

# LOCAL HAZARD MITIGATION PLAN



2015-2020

St. Johnsbury, Vermont | 2015-2020

# Certificate of Plan Adoption

## A RESOLUTION ADOPTING THE 2015 HAZARD MITIGATION PLAN

WHEREAS, the Town of St. Johnsbury has worked to identify hazards, analyze past and potential future losses due to natural and human-caused disasters, and identify strategies for mitigating future losses; and

WHEREAS, the St. Johnsbury Hazard Mitigation Plan contains recommended actions to mitigate future losses from disasters in the Town of St. Johnsbury; and

WHEREAS, the St. Johnsbury Selectboard held a meeting to formally approve sending the St. Johnsbury Hazard Mitigation Plan to FEMA Region I for review; and

WHEREAS, upon successful review by FEMA Region I, the St. Johnsbury Selectboard held a meeting to formally approve and adopt the St. Johnsbury Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that the St. Johnsbury Selectboard adopts the 2015 St. Johnsbury Hazard Mitigation Plan.

\_\_\_\_\_  
Date

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

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

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

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Selectboard Member

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Selectboard Member

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Selectboard Member

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Attested to by Town Clerk

## ACKNOWLEDGEMENTS

### ST. JOHNSBURY PLANNING COMMISSION

- Brad Alexander
- Jim Brown
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### ST. JOHNSBURY SELECTBOARD

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- Jamie Murphy
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### ST. JOHNSBURY TOWN STAFF

- David Ormiston, Assistant Town Manager
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### TECHNICAL SUPPORT

- Gail Aloisio, Northeastern Vermont Development Association
- Tracy McIntyre, Northeastern Vermont Development Association

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# Local Hazard Mitigation Plan

ST. JOHNSBURY, VERMONT | 2015-2020

St. Johnsbury has a bright future and a rich past. Unfortunately, hazards and disaster events – from flooding to fires, winter storms to highway accidents – are part of St. Johnsbury’s history and will inevitably be part of the years ahead. But it’s possible – and essential – to mitigate those hazards and help St. Johnsbury avoid and lessen future losses.

In 2014, St. Johnsbury undertook a town-wide hazard mitigation planning process. This document describes that process, along with a history of disaster events and analysis of future risk from manmade and natural hazards, and key action strategies to lessen those risks.

We invite you to read and think about this plan, consider what your own families, organizations and neighborhoods can do to reduce risk of loss, and get involved in making St. Johnsbury a safer and more resilient community in the years to come.



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## INTRODUCTION

Hazard mitigation is any action or process that reduces or eliminates threats to people, infrastructure, property or the economy by lessening the impact from natural or manmade hazards. In the wake of major recent disasters (like Tropical Storm Irene, winter ice storms and downtown fires), people are paying attention and want to reduce risk. This plan helps guide the St. Johnsbury community as it comes together to make hazard mitigation a priority – for the town, for organizations and businesses, and for residents in their homes and neighborhoods.

### Plan Purpose

Some hazards can be prevented through strong management and preparation. Other hazards can't be prevented but can be predicted, allowing communities time to plan and act to minimize damage and losses when those occur. This Hazard Mitigation Plan is a critical exercise for St. Johnsbury in risk management, or analyzing and reducing potential threats to the community. The federal government's *Risk Management Process for Federal Facilities: An Interagency Security Committee Standard* states<sup>1</sup>:

**Risk is a function of threat, consequence, and vulnerability. The objective of risk management is to create protection that mitigates vulnerabilities to threats and their potential consequences, reducing risk to an acceptable level.**

The benefits of hazard mitigation planning include:

- Reducing physical, financial, cultural and emotional losses caused by natural and manmade disasters
- Increasing public awareness and understanding of community and individual vulnerabilities and risks from likely disaster events
- Increasing the public's understanding of how climate change could affect the intensity of likely hazard events
- Increasing understanding of how the town's future land use, emergency operations and other plans can help mitigate hazards
- Increasing support for specific actions the town may propose to reduce losses from future hazard events
- Strengthening partnerships, establishing communications and creating opportunities to leverage resources among diverse town stakeholders with interests in hazard mitigation issues

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<sup>1</sup> U.S. Department of Homeland Security. 2013. *The Risk Management Process for Federal Facilities: An Interagency Security Committee Standard*, 1<sup>st</sup> Edition. <http://www.dhs.gov/publication/risk-management-process-federal-facilities-interagency-security-committee-standard>, accessed 9/15/14.

- Renewing St Johnsbury's eligibility for federal grants and aid following a federally-declared disaster and completing a requirement to become eligible for a higher match of state funds for disaster-related infrastructure repair

## Glossary + Acronyms

Hazard mitigation involves a number of terms that may be unfamiliar to the average person. The following definitions highlight terms and acronyms used commonly throughout this plan.

### KEY TERMS<sup>2</sup>

**Cascading Effects:** Long-term or indirect consequences and impacts caused by hazards and interrelated systems. (ex. firewood shortage triggered by ice storm damage)

**Event or Incident:** An occurrence, natural or manmade, that requires a response to protect life or property. (ex. fire, flood, major disaster)

**Hazard:** Something potentially dangerous or harmful, often the cause of bad outcomes.

**Impact:** Effects of a hazard on the community's residents, economy, property, infrastructure, environment and culture.

**Mitigation:** Steps to reduce loss of life & property by lessening the impact of disasters.

**Probability:** The likelihood that a certain event will happen in a given amount of time.

**Recovery:** The capabilities necessary to assist communities affected by an incident to recover effectively, including rebuilding infrastructure; providing housing; restoring health, social, and community services; promoting economic development; and restoring natural and cultural resources.

**Resilience:** The ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies.

**Response:** Those capabilities necessary to save lives, protect property and the environment, and meet basic human needs immediately after an incident has occurred.

### ACRONYMS

**EMD:** Emergency Management Director

**ERAF:** (Vermont) Emergency Relief and Assistance Fund

**FEMA:** Federal Emergency Management Agency

**NFIP:** National Flood Insurance Program

**NVDA:** Northern Vermont Development Association

**STAPLEE:** Social-Technological-Administrative-Political-Legal-Environmental-Economic (cost-benefit analysis framework)

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<sup>2</sup> Primarily excerpted or adapted from the FEMA Glossary. <https://www.fema.gov/glossary/acronyms-0#R>, accessed 1/12/15.



**Vulnerability:** The extent to which people will experience harm and property will be damaged from a hazard; a factor of likelihood, impact, and geographic extent.

## Hazard Mitigation Planning Requirements + Incentives

St. Johnsbury's first hazard mitigation plan was approved in 2005. In the decade since, St. Johnsbury, the State of Vermont and the country have been hit hard by more intense storms. The Federal Emergency Management Agency (FEMA) has updated its guidance and expectations for local hazard mitigation planning under a new "National Mitigation Framework,"<sup>3</sup> which requires more robust planning at the local level. In the wake of devastation from Tropical Storm Irene, the State also revised the Emergency Relief and Assistance Fund (ERAF) to offer increased state matching funds for federal disaster aid if municipalities take certain steps toward mitigating future impacts from disasters.

In order to qualify for the first step of increased match, municipalities must adopt state-prescribed road standards, flood hazard bylaws, a local emergency operations plan and a local hazard mitigation plan (approved by FEMA). With the adoption of this plan, St. Johnsbury will meet the first level of increased state matching funds when it is awarded federal funding for hazard mitigation. Additional steps beyond adoption of this plan are recommended, which will make the town eligible for even higher levels of state matching funds.

St. Johnsbury is also a "Designated Downtown" in the State's downtown program, modeled after the National Main Street Program. This designation makes the town eligible for infrastructure grants in the historic downtown core, and property owners are eligible for state historic tax credits to assist in maintaining buildings, such as adding sprinklers or other fire protection measures.



FIGURE 1 THE FEMA NATIONAL MITIGATION FRAMEWORK INCLUDES 7 CORE CAPABILITIES.

<sup>3</sup> "National Mitigation Framework." Federal Emergency Management Agency. <https://www.fema.gov/national-mitigation-framework>, accessed 1/12/15



Table x. State and federal requirements for hazard mitigation planning

| State or Federal Requirement               | Date Approved/<br>Instituted  | Notes   |
|--|-------------------------------|---|
| FEMA-approved local hazard mitigation plan | 2005 (past)<br>2015 (current) | St. Johnsbury's previous plan expired in 2010. When this plan is approved, it will be valid for five years.   |
| Flood hazard bylaws                        | 2014<br>(modified)            | St. Johnsbury has long had zoning regulations in effect. Its zoning, subdivision and flood hazard bylaws are combined into one set of land use regulations. The adopted flood hazard bylaw provisions follow the standard minimum elements of the National Flood Hazard Insurance Program (NFIP). |
| State-prescribed road standards            | 2013                          | Adopted by towns statewide to address concerns raised by FEMA.  |
| Local emergency operations plan            | 2014, re-adopted annually     | St. Johnsbury's plan is kept current by the Town's Emergency Operations Director. There is also a Rapid Response Plan in effect. <a href="#">WEB LINK</a>   |

## Planning History + Context

Hazard mitigation planning in St. Johnsbury is not new, and it's not happening in isolation. Several other local planning efforts include related measures and programs.

### HAZARD MITIGATION PLANNING

The previous St. Johnsbury Hazard Mitigation Plan was adopted in 2005 and expired in 2010. It consisted of both a regional All-Hazards Mitigation Plan completed by the Northeastern Vermont Development Association (NVDA) and a 19-page local annex plan for St. Johnsbury. The regional plan was written to encompass the needs of the 55 municipalities in northern Vermont, many of which face similar hazards. In the wake of the new State and FEMA requirements, all NVDA towns are now creating their own plans.

Plan Cover

2005 Plan Cover

## TOWN PLAN

St. Johnsbury also has a strong town plan, *Energizing Our Potential*, updated and adopted relatively recently in 2011. The plan involved a vigorous public process with more than 150 people working on nine committees. The town plan predates a new state requirement (enacted in 2012) to include a flood resilience requirement. Still, it includes extensive initiatives in areas related to hazard mitigation: health and human services, cultural and historic preservation, economic development, education, energy, housing and neighborhoods, land use, public services, utilities and transportation, and recreation.

## ENVIRONMENTAL PLANNING

Several river and environmental studies and plans have also been completed in St. Johnsbury. Phase 1 + 2 Geomorphic Assessments of the Moose River were completed in 2009, and did not suggest any major erosion or movement. Phase 1 and River Corridor Plans have been completed for the Passumpsic River tributaries. These studies show that the Sleepers River is undergoing significant adjustment, and riverbanks may be unstable. Finally, the Caledonia County Conservation District completed a bridge and culvert assessment, looking at all culverts in the Passumpsic River Watershed. All data has been uploaded to the Vermont Agency of Natural Resource's Bridge + Culvert Database. Nearly all the culverts were found to have problems, though some have more significant issues. A river corridor plan was recently produced, but the Planning Commission has not yet addressed it. More information on specific findings are included in the Flooding + Fluvial Erosion priority hazard profile on [page xx](#).

## PLAN INTEGRATION AND MAINTENANCE

There is little relationship between the actions recommended in the 2011 town plan and this hazard mitigation plan, except for initiatives relating to maintaining public safety services, creating alternative locations for critical services and practicing emergency operations procedures. Stronger integration of this plan with the town plan will occur at the next town plan update, scheduled for 2016. At that point, the new state planning statutes adopted after Tropical Storm Irene will require creation of a flood resilience element and reference to this hazard mitigation plan. St. Johnsbury should also work to improve integration between this plan and the Emergency Operations Plan, as well as other plans at the regional and local levels.

While the first All-Hazards Plan annex for St. Johnsbury was created with only the Selectboard, Fire Chief and Town Planner at a public meeting to prioritize risks, the town has since established a strong record and appreciation for public involvement in planning. The town plan and this hazard mitigation plan update have both benefited from robust outreach and participation. Improvements in social media have improved outreach. This plan has also benefited from having the responsibility for drafting shared by the Town Manager's Office, the regional planning commission and the St. Johnsbury Planning Commission. That cooperation should continue for future plan drafts and for implementation of recommended actions.

Future updates to this plan should begin prior to its expiration in five years and include continued strong public outreach and participation, as well as strong research to identify changes in weather patterns or other factors that will influence vulnerability and hazard likelihood.

## PLANNING PROCESS

This hazard mitigation planning process was marked by a robust effort to engage diverse stakeholders and the broader public. That effort represented an attempt to both learn from more people and gather a broad range of viewpoints, but also to engage and educate more people about the importance of hazard mitigation planning and prepare them to stay involved with implementation.

The planning process was coordinated by the Northeastern Vermont Development Association (NVDA), the regional planning commission. NVDA staff members were involved throughout the planning process and were key to public outreach. NVDA coordinated work with the planning consultants (Peg Elmer, AICP and Rebecca Sanborn Stone), St. Johnsbury town staff, and the general public. NVDA made certain that officials in surrounding towns were notified of the St. Johnsbury public process, through the Local Emergency Planning Committee (LEPC) and other measures. NVDA invited nearby municipalities and critical stakeholders (such as utility companies) to participate in both of the public meetings and to contribute to the draft plan development and review.


### Plan Goals

The 2005 Hazard Mitigation Plan for St. Johnsbury included the following goals, which are still applicable to this process:

- Reduce the loss of life and injury resulting from all hazards.
- Mitigate financial losses incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters.
- Reduce the damage to public infrastructure resulting from all hazards.
- Recognize the connections between land use, storm-water road design and maintenance and the effects from disasters.
- 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.
- Encourage all-hazard mitigation planning as a part of the municipal planning process.

### Public Outreach + Communication

This planning process included numerous attempts to inform the public about the process, gather their input about St. Johnsbury's hazard history and vulnerability, engage them in a town-wide risk assessment, and involve them in prioritizing action strategies.



Timeline graphic and/or  
participation infographic

Beyond the standard public warnings, NVDA and town staff publicized the process and engagement opportunities in many ways. They drafted articles promoting the public meeting, which were carried in the *Caledonian Record*, the daily newspaper based in St. Johnsbury (see copy in [Appendix xx](#)). They distributed posters to businesses and public locations around town and made announcements on the town's website, social media channels, and the public access television station, KATV. Most importantly, NVDA and the Town identified key residents and stakeholders who should be present and issued direct and personal invitations to those individuals.

