	42	1	0	0	43
1000	136	5	0	0	142

Shelter Requirements

Return Period	*Displaced Households (#Households)*	*Short Term Shelter (#People)*
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

Economic Loss (x 1000)

	Property Damage (Capital Stock) Losses		*Business Interruption*
ReturnPeriod	*Residential*	*Total*	*(Income) Losses*
10	0	0	0
20	0	0	0
50	0	0	0
100	426	426	0
200	1,380	1,392	0
500	4,548	4,631	16
1000	9,266	9,430	111
Annualized	41	43	1

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

School Functionality: 10 - year Event

June 04, 2015

	Count	Functionality (%)
Vermont		
Caledonia	29	100.00
Total	**29**	**100.00**
Study Region	**29**	**100.00**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

Page : 1 of 7

Shelter Summary Report: 10 - year Event

June 04, 2015

	# of Displaced Households	# of People Needing Short Term Shelter
Vermont		
Caledonia	0	0
Total	**0**	**0**
Study Region Total	**0**	**0**

Study Region : Lyndon Hurrican 1938

Scenario : Probabilistic

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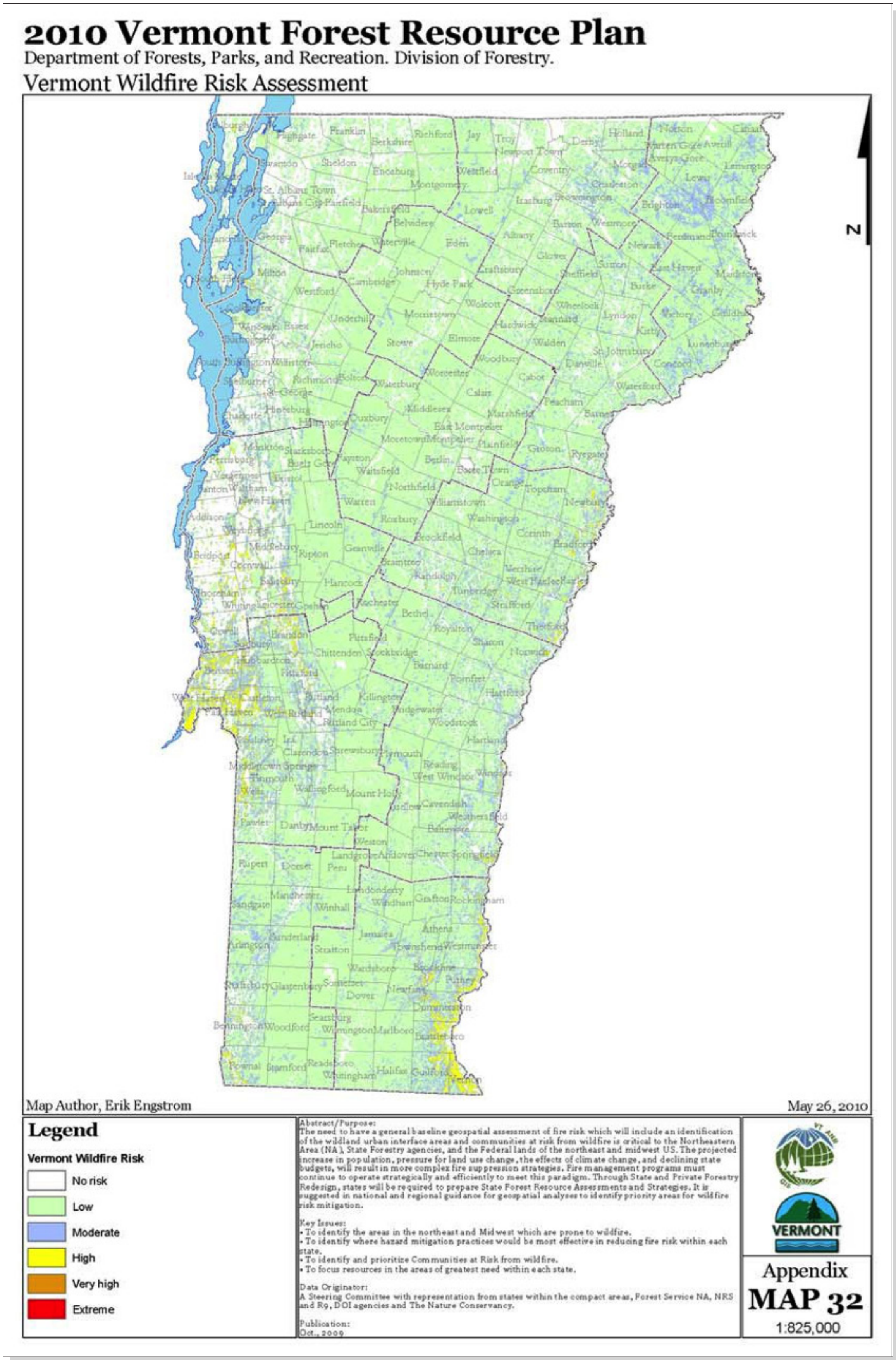
2010 Vermont Forest Resource Plan
Department of Forests, Parks, and Recreation. Division of Forestry.
Vermont Wildfire Risk Assessment
N
Map Author, Erik Engstrom
May 26, 2010
Legend
Vermont Wildfire Risk
No risk
Low
Moderate
High
Very high
Extreme
Abstract/Purpose:
The need to have a general baseline geospatial assessment of fire risk which will include an identification of the wildland urban interface areas and communities at risk from wildfire is critical to the Northeastern Area (NA), State Forestry agencies, and the Federal lands of the northeast and midwest US. The projected increase in population, pressure for land use change, the effects of climate change, and declining state budgets, will result in more complex fire suppression strategies. Fire management programs must continue to operate strategically and efficiently to meet this paradigm. Through State and Private Forestry Redesign, states will be required to prepare State Forest Resource Assessments and Strategies. It is suggested in national and regional guidance for geospatial analyses to identify priority areas for wildfire risk mitigation.
Key Issues:
• To identify the areas in the northeast and Midwest which are prone to wildfire.
• To identify where hazard mitigation practices would be most effective in reducing fire risk within each state.
• To identify and prioritize Communities at Risk from wildfire.
• To focus resources in the areas of greatest need within each state.
Data Originator:
A Steering Committee with representation from states within the compact areas, Forest Service NA, NRS and R9, DOI agencies and The Nature Conservancy.
Publication:
Oct., 2009
VERMONT
Appendix
MAP 32
1:825,000