The public and key stakeholders were heavily engaged in the planning process at three major points:

1. Vulnerability Audit survey, available online and in hard copy from late September through December, 2014
2. 1<sup>st</sup> Public Meeting (Hazard History + Vulnerability Analysis), held October 2, 2014
3. 2<sup>nd</sup> Public Meeting (Action Planning), held December 4, 2014

## Planning Phases

The planning process included four major phases:

### VULNERABILITY AUDIT + HAZARD HISTORY RESEARCH

NVDA distributed a "St. Johnsbury Vulnerability Audit" survey online, through the St. Johnsbury town website, and through hard copies available at the local public library (St. Johnsbury Athenaeum) and the Town Clerk's office (see copy in [Appendix xx](#)). The survey prompted individuals to think about their own personal hazard preparation, as well as what they know about the community's vulnerability. Hard copies also included a "Hazard History Checklist," asking individuals to share details about a range of past hazards. Only a handful of residents returned surveys, with very few details about hazard history. The planning consultants researched the hazard history of St. Johnsbury. They consulted more than [xxx sources](#), ranging from local newspaper accounts and historical records to major federal databases of hazard records ([see xxxxx for more details on sources and the research process](#)). The team then used a hazards history checklist to obtain public input at the first public meeting and by people who completed checklists on their own.

### VULNERABILITY ASSESSMENT

St. Johnsbury's Vulnerability Assessment was completed with information from the hazard history, the Vulnerability Audit, the risk assessment table completed by the Town Assessor for flood risk properties, and a critical early-stage public meeting.

The first public meeting was held on October 2, 2014, at the Fire Station, with more than 20 people in attendance. The Town Manager's Office issued many personal invitations to key officials to attend the meeting, and many did. The Assistant Town Manager, Fire Chief, Town Clerk, Public Works Director, Director of the St. Johnsbury Athenaeum, and School District Staff all attended. Also attending were representatives from the hospital, corrections facility, and Chamber of Commerce. Three attendees represented the region's principal utility, Green Mountain Power. Five members of the St. Johnsbury planning commission attended, one of whom is a state legislator, and another who is the district

watershed coordinator for the State's Agency of Natural Resources. Several elderly residents attended as well, including one who lives in an important senior housing facility in a former historic hotel. The meeting was broadcast live on KATV.

Attendees offered an excellent mix of community expertise and memories. After a brief overview of state and federal disaster and weather data related to St. Johnsbury, the group used the Hazard History Checklist (see Appendix xx) to hone the history of disaster events in St. Johnsbury, discuss likelihood of future events by hazard type and the level of probable loss or impact that the town should anticipate. The Vulnerability Audit survey was used in small groups to gather additional information on how well informed, connected and prepared the community and local institutions are for a variety of major disaster events. Attendees also reviewed the priorities of the 2009 plan and the State's hazard mitigation plan, as they relate to more recent weather events and the experience of the community with disaster situations.

The Vulnerability Assessment, a list of priority hazards for St. Johnsbury including flooding, severe storms, hazardous materials incidents and downtown fires; see Table xx on p. xx) was then reviewed and honed by a core team of the Assistant Town Manager (David Ormiston), Fire Chief + Emergency Operations Director (Troy Ruggles), the full Planning Commission, and NVDA staff.

### ACTION PLANNING

Prior to the mitigation action-planning phase, the team made further efforts to educate and involve the public, via an extensive program on KATV and another noticed meeting to review an early draft of the plan, priority hazards, and a list of possible actions.

The team held a second public meeting on December 4, using the same variety of methods (posters, online notices, newspaper and TV announcements and direct invitations) to inform and invite the public. More than 20 people attended again, including three members of the Planning Commission, Superintendent of Schools, Assistant Town Manager, Public Works Director, Director of the Athenaeum, Director of the Chamber of Commerce, representatives of the electric utility, affordable housing programs, the hospital, fire and police departments, public works, school operations department, and numerous residents. The meeting was again broadcast live on KATV and was recorded for later showing on New 7, the TV station run by Lyndon State College, along with interviews recorded with several participants.

After a brief slide presentation describing possible mitigation strategies to lessen losses from St. Johnsbury's priority hazards, attendees broke into three groups, each discussing a different set of possible mitigation actions that St. Johnsbury could adopt for the next five years. The groups were divided in part based on expertise (with representatives of the fire department considering actions related to fire hazards, for example). The groups scored the actions using an abridged STAPLEE (Social, Technical, Administrative, Political, Legal, Environmental and Economic) cost-benefit analysis worksheet (see Appendix xx). After the meeting, the consultants and NVDA reviewed the STAPLEE scores, adjusted for consistency between the groups, and selected priorities from among the strategies with the highest scores.

### PLAN DRAFTING + REVIEW

Finally, the results were compiled into the draft plan and reviewed again at publicly noticed meetings of the Planning Commission in January 2015 and the Selectboard in February 2015. Those boards carefully weighed the political, fiscal and technical feasibility of the plan actions for the next five years, detailed on pp xx, and then approved the draft plan before passing it on to FEMA Region 1 for review.

## COMMUNITY PROFILE AND ASSETS<sup>4</sup>

With a population of nearly 7,600 residents<sup>5</sup>, St. Johnsbury might be a small town in another state, but it is the “queen city” of the Northeast Kingdom in Vermont. Located at the confluence of three rivers (Passumpsic, Moose, and Sleepers), St. Johnsbury is also an important juncture for railroads, interstate highways and transmission corridors. Just as critically, it is a cultural, employment and service center for the region, drawing visitors and workers from across the border in New Hampshire as well as from around Vermont’s north country.

### GEOGRAPHY + ENVIRONMENT

St. Johnsbury is located at the southern end of Vermont’s Northeast Kingdom, near the border of New Hampshire and approximately 50 miles south of the Canadian border. Nearly 37 square miles in size, St. Johnsbury includes four distinct villages: St. Johnsbury (the primary downtown area), St. Johnsbury Center, East St. Johnsbury and Goss Hollow. Bordering towns include Waterford, Kirby, Lyndon, Danville and Barnet.

The town lies in the heart of the Passumpsic River Basin, which is one of the largest rivers feeding into the Connecticut. Its highest point is a hill in the eastern part of town, with an elevation of 1,594 feet. Its location in the river valley and eastern foothills of the Green Mountains means that St. Johnsbury’s terrain is less mountainous than many surrounding towns, leaving it less susceptible to flash flooding and erosion.

The downtown area has a high ridge, where the Fire Station, Athenaeum (library), Courthouse, Fairbanks Museum, Catamount Arts, Post Office, most of the large churches and St. Johnsbury Academy are located. The downtown then moves downhill to an area that abuts Rtes 2 and 5, and marks the confluence of the Moose and Passumpsic Rivers. Most of the main commercial area is located well above the riverbanks, but an industrial area downstream of the downtown is vulnerable to flooding. The wastewater treatment plant is located there. The municipal offices were moved into the former train station in the lower part of the downtown, which could be affected by a major flood or rail accident involving hazardous materials. Approximately 60% of the population of the town lives within the core downtown area of about two square miles.

St. Johnsbury is more densely populated than any other town in the Northeast Kingdom, but still retains significant tracts of undeveloped land. More than half of the town’s acreage is forested, some of which is open to public use. Parks and recreation areas include the Town Forest (or Memorial Forest) and Arlington Woods. Other parks for public recreation include: Arnold Park, Main Street Park (a.k.a. Summer St. Common and Four Seasons Neighborhood Park), South Park, Fred Mold Park, Peter and Polly Park, and Portland Street Park. Maintenance work is carried out by prisoners at the Northeast Regional Correctional Facility.

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<sup>4</sup> Unless otherwise noted, facts in this section are derived from St. Johnsbury’s 2011 Town Plan or the <http://stjvt.com> website.

<sup>5</sup> "Geographic Identifiers: 2010 Demographic Profile Data (G001): St. Johnsbury town, Caledonia County, Vermont". U.S. Census Bureau, American Factfinder. <http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>, accessed 1/6/15

### DEMOGRAPHICS AND POPULATION

At the 2010 Census, St. Johnsbury's population was 7,603 – a slight increase over the population ten years before (7,571). While development trends in some areas are still pushing population growth outside of downtown centers, many Vermont downtowns are growing as people prioritize community assets, walkability, and more livable communities. The median age is 41.8 years; 16.7% are over age 65 and 21.6% are under age 18. St. Johnsbury residents identify as 95.6% white, with small minorities identifying as Hispanic, black or African American, Asian, American Indian, and mixed races. Of the 3,158 households in St. Johnsbury, 59.2% identify as families and 27.2% include children under 18 years of age. St. Johnsbury includes 3,522 housing units, of which 89.7% are occupied and 43.5% are renter-occupied.<sup>6</sup>

### GOVERNMENT AND PUBLIC SAFETY

St. Johnsbury is the Shire Town of Caledonia County and the largest town in the county, with nearly 1/5 of the total population.<sup>7</sup> St. Johnsbury has a town meeting form of government and a 5-member Board of elected selectmen and women. A Town Manager and Assistant Manager handle day-to-day operations of the town, with **xx** additional staff members supporting the Town Manager's Office, Town Clerk, Assessor and Planning and Zoning Department. Its current zoning administrator is also a member of the planning commission. The municipal records are protected via cloud-based back up. The municipal offices are housed downtown on the second floor of the former train station, with an active regional visitors' center on the main floor.

St. Johnsbury maintains full time, 24-hour police and fire departments. The fire department has 10 full time staff and 17 on-call staff; it is regarded as one of the best-equipped and trained in the state. The full-time firefighters are certified and trained as Level II Firefighters and are Emergency Medical Technicians. All members of the fire department also have Hazardous Materials Training at various levels. The fire department is also trained and equipped to handle technical rescue. A trailer is filled with specialty equipment and the firefighters are ready to handle rope rescue, confined space rescue, trench rescue, and building collapse. The equipment and training were provided through Homeland Security funding. The Fire Department offers a home preparedness checklist and the Chamber of Commerce offers comparable disaster preparedness information to businesses. The historic downtown fire station next is under-sized for its multiple uses and needs, however, and the Town Plan recommends construction of a new fire station. The Fire Department maintains mutual aid agreements with **xxx surrounding towns: xxxxx**.

**The Police Department includes xxx full time officers,** a K-9 unit, a special investigations unit, 24-hour dispatch, and house checks when residents are away for extended periods. The Northeast Regional Correctional Facility in St. Johnsbury, a state prison, supports **xxx** Department of Corrections employees. The Facility maintains a positive role in the community, with staff attending community meetings and working to keep residents informed.

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<sup>6</sup> "Community Facts: St. Johnsbury town, Caledonia County, Vermont." U.S. Census Bureau, American Factfinder. [http://factfinder.census.gov/faces/nav/jsf/pages/community\\_facts.xhtml#none](http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml#none), accessed 1/6/15

<sup>7</sup> "Caledonia County." U.S. Census Bureau, State and County QuickFacts. <http://quickfacts.census.gov/qfd/states/50/50005.html>, accessed 1/6/15



## ECONOMY, BUSINESSES + CULTURAL ASSETS

A historic regional center, St. Johnsbury is anchored by rich cultural assets bequeathed by the Fairbanks family, which made its fortune through the Fairbanks Scales manufacturing company. The St. Johnsbury Athenaeum houses both the town library and a late 1800s art gallery, and the Fairbanks Museum and Planetarium is the site of the longest continuous meteorological record keeping in Vermont<sup>8</sup>. The town has experienced a recent renaissance in the arts as well, driven by the community arts center Catamount Arts, which houses a gallery, offices and was named the “Best All Around Community Arts Center in New England” in 2009 by *Yankee Magazine*.

Once dominated by industry and manufacturing, St. Johnsbury is now home to a vibrant mix of businesses and industries – from centuries-old manufacturing companies to small start-ups and traditional Main Street shops. The major employers of days past (like Fairbanks Scales and Maple Grove Farms, which once helped make St. Johnsbury the “maple center of the world,”) have scaled back and now employ only 100-250 people. It is still an essential regional employment center, though, with a labor force of 13,800 and an unemployment rate of only 4.6%.<sup>9</sup> St. Johnsbury shares a 34-lot industrial park with the town of Lyndon; about half of the lots are occupied, employing about 700 people. In a sign of the shift toward a creative economy, Catamount Arts now generates about 230 full time jobs.<sup>10</sup> St. Johnsbury’s jobs are now classified as 19.4% in the production of goods, 62.1% in service provision, and 18.5% in government.<sup>11</sup> An active Chamber of Commerce works to link businesses, promote the local economy, and ensure stability and sound business practices (including hazard mitigation).

While St. Johnsbury is the economic center of the region, the Northeast Kingdom is the poorest region in the State and St. Johnsbury’s economy is below the statewide average. The town’s median income for a family (\$37,184, based on the American Community Survey’s 5 year estimates, 2009-2013) is almost \$20,000 less than the state median (\$54,168) and 15.6% of St. Johnsbury’s population is below poverty level, compared to 11.6% statewide.<sup>12</sup> St. Johnsbury’s location along major international and interstate commerce routes leads to increased issues with gangs and illegal drugs, which are also related to high poverty rates and the presence of a state correctional facility.

## COMMUNITY SERVICES

Though it’s a relatively small town, St. Johnsbury’s role as regional center means that it offers a number of community services for its own residents and those of surrounding towns.

<sup>8</sup> “Why is the Museum involved with weather?” Fairbanks Museum website. <http://www.fairbanksmuseum.org/AboutEOTS>, accessed 7/15/14.

<sup>9</sup> Vermont Labor Force by LMA. November 2014. Vermont Department of Labor. <http://www.vtlmi.info/regionlma.cfm?lmacode=000016>, accessed 1/12/15

<sup>10</sup> *Vermont Life* magazine; Autumn 2014; “Remote Possibility: Art Connections drive hope in gritty St. Johnsbury”, p 34

<sup>11</sup> Vermont Labor Force by LMA. November 2014. Vermont Department of Labor. <http://www.vtlmi.info/regionlma.cfm?lmacode=000016>, accessed 1/12/15

<sup>12</sup> “Community Facts: St. Johnsbury town, Caledonia County, Vermont.” U.S. Census Bureau, American Factfinder. [http://factfinder.census.gov/faces/nav/jsf/pages/community\\_facts.xhtml#none](http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml#none), accessed 1/6/15

St. Johnsbury boasts a fine education system, with the St. Johnsbury School serving elementary students. The adjacent St. Johnsbury Academy is an independent high school with a fine reputation that serves the town's residents, attracts students from surrounding towns, and draws a number of international boarding students to its campus. St. Johnsbury also hosts a branch of the Community College of Vermont and has an Applied Technology Center at the St. Johnsbury Academy.

As a regional center for social services, St. Johnsbury is home to the Northeastern Vermont Regional Hospital (a full service medical center and designated trauma center), Umbrella (a domestic violence agency), Northeast Kingdom Community Action (providing services to moderate-to-low income families), Area Agency on Aging and Northeast Kingdom Youth Services (supporting youth and their families). St. Johnsbury also offers several public senior and low-income housing options and food shelves. The many regional human service agency leaders meet regularly to collaborate. In addition, the Community Justice Center has established a number of neighborhood associations in the town. Ambulance service is provided by a private entity, Calnex.

### INFRASTRUCTURE, TRANSPORTATION + UTILITIES

Green Mountain Power (GMP) is the electric utility serving St. Johnsbury, with the exception of the St. Johnsbury - Lyndonville Industrial Park, which is served by Lyndonville Electric. GMP monitors weather daily and has incident command routines in place. There are three major electric transmission corridors in St. Johnsbury; it is unlikely that all three would fail at the same time, leaving St. Johnsbury significantly less vulnerable to long-term power outages than many communities.

The town highway and water departments are consolidated into a Department of Public Works. Many of the Town's structures are served by public water and wastewater treatment systems. Stiles Pond is the primary water supply for St. Johnsbury, and the town has about 60 miles of water lines; there is an Emergency Response Plan in place for water supply emergencies, per the Environmental Protection Agency. Operation of the wastewater treatment plant is contracted to a private firm, Optech.

St. Johnsbury has about 100 miles of roads – half of which are gravel. In addition to local roads, St. Johnsbury is located along Interstate Highway 91, which runs the length of the Vermont-New Hampshire border and accommodates significant traffic between the United States and Canada. Interstate 93 in New Hampshire also ends at I-91 in St. Johnsbury. Two major state highways, U.S. Rte 2 (running east-west) and U.S. Rte 5 (running north-south) also intersect in St. Johnsbury. Many roads in town are vulnerable to flooding, including Rtes 2 and 5. All roads leading to the hospital are vulnerable to flooding. Finally, St. Johnsbury is the site of a major railroad junction, with tracks running through downtown and along the Passumpsic River. The railroad is heavily used for freight, including frequent shipments of propane and other hazardous materials.

Public transportation is provided in St. Johnsbury by Rural Community Transportation Inc. (RCT), a private non-profit corporation. There is limited service from St. Johnsbury to neighboring communities, such as a town bus route to Lyndonville and commuter service linking St. Johnsbury to Montpelier and points beyond on Green Mountain Transit. In the case of a major disaster, mass transit options could be supplemented by St. Johnsbury School District school buses and ten 12-passenger vans owned by the Department of Corrections.

## EMERGENCY PREPAREDNESS + COORDINATION

Fire Chief Troy Ruggles is St. Johnsbury's Emergency Management Director and lives in town. St. Johnsbury has one emergency dispatch site (at the fire station) and three emergency shelters. The primary emergency shelter is the St. Johnsbury School, which was flooded during a 2011 spring storm. The town installed a generator, enabling that site to serve as a shelter during extended power outages. The St. Johnsbury Academy created another shelter in its field house and paid for a generator, and the Good Shepard School is also available as a back up shelter. There are no emergency shelters located in the villages of East St. Johnsbury and St. Johnsbury Center, which could be isolated by storms.

St. Johnsbury has several systems in place to communicate during emergencies. Its NIXTL

communications system sends emergency text messages

to citizens on cell phones. Emergency information can be posted on the Town's website. St. Johnsbury also maintains a list of ham radio operators and an updated list of residents with special needs, which can be used to check on individual people. The Emergency Management Director is kept apprised of road status by the Public Works Department and any residents isolated in emergencies can notify the Fire Department or Emergency Management Director to ask for assistance. Several businesses and community groups also have knowledge and activities related to emergency outreach: Meals on Wheels drivers know many of the area's vulnerable citizens, and Green Mountain Power sends line workers out to impacted areas on foot when power lines are in danger.

St. Johnsbury is a community where neighbors help neighbors, and those personal relationships have proven essential in past disaster situations. In addition to personal action and town-wide emergency management procedures and responsibilities, many local entities have their own plans, procedures and offerings. Most of these departments and organizations are represented on the Local Emergency Planning Committee (LEPC) coordinated by NVDA.

- The Correctional Facility has a National Incident Management System (NIMS) command structure in place for emergencies and practices several times each month for emergencies caused by a long-term power outage, flooding, infectious epidemic, major accident or hazardous materials spill, fire or a jail break. It maintains enough fuel and food to last about a week and has two generators.
- The hospital maintains its Emergency Operations Plan and committee and practices each month for emergencies from a long-term power outage, flooding, infectious epidemic or major accident.



- The Canterbury Inn and St. Johnsbury House assisted living facilities conduct emergency drills in conjunction with the town's emergency services.
- The police have an emergency plan as well and a designated "command center" room. The police department's web page maintains an updated alert feed with important safety and municipal announcements.
- The Fire Department distributes household emergency kits, and the Chamber of Commerce maintains comparable information on its website for businesses.
- Green Mountain Power is working to improve coordination between its emergency response plans and the town's, and is providing education to local road crews about how to handle downed lines and other electrical emergencies.

PLACEHOLDER FOR MAP OF ASSETS



HAZARD + VULNERABILITY ASSESSMENT

Floods, fires, epidemics, tornadoes, landslides. St. Johnsbury may face any number of hazards in the future – both manmade and “natural” (or those caused by environmental and meteorological events). In order to effectively plan and mitigate for them, it’s helpful to distinguish between **events** (or causes – like storms), the **hazards** they cause (or threats like wind and flooding), and to acknowledge the **effects** of those hazards – or impacts on property, people, and the community. It is important as well to identify **“cascading effects”** – or longer-term consequences (such as gasoline shortages or business closures) that may result from a hazard. Still, there can be overlap between these categories (for example, floods and traffic accidents can be both causes and effects). And the most dangerous situations often arise when multiple hazards or events combine and effects are multiplied.

| Table xx. Events, Hazards and Cascading Effects |                  |  |
|---|------------------|--|
| Events (Causes)                                 | Hazards          | Effects                                    |
| Thunderstorms                                   |                  | Extended power outages                     |
| Winter storms                                   | High winds       | Property + crop damage                     |
| Hurricanes                                      | Flooding         | Infrastructure damage                      |
| Tornadoes                                       | Flash flooding   | Road closures + isolation                  |
| Microbursts                                     | Lightning        | Unsafe travel                              |
| Severe storms                                   | Structural Fires | Water contamination                        |
| Ice jams  | Wildfires        | Environmental damage                       |
| Accidents (all types)                           | HazMat Incidents | Erosion                                    |
| Chemical spills                                 | Snow and ice     | Unsafe travel                              |
| Aging infrastructure/<br>construction           |                  | Service disruption (water,<br>power, etc.) |
|   |                  | Loss of business                           |
|   |                  | Injury + death                             |

This section analyzes a wide range of data sources to understand the frequency and severity of past events and hazards in St. Johnsbury and the likelihood of future hazards. Many data sources have not – and still do not – distinguish between events and hazards as we did above. The data sources that follow often use the terms interchangeably.

Vulnerability assessment of natural and manmade hazards involves considering the **probability** that a certain hazard will occur and the **impact** of that hazard on the community (including the location, extent and severity), including the degree to which St. Johnsbury would be susceptible to loss of life, injuries, or damage to physical and cultural assets.<sup>13</sup>

In order to determine which threats pose the greatest risk to St. Johnsbury in the future, we:

- Examined the Vermont Hazard Mitigation Plan and federal resources for information about high priority hazards in the region
- Examined more than 100 years of historical records of hazard events in St. Johnsbury and Caledonia County
- Surveyed St. Johnsbury community members about their recollections of hazard events and their sense of vulnerability
- Assessed local leaders' and emergency managers' opinions on vulnerability and hazard probability

The Town of St. Johnsbury used the hazard history and statewide hazard rankings, as well as local knowledge, to rank the top priority hazards going forward. The team determined that the most likely future hazards include flooding, severe storms, and structure fires (Table XX).

## Hazard Identification

While detailed histories of hazard events are not typically available at the town level in national or statewide data, most hazards impacting the St. Johnsbury area are regional by nature, and county and regional datasets generally provide accurate information about local hazard history. We used four primary databases to generate an overview of the hazard history of Caledonia County and St. Johnsbury, supplemented with local data on ice jams and fires. The State of Vermont analyzes likely hazards for the state as a whole and for separate regions. Local history data and anecdotes in St. Johnsbury can help to fill in gaps, and the condition of critical infrastructure and facilities can help to predict some likely future hazards.

It is important to note that hazard data sources do not all offer directly comparable data. Different data sources sometimes use different vocabulary to refer to the same events and terminology can change over time. In other cases, the hazards themselves may be difficult to clearly separate, classify, or distinguish from hazard events or cascading effects. For example, in one case heavy rainfall could lead to flooding, which could lead to the effect of dam failure; in another case, dam failure itself could be the cause of flooding.

Infographic on hazard types

<sup>13</sup> Renfroe, Nancy A., and Joseph L. Smith. 2014. "Threat/Vulnerability Assessments and Risk Analysis." *Whole Building Design Guide*, National Institute of Building Sciences. <http://www.wbdg.org/resources/riskanalysis.php>, accessed 12/23/14.



Regardless of terminology, all major hazard history databases confirm that the primary hazard events for the Caledonia County area are related to storms. Winter weather, wind and thunderstorms are responsible for the greatest number of hazardous events at the town and county level. Localized flooding hazards (including flash flooding and erosion) result in the most significant damage to property and crops.

While they are not represented in national or county-level datasets on natural hazards, it is also worth noting that major structure fires have posed a significant threat to St. Johnsbury in the past. Major fires have destroyed entire blocks in St. Johnsbury’s downtown on numerous occasions, and continue to pose a risk to the local economy, public safety and infrastructure.

2005 PLAN

St. Johnsbury’s 2005 plan identified three high risks (flood, hazardous materials incident and structure fire) and twelve medium-high risks (flash flood, hazardous materials, structure fire, power failure, winter storm/ice, high wind, water supply contamination, dam failure, highway incident, forest fire, school safety issues and terrorism).

STATE HAZARDS RANKING

The State of Vermont’s Division of Emergency Management and Homeland Security ranks statewide hazards in the *State of Vermont Hazard Mitigation Plan*, which was last updated in 2013. The statewide ranking (Table xx) includes both natural and manmade hazards, and is intended to help guide towns in making an initial list of hazards to address.

In addition to the overall ranking, the state plan addresses major threats to specific regions within the state. Regions are broken down by regional planning association boundaries, or “jurisdictions.” According to the plan, the Northeastern Vermont Development Association region (in which St. Johnsbury falls) is at high risk for flooding and fluvial erosion and at moderate risk for ice storms. The plan notes that Caledonia is among the five Vermont counties with the highest number of reported floods and FEMA federal disaster declarations and St. Johnsbury is among the ten towns in Vermont with the highest number of repetitive flood losses. It also notes that the Northeast quadrant of the state is at the highest risk for extreme

Table XX. Vermont Statewide Hazard Ranking, 2013

|                                 |                          |
|---------------------------------|--------------------------|
| 1. Flooding and fluvial erosion | 10. Wildfires            |
| 2. Terrorism                    | 11. Dam failure          |
| 3. Earthquakes                  | 12. Severe winter storms |
| 4. Infectious disease outbreak  | 13. Hail                 |
| 5. Hurricanes / tropical storms | 14. Ice jams             |
| 6. Tornadoes                    | 15. Drought              |
| 7. Nuclear power plant failure  | 16. Rock cuts            |
| 8. Landslides / rockslides      | 17. Invasive species     |
| 9. Severe thunderstorms         | 18. Extreme temperatures |

cold temperatures.<sup>14</sup>

#### FEDERAL DISASTER DECLARATIONS

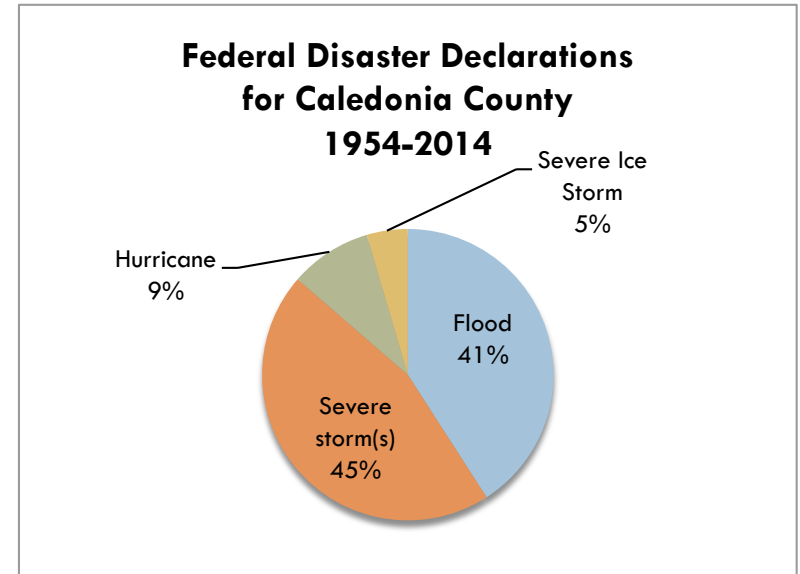
The Federal Emergency Management Agency (FEMA) has tracked federal disaster declarations for major disasters since 1953. The earliest disaster declaration for Caledonia County came in 1973; between then and 2014, FEMA recorded 22 disasters for the County. Caledonia County has averaged one disaster declaration nearly every two years since 1973, including the ice storm of 2014 and spring flooding in 2013 and 2014.

These events did not necessarily all lead to significant damage in St. Johnsbury specifically, but all were severe storm events, most of which impacted the whole region (Table xx.). A total of 86% of disaster declarations were caused by either severe storms or flooding.<sup>15</sup>

#### SHELDUS HAZARD DATABASE

The University of South Carolina manages the Spatial Hazard Events and Losses Database for the United States (SHELDUS). A national database of hazard events, SHELDUS tracks event types as well as reported injuries and damage to crops and property. From 1960-2013, SHELDUS reports a total of 1,034 hazard events in Caledonia County (Table xx) or an average of about 20 per year; these events caused 114 injuries and nearly \$75 million in reported damages.

According to SHELDUS, the most frequent hazards were winter weather (40%), wind (25%) and severe storms/thunder storms (18%). However, the most significant threat in terms of property and crop damage is flooding. While floods accounted for less than 6% of all the hazard events, they are responsible for 64% of the damages. Again, not all of the hazards in this database impacted St. Johnsbury directly, but they provide a good overview of the nature of hazard events in the area.<sup>16</sup>

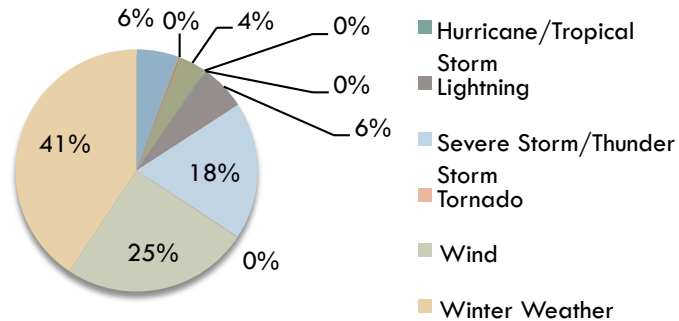


<sup>14</sup> Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. *State of Vermont Hazard Mitigation Plan*. November, 2013.