THE RECORD • FRIDAY, OCTOBER 9, 2015

FOR THE RECORD

NEWS BRIEFS

St. Johnsbury Police find underage drinkers at bike path parking area

ST. JOHNSBURY — Police responded to the bike path parking lot on South Main Street late at night on Oct. 2 and found some high school age children with alcohol.

Officers issued two diversion referrals and one juvenile citation - all for underage possession of alcohol. Police said they also located several other minors on the bike path without alcohol.

Police say they were investigating a report of a suspicious vehicle when they came upon the underage drinkers hanging out in the bed of a parked pick-up truck. Police say the incident remains under investigation.

Lyndon/Lyndonville hazard mitigation plan draft ready for public review

The draft Hazard Mitigation Plan for the town of Lyndon and village of Lyndonville is ready for public review. Paper copies of the plan are available for review at the Lyndon Town offices and at the Cobleigh Library.

To review the plan electronically, go to the Lyndon Town website at http://www.lyndonvt.org and click on the link to the draft Hazard Mitigation Plan.

To review a paper copy contact Kaela Gray, zoning administrator at 626-1269. Comments on the draft may be submitted through Oct. 23 to either the town zoning administrator or to Irene Nagle, senior planner at NVDA, inagle@nvda.net.

The purpose of the Hazard Mitigation Plan is to identify and assess the town's natural hazard risks (such as flooding, winter storms and hurricanes) and determine how to best minimize or manage those risks.

Sheffield traffic stop leads to arrest on active warrant

A Sheffield man was arrested Wednesday after police discovered an

Lyndon/Lyndonville Hazard Mitigation Plan Draft
Ready for Public Review

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The purpose of the Hazard Mitigation Plan is to identify and assess the Town's natural hazard risks (such as flooding, winter storms and hurricanes) and determine how to best minimize or manage those risks.

Work on the Multi-Jurisdiction Hazard Mitigation Plan was supported by a grant awarded by the Vermont Department of Emergency Management and Homeland Security and administered by the Northeastern Vermont Development Association (NVDA). NVDA hired Jamie Caplan Consulting LLC to work with them and the Town and Village to develop the Multi-Jurisdiction Hazard Mitigation Plan.