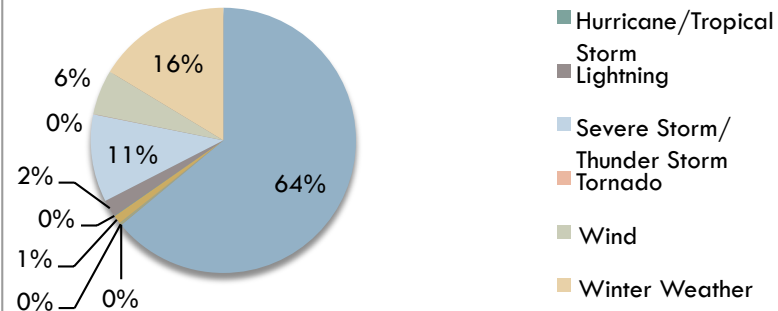
<sup>15</sup> Federal Disaster Declarations. Federal Emergency Management Agency. United States Department of Homeland Security. <http://www.fema.gov/media-library/assets/documents/28318>, accessed 7/30/14.

<sup>16</sup> SHELDUS (Spatial Hazard Events and Losses for the United States) Database. V13.1. University of South Carolina. <http://hvri.geog.sc.edu/SHELDUS/>, accessed 9/4/14.

### Hazard Events in Caledonia County, 1960-2013



### Hazard Damage in Caledonia County, 1960-2013



**Table xx. Hazard Events in Caledonia County (1960-2013)**

| Type                              | # Events | Damage (\$2013) |              |              | Injuries | % Total |        |
|-----------------------------------|----------|-----------------|--------------|--------------|----------|---------|--------|
|                                   |          | Crop            | Property     | Total        |          | Events  | Damage |
| <b>Flooding</b>                   | 59       | \$1,843,217     | \$45,821,438 | \$47,664,655 | 3        | 5.71    | 63.99  |
| <b>Fog</b>                        | 2        | \$0             | \$6666       | \$6666       | 0        | 0.19    | 0.01   |
| <b>Hail</b>                       | 37       | \$34,668        | \$186,256    | \$220,924    | 17       | 3.58    | 0.30   |
| <b>Heat</b>                       | 1        | \$760,985       | \$0          | \$760,985    | 0        | 0.10    | 1.02   |
| <b>Hurricane/ Tropical Storm</b>  | 2        | \$28,312        | \$23,352     | \$51,664     | 0        | 0.19    | 0.07   |
| <b>Lightning</b>                  | 63       | \$98,698        | \$1,445,687  | \$1,544,385  | 20       | 6.09    | 2.07   |
| <b>Severe Storm/Thunder Storm</b> | 190      | \$325,570       | \$7,642,583  | \$7,968,153  | 30       | 18.38   | 10.70  |

|                       |      |             |              |              |     |       |       |
|-----------------------|------|-------------|--------------|--------------|-----|-------|-------|
| <b>Tornado</b>        | 1    | \$0         | \$26708      | \$26708      | 0   | 0.10  | 0.04  |
| <b>Wind</b>           | 259  | \$236,076   | \$3,833,834  | \$4,069,910  | 26  | 25.05 | 5.46  |
| <b>Winter Weather</b> | 420  | \$1,063,808 | \$11,114,835 | \$12,178,643 | 18  | 40.62 | 16.35 |
| <b>TOTAL</b>          | 1034 | \$4,391,334 | \$70,101,359 | \$74,492,693 | 114 | 100   | 100   |

**Source: Spatial Hazard Events and Losses Database for the United States v.13.1**

#### NCDC STORM EVENTS DATABASE

The National Climatic Data Center (NCDC), run by the National Oceanic and Atmospheric Administration (NOAA), also compiles storm events nationally. NCDC has compiled data from numerous sources from 1950 to May, 2014, so tracking is incomplete for certain hazards and time periods. For example, only tornados were tracked from 1950-1954; tornados, thunderstorms, winds and hail from 1955-1995; and a full 48 hazard event types from 1996 to present. This means that the dataset likely underrepresents key hazards for St. Johnsbury, including flooding. NCDC also includes some regional weather events that affected the general Caledonia County area as well as “local” events (such as flash floods, tornadoes, lightning or hail) that affected specific towns or neighborhoods. In some cases, the NCDC database also includes multiple events from the same storm system.<sup>17</sup>

NCDC reports 495 countywide or local storm events (Table xx.) over this 64-year period (averaging nearly eight per year). That tally includes 16 local events in St. Johnsbury, consisting primarily of hail (7) and thunderstorms/wind (7). The database also reports nearly \$16.5 million in property and crop damage at the county level. Like the SHELDUS data, the NCDC data confirms that most events are winter weather or severe thunder/wind storms, while flooding causes the majority of damage.<sup>18</sup>

#### Hazard Profiles

Based on the history of hazard events in St. Johnsbury’s past and predictions about future events, we asked community leaders and the public to share information on the most likely hazards and their recollections about past extent, geographical locations and damage. The following profiles summarize local, regional and national information for St. Johnsbury’s top hazards.

#### DAM FAILURE

<sup>17</sup> NCDC Storm Events Database. National Climatic Data Center. National Oceanic and Atmospheric Administration. <http://www.ncdc.noaa.gov/stormevents/>, accessed 9/4/14.

<sup>18</sup> NCDC Storm Events Database. National Climatic Data Center. National Oceanic and Atmospheric Administration. <http://www.ncdc.noaa.gov/stormevents/>, accessed 9/4/14.

Dam failure in St. Johnsbury is possible, but unlikely. A section of the north dam at Arnold Falls blew away in 1976, but the dam was replaced with a concrete structure in 1995. The bridge at Robinson's log transfer station was also washed away. It is more likely that St. Johnsbury would need to shelter displaced residents from other towns if the Moore or Comerford dams failed.

### DROUGHT + HEAT SPELLS

SHELDUS data records a heat event in 2012 that caused \$750,000 in crop damage in Caledonia County, and a drought in 1994-1995 was substantial enough that residents remembered it. One landscaper said, "there was no reason to mow, since nothing was growing." Still, the drought was not major enough that any water conservation measures were necessary.

### EARTHQUAKES

Residents can recall several earthquakes that were strong enough to be felt in St. Johnsbury. The most recent and significant was in April 2002, when a 5.1-magnitude quake was centered in Au Sable Forks, NY; residents reported rattling of houses and items falling out of cupboards in St. Johnsbury.<sup>19</sup>

### FLOODING, FLASH FLOODING + FLUVIAL EROSION

Flash flooding is not common in St. Johnsbury, due to its valley location, but other types of flooding and erosion are very common. Flash flooding does occur occasionally, and residents recall one particular event on the Sleepers River in 2006 in which Riverfront Enterprises experienced losses. In rare cases, St. Johnsbury has also experienced flooding due to infrastructure failure: the Green Mountain Mall was flooded when a water main broke in 2014, and the Athenaeum was flooded once when an outlet drain backed up.

St. Johnsbury's rivers flood to some degree nearly every spring, particularly around the Passumpsic River and at the junction of the Passumpsic and Moose Rivers. Flooding is also common at other times of year, including in the winter in relation to ice jams. St. Johnsbury has experienced major flood events in 1927, 1973, 2011 and 2012 with typical flooding of low-lying and floodplain areas. The northern portion of St. Johnsbury has often become isolated due to flooding, and many roads have been washed out or become impassible. While flooding does not typically result in injuries or loss of life, it is the most significant cause of property and crop damage in the town. The SHELDUS database records 59 hazardous

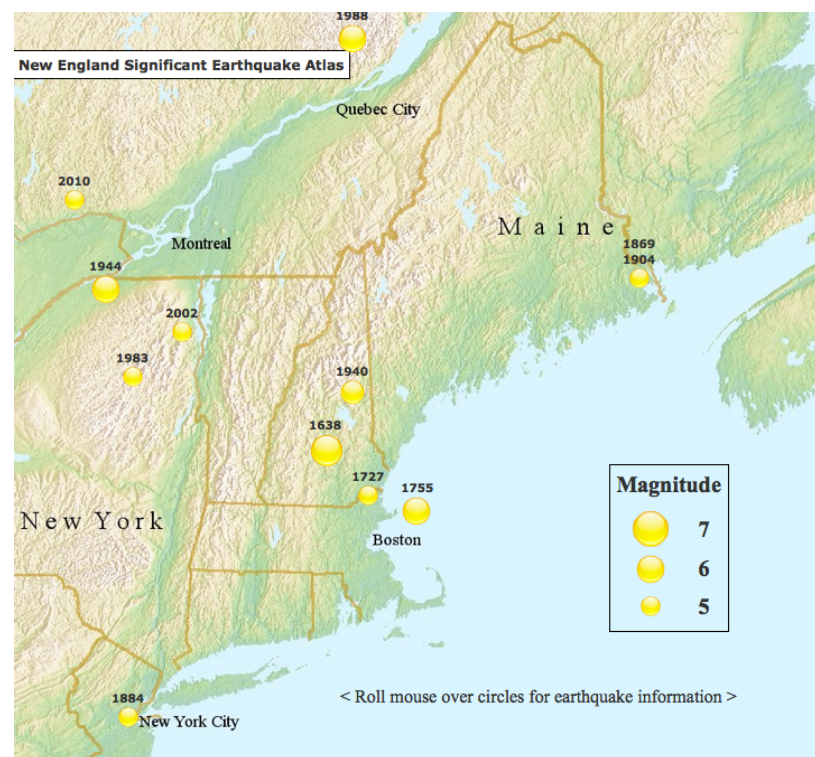


FIGURE 2 THE NEW ENGLAND SEISMIC NETWORK RECORDS THREE EARTHQUAKES IN THE REGION OVER 5.0 MAGNITUDE SINCE 1950.

<sup>19</sup> New England Seismic Network records. "New England Significant Earthquake Atlas." [http://aki.bc.edu/quakes\\_historical.htm](http://aki.bc.edu/quakes_historical.htm), accessed 1/12/15

flood events for Caledonia County since 1960, with 20 causing more than \$10,000 in damage and the costliest storms tallying tens of millions in damages.

**“The Passumpsic always floods – that’s just what it does.”**

–St. Johnsbury resident at October, 2014 public meeting

#### HAIL

Major hailstorms are not common in St. Johnsbury, but happen periodically. Residents recall hail that has damaged vehicles and broken glass and hail has been measured up to 1.75 inches in diameter. The SHELDUS database records 37 hail events in Caledonia County after 1960, six of which caused more than \$10,000 in damage. A 1965 hailstorm caused 17 injuries, and storms in 2011 and 2010 caused \$67,316 and \$32,049 in property and crop damage.

#### HURRICANES + TROPICAL STORMS

Only one substantial hurricane (1938) has reached St. Johnsbury in recent history. The Hurricane of '38 did cause significant damage in town, including felling many trees. Tropical Storm Irene in 2011 also caused substantial flooding, though not as significant as other recent spring flooding events. Tropical storms in 1960 and 1971 caused minor damage.

#### ICE JAMS

St. Johnsbury’s three rivers have a long history of ice jams, though problems were more common in the 20<sup>th</sup> century. Historically, ice jams along the Passumpsic and Moose Rivers in particular led to major floods and caused significant damage, sometimes spilling major amounts of ice onto Rt. 5 and other town roads. St. Johnsbury often used blasting to clear them. The Moose River experienced one significant ice jam in 2011 and the town hired an excavator to clear it, as it was flooding houses on Concord Ave. and Elm St. Today, ice jams are significant primarily as a cause of flooding.

#### ICE STORMS

Ice storms are common in St. Johnsbury and can cause significant damage to property and agricultural operations, as well as creating unsafe travel conditions and extended power outages. Jay Peak was impacted by 1998 and 2014 ice storms, and local sugarbushes were severely damaged in 2014.

#### LANDSLIDES / SUBSIDENCE

Landslides occur with some regularity in St. Johnsbury, but they are typically minor and do not result in significant damage. One landslide related to a major storm in May of 2011 sent earth from an old railroad bed onto High Street. In the Great Flood of 1927, landslides were common in the Connecticut River Valley region, causing major damage. A snowslide blocked the St. Johnsbury-Newport road in 1936.<sup>20</sup>

### SEVERE THUNDERSTORMS / LIGHTNING

Severe thunderstorms happen every year in St. Johnsbury, typically during the warmer summer months, and frequently include lightning, heavy rain and wind. Despite their frequency, they rarely cause significant damage or injuries. Lightning occasionally sparks house fires, and accompanying rains can lead to flooding or flash flooding and result in isolation or damage. The SHELDUS database notes 253 hazardous lightning events and severe storms in Caledonia County since 1960, including the same 1965 hailstorm mentioned above that caused 17 injuries. Storms in 1999 and 2010 caused 1 or 2 injuries, and ten lightning storms caused more than \$10,000 of property and crop damage. The most expensive storm was a storm in 1990 that caused nearly \$100,000 in damage.

One particularly bad thunderstorm occurred in May of 2011; Green Mountain Power placed nearly 90 crews in the area and it took three days to restore power. Several homes were hit by lightning and people were rescued after stranding in homes and vehicles. “Training” thunderstorms are events in which one storm rapidly follows another, which can lead to particularly severe flooding and landslide impacts; according to Green Mountain Power representatives, 13 such thunderstorms preceded Tropical Storm Irene in 2011.

### SEVERE WINTER STORMS

Severe winter storms are extremely common in St. Johnsbury and throughout the northeast, but they can take many forms. Their impacts vary depending on whether they involve major amounts of snowfall; snow compounded by ice, rain or wind; storms followed closely by very cold or very warm temperatures; or major winter storms occurring in fall or spring. In October, 2006, a winter storm brought significant amounts of heavy, wet snow that knocked out power for three days. In 2008, a major Valentine’s Day storm shut down the region simply due to extreme amounts of snowfall. SHELDUS records 420 winter weather events in Caledonia County since 1960; that includes 25 storms more than \$100,000 in damage, all but five occurring since 1985. While St. Johnsbury residents are used to winter weather, major storms can cause significant power outages, transportation problems, substantial damage and unsafe conditions – particularly for vulnerable residents.

### TORNADOES

Tornadoes are not common in St. Johnsbury or the region, but they do occur occasionally and can cause significant damage. Green Mountain Power representatives noted at the October public meeting that they typically hear tornado warnings for the St. Johnsbury area about once a year. Those events always turn out to be isolated “windshears,” which have lower wind speed than tornadoes but can still cause damage. The SHELDUS database records one tornado in Caledonia County since 1960 – a small 2010 storm that caused just over \$25,000 in damage. In addition to the low likelihood of tornadoes in St. Johnsbury, it would be nearly impossible for the community to predict or plan for them.

### WILDFIRES

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<sup>20</sup> Baskerville, Charles A., Fitzhugh T. Lee and Charles A. Rate. 1993. “Landslide Hazards in Vermont.” U.S. Geological Survey Bulletin 2043.



Small wildfires happen frequently in St. Johnsbury, typically burning no more than a few acres. A large fire is not likely, given the local climate and land use patterns, but it is possible. Climate change may cause longer and more severe heat spells and droughts, increasing the probability of wildfire.

#### WINDSTORMS

St. Johnsbury frequently experiences heavy winds in conjunction with other severe storms, resulting in fallen trees and limbs and occasional damage to power lines, houses or cars. Wind speeds can reach 35 to 60 knots (40 to 70 miles per hour). The SHELATUS database records 259 windstorms in Caledonia County since 1960. Most of them caused measurable damage and 24 resulted in more than \$10,000 of damage; a 2006 storm led to six injuries. St. Johnsbury likely fared better than other Caledonia towns in these storms, however: according to a representative from Green Mountain Power who attended the October public meeting, St. Johnsbury is in a lucky place for “downsloping wind events.” While many neighboring communities are located below the mountains and receive forceful winds coming downslope, St. Johnsbury is located away from both the White and Green Mountains, avoiding such events.

#### NUCLEAR INCIDENTS

With the recent closures of the Vermont Yankee nuclear plant in Vernon, VT and the Gentilly plant in Quebec, the closest nuclear power plant is in Seabrook, NH. The plant is far enough away that it does not pose an immediate risk to St. Johnsbury.

#### HAZARDOUS MATERIALS INCIDENTS

Small hazardous materials incidents happen frequently in St. Johnsbury. Propane leaks are most common, along with small oil spills at homes or businesses, along roadways or the Interstate highways. There have been no major hazardous materials incidents in recent years, but residents and emergency officials consider this a likely future hazard given St. Johnsbury’s location along key transportation corridors.

#### LARGE TRANSPORTATION INCIDENTS

Because St. Johnsbury is a major transportation junction (with Interstates 93 and 91, as well as a railroad and smaller state highways), it is frequently the site of traffic accidents and other transportation incidents. St. Johnsbury has not experienced a mass transportation incident, but one could easily happen: major automobile pile-ups have occurred in I-93 in New Hampshire in recent years, including a 35-car pileup in January 2015 resulting from a snow squall.<sup>21</sup> Transportation incidents are particularly likely in combination with severe weather events and winter storms. Several locations in town experience frequent smaller accidents. Bonsai Bridge and the base of the Rt. 18 junction are common places for cars to lose brakes.

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<sup>21</sup> Pattani, Aneri and Meilssa Hanson. “Snow squall blamed for pile-up on I-93 in NH.” *The Boston Globe*. January 2, 2015. <http://www.bostonglobe.com/metro/2015/01/02/weather-related-crash-shuts-northbound-new-hampshire/MFftv3aRI24v1IjiEdeodK/story.html>, accessed 1/12/15.

St. Johnsbury has also not seen a major railroad accident, but it is vulnerable as the tracks run through downtown. Railroad cars have occasionally gone into the Passumpsic River due to storm damage or severe weather, but have only dumped grain. There is currently no crude oil coming through on the railroad, though other hazardous materials may be transported.

### MAJOR INFRASTRUCTURE FAILURE

Aside from the dam failure discussed above, St. Johnsbury has not experienced failure of any major infrastructure to date. The Sleepers River bridge by Albright Springs is considered by some to be vulnerable, but most bridges in town are in sound condition. Several essential pieces of infrastructure are aging or have known issues and need to be replaced before they fail: in particular, the wastewater treatment plant needs screw pumps need to be replaced soon, as does a critical water line across the Moose River.

### STRUCTURE FIRES

Small fires in homes and other structures in St. Johnsbury are routine, as they are in any town. The most concerning risk here is for large structure fires in St. Johnsbury's historic downtown blocks. Fires are relatively common downtown and, because modern fire prevention technology (like sprinklers and fire walls) is absent in most historic buildings, these fires have proven devastating. The Daniels Block burned in 2000, resulting in deaths as well as major property damage and economic losses. Two commercial buildings on Eastern Ave. burned the same year, along with the O'Dean/Hale block. A major Main Street fire occurred in 2009 and the Ravel Block (Landry's Drug Store) was the site of a fire in 2012.

### INFECTIOUS DISEASE EPIDEMIC

The last major infectious disease epidemic in St. Johnsbury was in 1918. The sense in the community is that this is a very low risk.

### TERRORISM + SCHOOL SAFETY

The 2005 Hazard Mitigation Plan identified terrorism as a significant risk, but it was written at a time of heightened concern over terrorism, soon after the September 11, 2001 attacks. The sense today is that terrorism is also a very low risk for the Town of St Johnsbury and that key facilities are protected well enough. The schools are currently very focused on addressing shooting events in their safety plans and exercises, making it unnecessary to address in this plan as well.

## Risk + Vulnerability Assessment

After identifying the most frequent (historically) and likely (future) hazard events, community members and the planning team ranked priority hazards for St. Johnsbury to address. Priority is based on the likelihood that events will happen again, as well as level of impact. Residents and stakeholders provided input on priority hazards at the first public meeting in October, 2014, and residents also offered input via online and paper surveys. The consultants and Planning Commission incorporated that public input into the final ranking, detailed in **Appendix xx**.

**Table xx** presents an analysis of all hazards in St. Johnsbury, including estimates of probability, impact, and overall community vulnerability, applying the following standards:

### **Likelihood**

L (Low): < 1% probability in the next 100 years

M (Medium): 1% -10% probability in the next year, or at least one chance in 100 years

H (High): 10%-99% probability in the next year, or at least one chance in 10 years

V (Very High): Near 100% probability, or occurs nearly every year

### **Impact**

L: < 10% of properties damaged / minimal disruption to quality of life

M: 10% - 25% of properties damaged / loss of essential facilities + services for up to 7 days / few (< 1% of population) injuries.

H: 25% - 50% of properties damaged / loss of essential facilities + services for 7-14 days / major injuries (< 10% of population) / few deaths possible

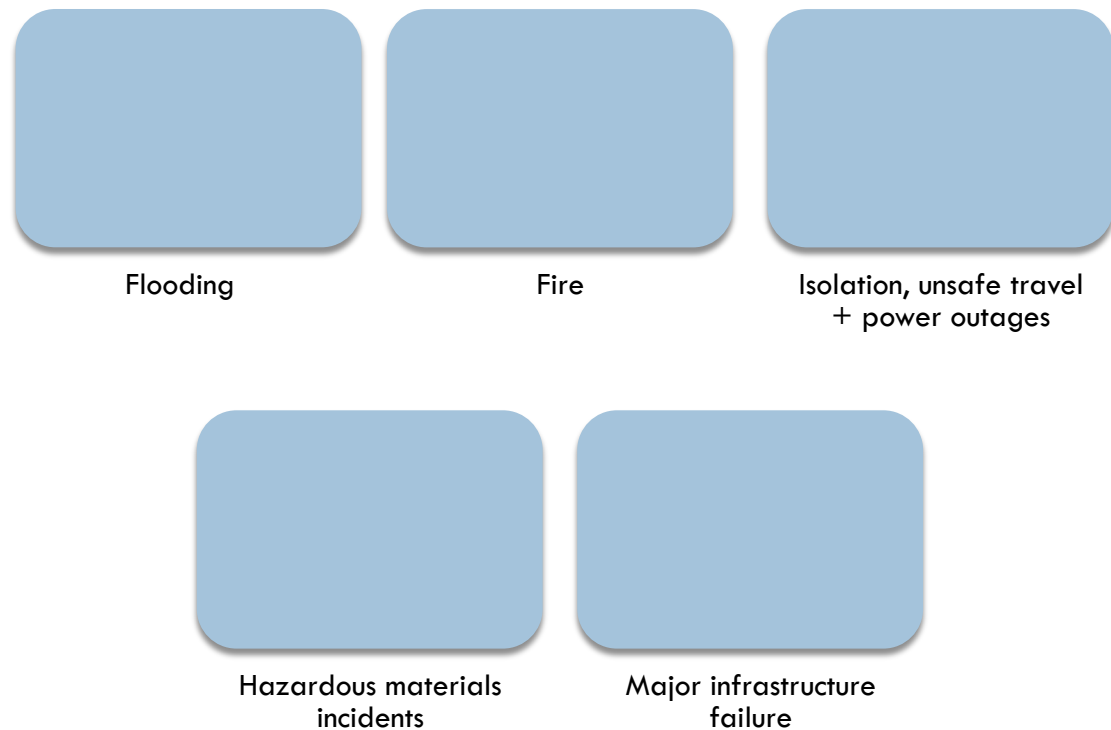
V: > 50% of properties damaged / loss of essential facilities + services for > 14 days / severe injuries (> 10% of population) / multiple deaths possible

**Table 2?: Hazard Vulnerability Assessment**

| Natural Hazards                  |            |        |                         | Manmade Hazards               |            |        |                         |
|----------------------------------|------------|--------|-------------------------|-------------------------------|------------|--------|-------------------------|
| Hazard                           | Likelihood | Impact | Community Vulnerability | Hazard                        | Likelihood | Impact | Community Vulnerability |
| Flood / fluvial erosion          | H          | V      | H                       | Structural fire               | H          | V      | H                       |
| Ice jam                          | H          | V      | H                       |                               |            |        |                         |
| Severe thunder/ lightning storms | V          | M      | M                       | Major infrastructure failure  | M          | M      | M                       |
| Severe winter storm              | H          | V      | M                       | Hazardous materials incident  | H          | M      | M                       |
| Ice storm                        | H          | V      | M                       |                               |            |        |                         |
| Windstorm                        | H          | M      | M                       |                               |            |        |                         |
| Drought                          | L          | L      | L                       | Nuclear incident              | L          | L      | L                       |
| Landslide/ subsidence            | H          | M      | L                       | Large transportation incident | H          | M      | L                       |
| Hailstorm                        | H          | M      | L                       |                               |            |        |                         |
| Tornado                          | M          | M      | L                       | Infectious disease epidemic   | M          | M      | L                       |
| Wildfire                         | L          | L      | L                       |                               |            |        |                         |
| Hurricane                        | H          | M      | L                       |                               |            |        |                         |
| Dam failure                      | M          | M      | L                       |                               |            |        |                         |
| Earthquake                       | M          | M      | L                       |                               |            |        |                         |

The disaster events for which St. Johnsbury is most vulnerable are severe storms (thunderstorms, winter storms and wind storms) and ice jams, as well as structural fires, hazardous materials incidents, and major infrastructure failure. The planning team then identified the most significant hazards that are likely to be caused by those events.

The process resulted in identifying two high priority hazards (flooding and structure fires) and five moderate priority hazards (isolation, unsafe travel + power outages; severe wind; lightning; hazardous materials incidents; and major infrastructure failure). During the second public meeting, groups evaluated feasibility of mitigation strategies to address the above hazards. They selected a number of strategies that will address all hazards, which will also lessen impacts from events involving wind or lightning, but settled on no further strategies that specifically address either severe wind or lightning. The discussion in fact led to comments that St. Johnsbury's location protects it from severe wind impacts, compared to adjacent towns, with the result that those two hazard events are not listed individually in the final list of action plan strategies or priority hazards.



These hazards echo the findings in St. Johnsbury's 2005 Hazard Mitigation Plan, which found that the town is at high risk for flooding, hazardous material incidents, and structure fires.<sup>22</sup> The following sections provide detailed profiles of the high and moderate priority hazards for St. Johnsbury (based on probability of occurrence, impact, and community vulnerability).

#### NON-PRIORITY HAZARDS

While any of these hazards could potentially affect St. Johnsbury, the town decided not to plan for these non-priority hazards due to limited community vulnerability:

**Drought, earthquakes, hailstorms, hurricanes, landslides/subsidence, tornadoes, wildfires, large transportation incidents, and infectious disease epidemics.** These incidents are relatively unlikely to occur in St. Johnsbury, and if they do occur, their impact is likely to be limited or negligible; they are not covered further in this plan.

<sup>22</sup> All-Hazards Mitigation Plan. Town of St. Johnsbury. July 8, 2005.

**Dam failure, ice jams, ice storms and severe winter storms** are not covered further in this plan because the hazards they cause are addressed under other hazard categories. (Ice jams primarily cause flooding; ice storms and severe winter storms primarily cause isolation, unsafe travel and power outages; and dam failure because it is a result of either flooding or infrastructure failure.)

**Lightning and severe wind** are not covered further because groups at the mitigation strategies planning meeting felt they were adequately covered through the “all hazards” mitigation strategies and determined that there were no further feasible and appropriate strategies for St. Johnsbury to pursue at this time for these hazards.

## Priority Hazard Profiles

### FLOODING + FLUVIAL EROSION

Minor floods occur regularly in St. Johnsbury and major floods occur with increasing frequency. While flooding accounts for only 6% of the total hazard events in Caledonia County (according to SHELUS data, **see Figure xx on p. xx**) it accounts for nearly 65% of the property and crop damage in the town, which totals \$47,664,655 (\$2013).<sup>23</sup> St. Johnsbury has received 22 federal disaster declarations since 1973. Flooding directly caused nine, and flooding was involved in all but one of the rest.<sup>24</sup>

Given that history – as well as trends in climate change and a greater frequency of severe weather events – flooding is St. Johnsbury’s highest priority natural hazard. Flooding and fluvial erosion are both natural events that occur on a regular basis in flood plains and in and around water bodies. Flooding becomes a hazard when floodplain areas are developed with roads and buildings or when they are degraded and compromised. Development in and around floodplains significantly increases the potential for safety issues as well as property and crop damage. Some fluvial erosion typically happens alongside any major flood event; however, due to St. Johnsbury’s valley location, erosion is less of a concern here than in many of the neighboring mountain towns.

#### Hazard Profile: Flooding and fluvial erosion

**Definition:** Flooding is overflowing of streams, rivers, drains and water bodies due to heavy rain, rapid snow melt, or channel blockage. Flash flooding is rapid flooding usually due to excessive rain. Fluvial erosion is loss or movement of sediment in stream and river channels due to water flow.

**Locations:** Along Moose, Passumpsic and Sleepers Rivers. North side of town along Rte 5 opposite the mall, and the lower part of Bay Street are particularly susceptible to flooding and isolation. Downtown streets and buildings near rivers are vulnerable.

**Impacts:** Property damage, road closures and isolation, road and culvert damage, utilities, crop damage, injuries and vulnerable population risks

**Frequency:** 1 event/year

<sup>23</sup> CITE

<sup>24</sup> CITE

**Table 2?: Flood Vulnerability Assessment**

| Type of Structure   | Number of Structures                 |                        |                                     | Value of Structures                           |                                 |  |
|---|--------------------------------------|------------------------|-------------------------------------|---|---------------------------------|--|
|   | Total # in Town (incl. Outbuildings) | # in Flood Hazard Area | Percentage (%) in Flood Hazard Area | Total Value (\$) in Town (incl. Outbuildings) | Value (\$) in Flood Hazard Area | Percentage (%) Value (\$) in Flood Haz. Area |
| Accessory building  | 1                                    | 1                      | 100%                                | NO RECORD                                     | NO RECORD                       | NO RECORD                                    |
| Commercial  | 344                                  | 36                     | 10%                                 | 151,813,732                                   | 14263470                        | 9%   |
| Government  | 2                                    | 2                      | 100%                                | 3,290,350                                     | 3290350                         | 100%   |
| House of worship  | 9                                    | 1                      | 11%                                 | 8,485,800                                     | 164610                          | 2%   |
| Industrial  | 14                                   | 7                      | 50%                                 | 19,373,268                                    | 9571260                         | 49%  |
| Land only   | 269                                  | 1                      | 0.4%                                | 18,710,860                                    | 267930                          | 1%   |
| Mobile home   | 203                                  | 1                      | 0.5%                                | 8,188,760                                     | 90440                           | 1%   |
| Multi-family dwelling   | 337                                  | 12                     | 4%                                  | 48,174,840                                    | 1587830                         | 3%   |
| Other   | 16                                   | 1                      | 6%                                  | 1,965,960                                     | NO RECORD                       | NO RECORD                                    |
| Other commercial  | 52                                   | 8                      | 15%                                 | 14,000,730                                    | 1144040                         | 8%   |
| Parking lot   | 13                                   | 1                      | 8%                                  | 453,520                                       | 59940                           | 13%  |
| Public gathering  | 3                                    | 3                      | 100%                                | 446,820                                       | 446820                          | 100%   |
| Single family dwelling  | 1349                                 | 57                     | 4%                                  | 204,190,745                                   | 6340810                         | 3%   |
| Temporary structure   | 1                                    | 1                      | 100%                                | NO RECORD                                     | NO RECORD                       | NO RECORD                                    |
| Utility   | 11                                   | 2                      | 18%                                 | 17,000,011                                    | 234830                          | 1%   |
| <b>Total</b>  | <b>2624</b>                          | <b>134</b>             | <b>5%</b>                           | <b>\$496,095,396</b>                          | <b>\$37,462,330</b>             | <b>8%</b>                                    |
| <b>Note: In addition to structures in the Special Flood Hazard Area, counts and valuations include structures that are within Zone B &amp; Zone C. These areas are above the 100-year flood plain, but are still considered to have moderate to minimal flood hazard, respectively.</b> |                                      |                        |                                     |   |                                 |  |

**Table 2?: Flood Vulnerability Assessment**



Few areas in St. Johnsbury are prone to significant flash flooding, or rapid flooding, but many low-lying areas along the Passumpsic, Moose and Sleepers Rivers are frequently flooded by heavy rainstorms, rapid snowmelt, or ice jams. The junction of the Moose and Passumpsic Rivers is particularly vulnerable, as are the floodplain areas around Route 5. St. Johnsbury Center is vulnerable to flooding and isolation, as well as the industrial area just downstream of the downtown. Much of the lower floodplain in that industrial area is maintained as open recreation space and is relatively unaffected by flooding.<sup>25</sup>



Of the three major rivers in town, the Passumpsic has caused the most significant problems with flooding, largely because of its central location and larger size. The main stem of the Passumpsic is relatively controlled, due to the presence of three dams, and rip rap has been placed in several key locations. The Moose River is somewhat less vulnerable to major floods than the Passumpsic and Sleepers Rivers, since its headwaters are the Victory Bog, which maintains a steadier flow. A large gravel bar has formed near where it enters the Passumpsic, which does leave it vulnerable to ice jams. In 2013, a major ice jam at that location flooded Bay Street; it resulted in flooded businesses, road closures, and water rose so rapidly that emergency responders had only a few minutes to evacuate businesses. Six people were evacuated by boat.<sup>26</sup> Upstream from that location, the Moose River banks are largely

forest and bedrock, so those stretches are not particularly vulnerable even when floods occur.

The Sleepers River comes into town along Rt 2. and passes through large culverts under the Interstate before going over Emerson Falls. A Phase 1 Geomorphic Assessment of the Sleepers River shows that it is currently undergoing significant adjustment and the river corridor is likely to move and remain unstable for some time. Three reaches are identified as extremely sensitive, including some with degradation and others going through a widening process; fluvial erosion is a larger concern in these locations. Those prediction have played out in recent years: Sleepers River has required significant repair and maintenance work over the years to prevent and repair flood damage and erosion, including work to protect roads that run alongside. Large amounts of rip rap have been placed along Goss Hollow Road in particular, including after the May, 2011 floods, focusing on keeping the road in place. Whiteman Brook is a small tributary near Rt. 2, running down steep sections and then forming an alluvial fan where it meets the Sleepers River valley; that fan also tends to move significantly, though only a small portion is located in St. Johnsbury. The lower reaches of the Sleepers River primarily run through agricultural land and do not threaten many structures, but upper reaches run through more developed sections of town and one house is particularly close to the junction with Whiteman Brook.

<sup>25</sup> River corridor information that follows was provided by Ben Copans, in a phone conversation on 11/13/14

<sup>26</sup> "Ice Jams Flood Bay Street, St. Johnsbury." March 13, 2013. WPTZ News Channel 5. <https://www.youtube.com/watch?v=kKaLs6w3Mec>, accessed 1/12/15

According to Ben Copans, Watershed Coordinator for the State of Vermont's Department of Environmental Conservation and Planning Commission member in St. Johnsbury, additional river studies would be helpful in several locations:

- Additional research on the Passumpsic, focusing on areas where historical damage has occurred and the impact of repairs
- Stark Brook and Roberts Brook, where they flow into the Passumpsic

According to a flood vulnerability assessment completed by NVDA, only 5% of St. Johnsbury's 2,624 structures are in the town's mapped Flood Hazard Area. The structures there are disproportionately valuable, however, accounting for 8% of the value of town structures and including both town government buildings, 50% of the industrial buildings in town, and nearly 20% of utility structures. While other homes and businesses are located in St. Johnsbury's Flood Hazard Area have been affected by flooding, but only four have made repeated claims on flood insurance<sup>27</sup>. Others are not located in the mapped Flood Hazard Area but are still impacted, such as the trash container business shown in Fig. xx. That business and those around it are shown to be in the newly-mapped river corridor,<sup>28</sup> as is the town's wastewater treatment plant further downstream.

St. Johnsbury averages one significant flood per year, though most do not cause widespread or lasting damage. Those present at the October 2014 public meeting commented that the Passumpsic River always floods ("That's just what it does!") by Rte 5 adjacent to the mall, often in the spring. The annual event was worse than usual in 2006, when houses flooded and residents were evacuated.



Containers at this trash business in St. Johnsbury's industrial area downstream of the downtown float away in high water almost annually and are then retrieved.

<sup>27</sup> Ned Swanberg, VT DEC (PEG: NEEDS COMPLETE CITATION)

<sup>28</sup> CITE NEW River CORR map

The worst floods in St. Johnsbury's history all involved major storms and caused significant damage, described in **Table xx**.

**Table xx. Major Flood Events in St. Johnsbury**

| <b>Date</b>      | <b>Event</b>                | <b>Location</b>                            | <b>Extent &amp; Damage</b>   |
|------------------|-----------------------------|--|--|
| <b>4/15/2014</b> | Flooding                    | Rte 5                                      | 1.5" of rain; Rt 5 closed near St. Johnsbury Center  |
| <b>3/13/2013</b> | Ice jam                     | Bay Street                                 | Bay Street flooded due to ice jams on Moose and Passumpsic Rivers, caused by melting snow and heavy rain. Resulted in road closures, evacuations and business disruption |
| <b>8/28/2011</b> | Tropical Storm Irene        | Widespread                                 | 4.83" of rain by 3 PM on 8/28/11 broke daily rainfall record. Relatively minor damage to town, with exceptions. Joe's Brook Farm experienced near total crop losses.     |
| <b>5/26/2011</b> | Flooding, lightning, + hail | Bay Street and Rte 5                       | Nearly 8" of rain caused more flooding than Tropical Storm Irene in August. Along with hail and lightning, resulted in \$1.4 million in damages                          |
| <b>1973</b>      | Flooding                    | Widespread                                 | 2 <sup>nd</sup> highest flood levels, behind the '27 flood   |
| <b>3/13/1936</b> | Flooding + landslides       | Widespread                                 | 3 people killed in landslides, avalanches and torrential rains   |
| <b>11/4/1927</b> | Great Flood                 | St. Johnsbury Center, all floodplain areas | Main Street in St. Johnsbury Center was 15 feet under water; damage in the CT River Valley from St. Johnsbury to Bellows Falls estimated at \$1 million                  |
| <b>7/24/1897</b> | Flooding                    | Sleepers River                             | Four bridges lost on the Sleepers River and water ran 4 feet deep in machine shops and foundries   |
| <b>10/2/1869</b> | Flooding                    |  | Recalled as the worst flood in history by residents until the Flood of 1927  |
| <b>9/5/1828</b>  | Flooding                    | West Branch of Sleepers River              | Washed away 5 bridges and several mills  |

**Sources:** National Climatic Data Center Storm Events Database; *The History of the Town of St. Johnsbury, Vermont*; FEMA Disaster Declarations; *Caledonian Record* articles, *Historical Floods of New England*

**Hazard Profile: Ice Jams**

**Definition:** Ice jams occur when river ice thaws, breaks up, and collects in a large jam downstream. Jams can cause flooding and force ice out of river channels.

**Locations:** Moose, Passumpsic and Sleepers Rivers

**Impacts:** Flooding and flash flooding, road closures, property damage, infrastructure damage

**Frequency:** 1 event every 3 years

Many of St. Johnsbury's historic floods were caused by ice jams, which are a relatively frequent occurrence on the three rivers in town. 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." Ice can pile up thickly, blocking the flow of water and even spilling over channel banks. Ice jams are most severe when combined with melting snowpack or heavy rainfall.

The U.S. Army Corps of Engineers' Cold Regions Research and Engineering Laboratory (CRREL) maintains a database of ice jams in northern rivers. Ice jams have caused frequent and significant issues with flooding along the rivers in St. Johnsbury, primarily in the early spring. CRREL has recorded 38 accounts of ice jams in St. Johnsbury since 1896, with the majority on the Moose (61%) and Passumpsic (26%) Rivers.<sup>29</sup>



**Table xx. Ice Jams in St. Johnsbury (1896-2014)**

| River                                  | # of Ice Jams | Dates     |
|--|---------------|-----------|
| Connecticut                            | 1             | 1935      |
| Moose                                  | 23            | 1936-1981 |
| Passumpsic                             | 10            | 1896-2013 |
| Sleepers                               | 4             | 1896-1996 |
| <b>TOTAL</b>                           | <b>38</b>     |           |
| <b>Source: CRREL Ice Jams Database</b> |               |           |

<sup>29</sup> CRREL Ice Jam Database. Cold Regions Research and Engineering Laboratory. United States Army Corps of Engineers. <http://icejams.crrel.usace.army.mil/>, accessed 7/30/14.

Descriptions in the CRREL database show that ice jams were historically an even greater problem in St. Johnsbury than they are today. According to CRREL, "Ice jam flooding occurred about once every two years before construction of Interstate 91 in 1974." The Town occasionally used blasting to clear jams (St. Johnsbury reported an annual blasting cost of \$7,000 in 1974) and built dikes after 1965 to protect the "loop" section of town.<sup>30</sup>

Ice jam events sometimes pass with no significant damage or flooding, while other events cause major problems. An ice jam caused flooding to seep in at the wastewater treatment plant in 2013, but no major damage was reported. The most significant localized problems reported in the CRREL database are described in Appendix xx.

### SEVERE WIND, ICE, AND SNOW (CAUSING ISOLATION, UNSAFE TRAVEL + POWER OUTAGES)

Severe storms include a variety of different weather types, including high winds, thunder and lightning, heavy rain, winter snow and ice storms, and even hail. Severe storms are frequent throughout the year, and become hazardous when they are strong enough to cause damage to property or crops or threats to safety. St. Johnsbury experiences nearly ten severe storms per year, on average, plus an additional eight hazardous winter storms. Frequent impacts include downed trees, loss of power, unsafe travel conditions, and property damage from heavy rain and wind.

Estimated wind speeds in St. Johnsbury's worst storms range from 35 to 60 knots (40 to 70 miles per hour) and hail can reach up to 1.75 inches in diameter.<sup>31</sup> Wind damage typically centers on power lines and roofs, while hail most often impacts crops, vehicles and windows. Thunder and lightning are frequent occurrences especially during summer storms, and commonly lead to lightning strikes and small fires. High or exposed locations within St. Johnsbury may be more vulnerable to heavy wind, but all areas of town are vulnerable in most severe storms. Severe storm events since 1954 have resulted in nearly \$14 million in damages (\$2013) according to SHELDUS data, including damage to both property and crops. The most significant severe summer storm in recent years was Tropical Storm Irene in 2011. While St. Johnsbury did not experience the level of damage that hit much of the state, the storm did cause flooding and damage in the town.

Severe winter storms are common in St. Johnsbury and the surrounding area, with impacts often extending to the state and region. They are considered hazards when they generate enough precipitation to cause property damage or

#### **Hazard Profile: Severe Storms**

**Definition:** Sufficient force (through wind, thunder, lightning, hail, or excessive precipitation) to cause property damage or hazardous conditions

**Locations:** Townwide

**Vulnerability:** Property damage, infrastructure damage, downed trees and lines, power failures, vulnerable population risks

**Frequency:** 10 major events/year

<sup>30</sup> CRREL Ice Jam Database. Cold Regions Research and Engineering Laboratory. United States Army Corps of Engineers. <http://icejams.crrel.usace.army.mil/>, accessed 7/30/14. Record Index # 1233.

<sup>31</sup> NCDC Storm Events Database. National Climatic Data Center. National Oceanic and Atmospheric Administration. <http://www.ncdc.noaa.gov/stormevents/>, accessed 9/4/14.



hazardous conditions. Residents are used to winter weather and most winter storms do not cause significant or lasting damage in St. Johnsbury. Still, winter storms do commonly lead to limited power failures and traffic accidents. Winter storms are most dangerous when a mix of conditions (such as heavy snow followed by ice or extreme cold) leads to cascading effects like ice jams or flooding. Power outages can become deadly when residents are trapped in their homes by snowy or icy roads and temperatures plummet.

There are numerous notable winter storms in St. Johnsbury's history, including the ice storm in late 2013 (which resulted in a federal disaster declaration in Caledonia County). The storm resulted in power losses to nearly 75,000 Vermonters at its peak<sup>32</sup> and caused major damage to forests and sugar bushes. The highest 1-day snowfall total for St. Johnsbury was in 1969, when 33 inches of snow fell in 24 hours.<sup>33</sup>

During the second public meeting for this plan, in December 2014, the district foreman for Green Mountain Power noted that it would be highly unlikely for St. Johnsbury to lose power for more than three days. Three major transmission lines come into the town, a new substation in St. Johnsbury Center was built specifically to address reliability, and utility engineers focus on issues affecting stability, such as ice build-up and wind, all the time. He noted, based on the above and having worked there for more than 40 years, that St. Johnsbury was "in much better shape than other towns."<sup>34</sup>

Within a week following that meeting, Winter Storm Damon hit Vermont, causing extended power losses for 100,000 people in the State. Some areas were without power for five days, many for more than three days. Officials estimate the damages from that storm could exceed \$4 million and are pursuing a federal disaster declaration.<sup>35</sup> Mary Powell, president and CEO of Green Mountain Power, said the heavy, wet snow combined with the duration of the storm made the damage worse. "We were not anticipating this kind of weather event," she said. "Nobody even came close to anticipating the kind of damage this would create. To put it in context for folks, this is unprecedented in the team's history and I have folks who have been working in the business for 30 years."<sup>36</sup> St. Johnsbury, however, never lost power, bearing out the prediction that this town is less vulnerable to extended power losses than many neighboring communities.

#### **Hazard Profile: Winter weather**

**Definition:** Snow, ice or sleet that results in hazardous conditions and/or property damage

**Locations:** Townwide

**Vulnerability:** Property damage, traffic accidents, infrastructure damage, downed trees and lines, power failures, extreme cold, vulnerable population risks

**Frequency:** 8 significant events/year

<sup>32</sup> "State Seeks FEMA Help Due to Ice Storm." Robin Smith. *Caledonian Record*, 12/27/13. Accessed 10/15/14, <http://caledonianrecord.com/main.asp?SectionID=180&SubSectionID=778&ArticleID=104622>

<sup>33</sup> "Vermont Climatology." Northeast Kingdom Weather. Accessed 10/15/14, <http://www.nekweather.net/wxrecords.php>.

<sup>34</sup> Frank Chaloux, District Power Production Foreman, GMP, comments at December 4, 2014 public meeting.

<sup>35</sup> Vermont Division Emergency Management and Homeland Security. News Release. December 19, 2014. <http://vermont.gov/portal/government/article.php?news=5223>, accessed 1/12/15.

<sup>36</sup> VT Digger, December 11, 2014 SOURCE MISSING

## STRUCTURAL FIRE

St. Johnsbury's historic downtown has a history of devastating fires and the town works hard to be prepared for future incidents. In addition to the loss of historic resources, damage to buildings and businesses, threat to lives and safety, and cost to the town, St. Johnsbury's fires have a history of significantly threatening the local economy.

The last major downtown fire destroyed the Ravel Block (including Landry's Drug Store) on Railroad Street just before Christmas in 2012; the scale and timing of the fire threatened to seriously hamper the key holiday shopping season. The town launched a major social media campaign to provide accurate information about businesses still being open, and the Department of Public Works responded quickly to put barriers in place to guide vehicles and pedestrians safely. In 2009, the Boardman Block was hit hard by fire; it resulted in destruction of three buildings, one from smoke damage. In 2000, the Daniels Block, the O'Dean/Hale Block, two commercial buildings on Eastern Ave and a multi-family home on Main Street were all struck by fire. After one of the big fires in 2000, the area lost telephone and power for two weeks even though the streets were re-opened as soon as crews cleared the damage.

St. Johnsbury does not have municipal building codes (few towns in Vermont do). Any public buildings (those with commercial uses, having employees or renting dwelling units) are subject to state review by the fire marshal and state building code requirements. Fires are "largely unforeseeable," making it "difficult to identify how and where fires may occur." The best the town can do is identifying "exacerbating conditions" and build awareness of how property owners can improve building design, electrical and heating systems to decrease risk and vulnerability.<sup>37</sup>

At the October 2014 public meeting, Fire Chief Troy Ruggles noted several factors that increase St. Johnsbury's vulnerability to downtown fires: the lack of sprinklers in many older buildings, shared exterior walls, and shared air space below the roofs – all outdated building techniques that can lead to major fires and destruction. In addition, the historic but cramped fire station is also a problem. Replacing the fire station was a priority in the 2005 Hazard Mitigation Plan, but the town has still not obtained enough funding support to replace it.

## HAZARDOUS MATERIALS INCIDENTS

Small-scale hazardous materials incidents are routine in St. Johnsbury, such as small amounts of gasoline or fuel spilled in residential homes and businesses. These incidents may even go unreported, typically have no lasting impacts on health and property, and require little if any assistance to clean up.

### Hazard Profile: Structural Fires

**Definition:** Structural fires are any fires that break out in a home, business, or other occupied or unoccupied structure due to natural or manmade causes.

**Locations:** Downtown business blocks. Residences and other buildings throughout the town.

**Impacts:** Injuries and death, property damage, long- and short-term economic losses

**Frequency:** Small fires: xxxxx; major fires: xxx

<sup>37</sup> Integrating Manmade Hazards into Mitigation Planning; FEMA 386-7; pp. 2-4 [LINK OR FULL SOURCE MISSING](#)

St. Johnsbury is at risk of larger hazardous materials spills (gas, chemical or other) through transportation accidents. Its location at the intersection of Interstates 91 and 93 and the large volume of traffic going to and from the Canadian border crossing in Derby, VT, as well as the downtown railroad line, mean that significant quantities of hazardous materials do pass through and near the town. Documented spills for St. Johnsbury in the state database include the many typical minor spills associated with delivery of fuel, and a few larger spills created by accidents on the interstate.<sup>38</sup>

The St. Johnsbury Fire Department is a regional response team for hazardous material response. The department is equipped with a special HazMat trailer, which provides defensive control equipment as well as the necessary equipment to decontaminate people who have been in contact with dangerous products. The Department's technical rescue training and equipment will also help reduce major losses in such events. St. Johnsbury is also the only nearby town that maintains a supply of specialized chemical foam to treat major spills and prevent fire, though Chief Troy Ruggles notes that St. Johnsbury's foam supply is not adequate for major spills.

#### MAJOR INFRASTRUCTURE FAILURE

Like most towns, St. Johnsbury relies on several major infrastructure systems for normal services. Failure of any system could result in minor problems for residents and businesses or major hazards to people, property or the environment. The major infrastructure systems in St. Johnsbury include the wastewater treatment plant, the water system, the fire protection system, and utility systems. Systems may be vulnerable because of aging or outdated construction or components, because of their geographic location or because they receive excess wear and stress in disaster situations.

St. Johnsbury's wastewater treatment system is particularly vulnerable to hazards because of its location on the Passumpsic River. It has flooded in the past, but has avoided significant damage in its current location. The plant plays an essential role in ensuring that the River is not contaminated in times of heavy rain and flooding as well as every day. The wastewater treatment system uses screw pumps to lift wastewater, and St. Johnsbury's pumps are aged and in danger of failing. The town is currently in the process of replacing them, but lacks funding.

#### Hazard Profile: Hazardous Materials Incidents

**Definition:** Hazardous materials are any substances that may pose unreasonable risks to health and safety or the environment when not properly contained. Hazardous materials incidents are any accidents or spills that cause such materials to be released into the environment or into contact with people.

**Locations:** At industrial sites. Along Interstates 91 and 93, as well as the railroad line and other roads.

**Impacts:** Injuries and death to the public or emergency responders, environmental contamination, property damage and fire

**Frequency:** 278 spills documented over 30 years, predominantly minor

<sup>38</sup> [http://www.anr.state.vt.us/dec/wastediv/SMS/WMID\\_Intro.htm](http://www.anr.state.vt.us/dec/wastediv/SMS/WMID_Intro.htm) and <http://www.anr.state.vt.us/wmid/Spills.aspx>



St. Johnsbury's municipal water supply originates at Stiles Pond. It passes through aging lines underneath many roadways in the most developed sections of town. Stiles Pond is vulnerable to potential contamination through intentional acts, though it is unlikely that contamination would result accidentally through spills or storm situations. The water treatment plant is surrounded by a high fence and has an alarm system. Water lines could potentially rupture in numerous locations, leading to flooding and loss of water service as well as significant property damage. In 2014, a major water line did rupture beneath the Green Mountain Mall, resulting in closure of the mall and significant damage.<sup>39</sup> St. Johnsbury's water system also includes an essential line that spans the Moose River; that line is outdated and needs replacement. St. Johnsbury is currently studying options but lacks funding to implement the replacement.

Fire protection and dispatch services are both located in the historic downtown fire station, and both are vulnerable because of outdated infrastructure. The fire station is too small to accommodate the needs of the region's strongest and largest fire department, which is responsible not only for protecting St. Johnsbury but also providing essential mutual aid services to nearby towns. The dispatch center is located in the same building and is also sub-par; it does not have a backup location in case of emergency or damage to the existing center, and does not have adequate facilities for use as a longer-term command center in case of extended disaster situations.

St. Johnsbury's dams and utility systems are managed by private companies and are generally less vulnerable. St. Johnsbury is home to three dams along the Passumpsic River, all of which are relatively small (under 20 feet high) and in good condition. Failure at any of these dams would impact the town of Barnet downstream, but would not cause major flooding in St. Johnsbury.<sup>40</sup> Green Mountain Power manages electrical service to St. Johnsbury and maintains its own emergency operations plans and procedures. Green Mountain Power coordinates with the town and Emergency Operations Director in case of problems. St. Johnsbury includes three distinct transmission corridors, making it very unlikely that the town would completely lose power for extended periods.

### CLIMATE CHANGE

Climate change is not a hazard by itself, but many of the priority hazards identified in St. Johnsbury 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

#### Hazard Profile: Major infrastructure failure

**Definition:** Major infrastructure failure occurs when a significant element or an entire infrastructure system is damaged or ceases to function. Failure may occur due to aging or wear on components, damage from hazards (such as a lightning strike) or excess stress (such as high water from flooding).

**Locations:** Wastewater treatment plant, public water system, fire protection system, dams, dispatch system, and utilities.

**Impacts:** Loss of critical services, injuries or death, environmental contamination, and economic losses.

**Frequency:** xxxxxx

<sup>39</sup> Sullivan, Adam. "Flooding Closes St. Johnsbury Mall." WCAX, February 4, 2014. <http://www.wcax.com/story/24631105/flooding-closes-st-johnsbury-mall>, accessed 9/28/14.

<sup>40</sup> 2005 Hazard Mitigation Plan

storms, heavy rain and flooding will all increase in the coming years. The extent of flooding, high winds and other extreme weather experienced in the past are likely to increase in intensity and frequency.

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;<sup>41</sup> St. Johnsbury and other New England towns should expect both more heat spells and more cold snaps, as well as generally more unstable climate patterns, in the future. Historically, St. Johnsbury 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 the National Climatic Data Center does report six heat-related hazards in the data it tracks. All six heat waves have occurred since 1996, and that includes a dry spell in 2012 that resulted in significant crop damage.<sup>42</sup> Droughts may become increasingly common, as may hazards related to invasive species and infectious diseases that thrive in a changing climate. These changes pose risks to property, crops and public safety, but also to the economy and traditional land-based businesses such as ski areas and maple sugaring.

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<sup>41</sup> Climate Change Indicators in the United States. Environmental Protection Agency website.

<http://www.epa.gov/climate/climatechange/science/indicators/weather-climate/index.html>, accessed 9/22/14.

<sup>42</sup> NCDC Storm Events Database. National Climatic Data Center. National Oceanic and Atmospheric Administration.

<http://www.ncdc.noaa.gov/stormevents/>, accessed 9/4/14.

## MITIGATION PROGRAM

The assessment of hazard risks and vulnerability for St. Johnsbury pointed to ongoing and highest concern for:

- Nearly annual flooding of structures in limited, low-lying areas within the river corridors (none of which have caused loss of life or critical structures)
- Occasional and short power outages that are primarily concerning for vulnerable citizens such as the elderly and disabled
- Downtown fires, which have resulted in the loss of lives and large historic property in the region's economic center
- Transport of hazardous chemicals over the Interstate highways or the rail line that passes through the center of the downtown
- Loss of water supply or wastewater treatment due to failure of vulnerable elements in those systems

### 2005 Plan Review

St. Johnsbury's 2005 Hazard Mitigation Plan worked to decrease the risk from many of the same issues, including flooding, water supply contamination and hazardous material incidents through proactive planning, policies and mitigation actions. **Appendix xx.** presents the key action steps from 2005 and an update on status.

The consultants discussed the 2005 strategies at length with St. Johnsbury's Fire Chief, Public Works Director, Assistant Town Manager and the Planning Commission. These conversations yielded important insights about the relevance and status of previous action items.

**MUNICIPAL WATER SECURITY SYSTEM.** Concerns about the security of the water system are mystifying now and may have been connected to heightened concern for terrorism after the destruction of the World Trade Center in 2001. Town officials noted the town permits fishing at Stiles Pond, which doesn't indicate high concern for access to the water source. The water treatment plant is surrounded by a high fence and has an alarm system. There is a detailed emergency plan for the water system, as required by EPA. The town does not see a need for further action on water system security.

**PROVISION OF WATER SOURCES AT THE INTERSTATE EVERY 2.5 MILES.** This action step also mystified the Emergency Management Director, who was the Fire Chief when the 2005 plan was written. The outlet stream from Stiles Pond is accessible from the Interstate highway and other stream crossings occur regularly along stretches of the both Interstate highways, providing access to water year-round. This strategy no longer appears relevant.

**SPRINKER SYSTEMS FOR DOWNTOWN BUILDINGS.** This remains a high concern, with little progress made since 2005. Several serious fires have occurred, highlighting the need for action. Sprinkler systems are costly and are the responsibility of individual building owners and the town has little control over their decisions to implement.

**NEW FIREHOUSE.** This remains a deep concern, with no progress in gaining public funding support. The Fire Department has very cramped quarters and the location makes it difficult to maneuver large trucks. The current station hampers an effective fire response.

**EXTRA GENERATORS FOR ALL EMERGENCY SHELTERS.** Generators are present at two of the three current shelters. This strategy gained public support at the 2014 public meetings, but the Fire Chief pointed out that people do not flock to the shelters or stay very long when they do come. The two shelters with generators have the capacity to serve almost 900 people. Town leaders sense that residents would prefer to become more secure in their own dwellings and neighborhoods.

**GIS MAPPING OF NFIP AREAS.** Mapping was completed and GIS river corridor maps are now available online from the VT Agency of Natural Resources, which are more extensive than the NFIP hazard areas. Maps can be found at [tinyurl.com/floodreadyatlas](http://tinyurl.com/floodreadyatlas).

## Existing Mitigation Programs + Policies

St. Johnsbury has a number of current programs, policies and organizations that are currently assisting with hazard mitigation work or could play a role in the future. See St. Johnsbury's Capacity Assessment table in **Appendix xx** for more information.

- Vermont has a strong Downtown Program aimed at supporting commercial vitality in the regional centers, and which, through its historic tax credits program, can offer funding resources to owners of downtown structures to improve fire protection.
- St. Johnsbury has an active marketing association, which can encourage fire safety projects by building owners, and has gained grants to support commercial investment in its historic downtown.
- Vermont's public building regulations require fire safety improvements with substantial building upgrades.
- St. Johnsbury has maintained land use regulations (zoning, subdivision and site plan review) for a long time, though the town experiences primarily re-development/re-use of existing structures and little new development on open land.
- The town has previously had a capital budget and program in place to fund hazard mitigation measures, among other major expenses. This program has lapsed and is being updated and revived.

## 2015-2020 Mitigation Strategies

Given the risk analysis and progress on 2005 mitigation strategies, the goals of this 2015-2020 mitigation plan are to:

- Minimize new development that would be at risk of flooding
- Reduce losses due to flooding of existing structures
- Encourage integration of mitigation planning strategies into the municipal plan and revisions of land use regulations
- Ensure that mitigation actions are compatible with natural watershed functions; historic resources; character of neighborhoods; and the capacity of the community to implement them.
- Protect life, health and safety of visitors and residents by:
  - increasing security and comfort of vulnerable residents during extended power outages
  - decreasing risks and vulnerability to major downtown fire
  - decreasing risks and vulnerability to hazardous chemical accidents

- protecting against major failures in fire protection, water and wastewater treatment systems

St. Johnsbury will work to mitigate hazards and pursue these goals through a combination of proactive planning, policies and regulatory strategies, hazard mitigation actions, and community education.

The planning team developed a list of 41 potential strategies to address the town's priority hazards, which were shared with attendees at the December public meeting. Attendees broke into three small groups, each of which discussed and evaluated the strategies based on cost, benefit and overall feasibility. Groups used a modified STAPLEE scoring system, which covered Social/Political Readiness, Administrative/Technical Feasibility, Public Benefits, Environmental Benefits; Local Costs; and Availability of Outside Assistance.

Appendix xx includes a full list of all strategies that the groups considered. Appendix xx shows the scoring table, which includes less detail. Attendees worked with both documents to make decisions about strategies. After reviewing categories C and D, for lightning and wind respectively, participants determined that those hazards are effectively addressed through actions for other hazards. They identified no appropriate strategies for those hazards and removed them from the priority hazards list.

The priority actions chosen by St. Johnsbury and approved by the Planning Commission and Selectboard follow in Tables xxx. Implementation timelines, responsibilities and costs are included as well.

St. Johnsbury has a strong collaborative spirit around resilience and hazard mitigation, which it strengthened by making this planning process as inclusive and engaging as possible. The town will continue to foster that spirit and the mentality that everyone in town can contribute to hazard mitigation. Many of the selected action steps require involvement or leadership from residents, community groups and organizations that are not often involved in hazard mitigation. Others will require continued partnerships and robust collaboration with neighboring towns, regional and state agencies, and departments within the town.

St. Johnsbury looks forward to continuing an open process of growing stronger and safer – together.

## All Hazards (A) Priority Mitigation Actions

| Mitigation Action   | Cost   | Leadership                          | Timeframe                                       | Funding & Resources                               | Implementation Partners & Programs  |
|---|--------|-------------------------------------|---|---|---|
| A1a. Include hazard mitigation measures when retrofitting/upgrading town facilities   | Medium | Town Manager & Public Works         | Ongoing, when upgrades occur and funding allows | Town budget/state and federal sources as possible | State and federal funders/DHCD, DEMHS, DEC, VTrans, FEMA, EPA, HUD, US DOT, USDA RD |
| A2c. Create secondary dispatch site for backup  | Medium | Emergency Management Director (EMD) | 2017  | Town budget                                       |   |
| A2d. Acquire generator for Good Shepherd School shelter   | High   | EMD; Town Mgr                       | 2016  | FEMA  | FEMA, school  |
| A3. Appoint a Community Resilience team (CRO) to build broad community resilience and organize resilience actions               | Low    | Selectboard                         | 2016-2017                                       | Town budget                                       | Statewide CROs, Chamber of Commerce<br>St. Johnsbury Academy                        |
| A4. Develop a public education and outreach program around hazard mitigation and individual preparedness (Combine with B3, C2). | Low    | Planning Commission; EMD            | 2016  | Town budget<br>Grants                             | CROs, Chamber of Commerce<br>St. Johnsbury Academy                                  |

**Flooding (B) Priority Mitigation Actions****(from Hurricanes, Severe Thunderstorms, Ice Jams or Severe Winter Storms)**

| <b>Mitigation Action</b>  | <b>Cost</b> | <b>Leadership</b>                     | <b>Timeframe</b>   | <b>Funding &amp; Resources</b>                                  | <b>Implementation Partners &amp; Programs</b>                      |
|---|-------------|---------------------------------------|--|---|--|
| B2. Maintain regional partnerships to support floodplain/river corridor management  | Low         | Town Manager, Planning & Zoning Dept. | Ongoing  | Town Budget<br>Planning Budget                                  | Adjoining towns, NVDA, regional service providers, state officials |
| B3. Update town flood hazard area regulations to:<br>a. Prohibit development in floodplains<br>b. Require new critical facilities to be 1' above 500 year base flood elevation<br>c. Prohibit new critical facilities in known hazard areas | Low         | Planning & Zoning Dept.               | 2015   | DHCD and/or DEC funding/assistance; Planning & Zoning work plan | NVDA assistance;<br>Incorporate into new town plan                 |
| B4c. Create education and outreach program on flood hazard mitigation actions for individuals, businesses and private property  | Low         | Planning Commission                   | 2016   | Town budget   | CROs, Chamber of Commerce, Academy                                 |
| B9a. Seek funding to address top priority town culverts and bridge  | High        | Town Manager                          | Severance Hill & Sylvain Rds 2015; Hutchinson 2019; Goss Hollow Bridge study by 2019 | FEMA, VTrans  | FEMA, VTrans   |
| B12. Monitor and record local flood events by establishing high water marks   | Low         | Town Mgr's Office; Public Works Dept. | 2016   | Town budget   | CROs, Academy, Chamber of Commerce                                 |

### Isolation, Unsafe Travel + Power Outage (E) Priority Mitigation Actions (from Severe Thunderstorms and Winter Storms)

| Mitigation Action   | Cost | Leadership           | Timeframe | Funding & Resources  | Implementation Partners & Programs                       |
|---|------|----------------------|-----------|--|--|
| E5d. Add generator capacity to housing/facilities for seniors   | High | Rural Edge           | 2018      | Grants, FEMA HMG, town match                                   | Social service organizations, Rural Edge                 |
| E6b. Create public education campaign to inform vulnerable & elderly residents about emergency resources and procedures | Low  | EMD                  | 2016      | Grants, FEMA HMG, minor town match                             | Rural Edge, CROs, Academy, Red Cross                     |
| E7b. Appoint and train a back up Emergency Director   | Low  | EMD,<br>Select board | 2015      | Town Work Plan   | Fire Department, Town Manager's Office                   |
| E7c. Create a system to identify vulnerable people and check on them during extended power outages                      | Low  | EMD                  | 2015      | Grants, town match, FEMA HMG                                   | Social services organizations, Red Cross, CROs, churches |
| E7d. Practice building evacuation plans in multi-unit residences, especially those housing vulnerable populations       | Low  | EMD                  | 2016      | Town budget;<br><br>Build into public safety annual work plans |  |



### Structural Fire (F) Priority Mitigation Actions

| Mitigation Action  | Cost   | Leadership      | Timeframe  | Funding & Resources  | Implementation Partners & Programs                 |
|--|--------|-----------------|--|--|--|
| F2. Investigate steps to improving back-up response capacity of town fire & emergency services during widespread, major events | Low    | Fire Dept., EMD | 2017   | Town work program  | Neighboring fire and emergency response services   |
| F3. Develop and implement a fire prevention plan for downtown  | Medium | EMD, Fire Dept. | Develop by 2016; Seek grants 2017; Begin implementation 2019 | Downtown Program, Preservation Trust; HUD CDBG; Town budget; Fire Dept. budget | Chamber of Commerce; property owners               |
| F4. Continue public outreach and education on fire prevention and hazards  | Low    | Fire Dept.      | Ongoing  | In annual work plan  | CROs, Chamber of Commerce<br>St. Johnsbury Schools |
| F5. Continue to maintain mutual aid agreements with neighboring communities  | Low    | Fire Dept.      | Ongoing  | In Fire Dept. budget & annual work plans                                       | Area towns   |

### Hazardous Materials Incident (G) Priority Mitigation Actions

| Mitigation Action   | Cost   | Leadership              | Timeframe | Funding & Resources            | Implementation Partners & Programs                  |
|---|--------|-------------------------|-----------|--------------------------------|---|
| G1. Encourage DEMHS to conduct emergency exercise for downtown rail accident w/chemicals, in St J or other similar downtown | Low    | EMD/Selectboard         | 2017      | Fire Dept. Workplan/DEMHS      | DEMHS – state exercise                              |
| G2. Obtain and maintain an adequate supply of foam to treat hazardous materials spills                                      | Medium | Fire Dept.              | 2016      | Town budget<br>Grants          | DEMHS   |
| G4. Continue to maintain coordination with the EMS District and the hospital to ensure adequate treatment capacity          | Low    | EMD                     | Ongoing   | In EMD work plan               | EMS District<br>Northeast Vermont Regional Hospital |
| G6. Update land use plan to discourage siting of hazardous materials sites & storage near critical facilities               | Low    | Planning & Zoning Dept. | 2015      | In Planning & Zoning work plan | NVDA assistance<br>Incorporate into new town plan   |

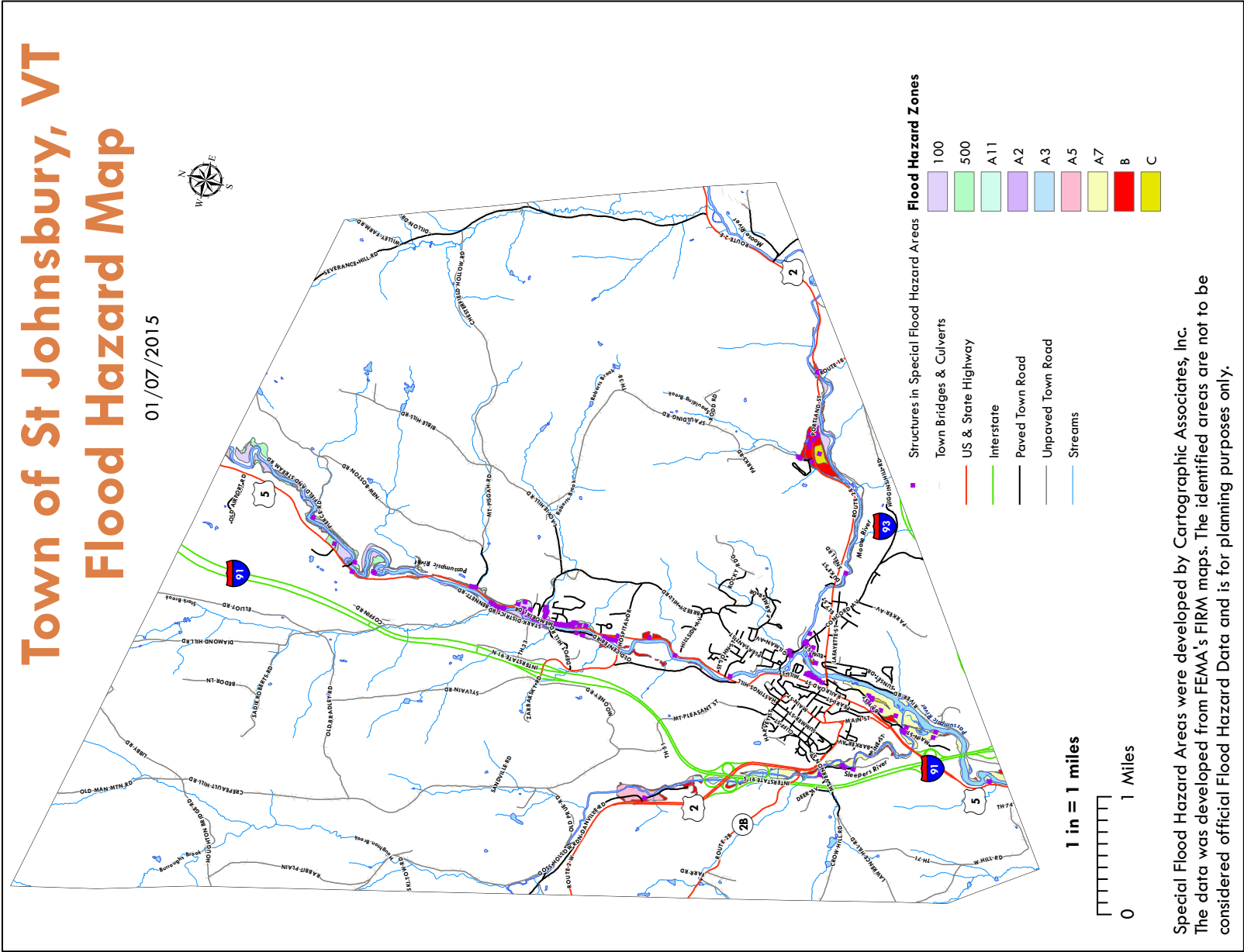
### Major Infrastructure Failure (H) Priority Mitigation Actions

| Mitigation Action   | Cost | Leadership            | Timeframe | Funding & Resources                       | Implementation Partners & Programs |
|---|------|-----------------------|-----------|---|------------------------------------|
| H1. Seek funding to replace the screw pumps in the wastewater treatment plant | High | Town Mgr; Selectboard | 2016      | USDA RD; HUD CDBG; EPA via state agencies | NVDA; DHCD; ANR                    |
| H2. Seek funding to replace the water line across the Moose River             | High | Town Mgr; Selectboard | 2016      | Same as above                             | NVDA; DHCD; ANR                    |

## APPENDICES

[INDEX TO APPENDICES]

Flood Hazard Map



## St. Johnsbury Capability Assessment

| St. Johnsbury Capability Assessment     |         |   |                            |        |   |
|---|---------|---|----------------------------|--------|---|
| Category                                | Status  | Notes [Names, adoption dates, description, etc. ] | Category                   | Status | Notes [Names, adoption dates, description, etc. ] |
| <b>Plans</b>                            |         |   | <b>Technical Resources</b> |        |   |
| Comprehensive Municipal Plan            | Yes     | Updated extensively through 2010 and adopted 2011 | E-911                      | Yes    | Region PSAP Center                                |
| Capital Improvement Plan                | Expired | Currently being re-instituted                     | Warning Systems            | Yes    | Code Red Mass Notification System                 |
| Hazard Mitigation Plan                  | Expired | Adopted in 2005 as addendum to regional HMP       | Data, Information          | No     |   |
| Emergency Operations Plan               | Yes     | Updated 2014                                      | Grant Writing              | Yes    |   |
| River Corridor Man. Plan                | No      |   | Hazus Analyses             | No     |   |
| Other                                   |         |   | Other                      |        |   |
| <b>Regulations</b>                      |         |   | <b>Financial Resources</b> |        |   |
| Zoning Regulations                      | Yes     | Adopted in 1973 and amended in 2006 and 2014      | Property Tax               | Yes    |   |
| Subdivision Regulations                 | Yes     | Included as part of the Zoning Regulations        | Reserve Funds              | Yes    |   |
| Flood Hazard Area Regulations           | Yes     | Also included as part of the Zoning Regulations   | Other                      |        |   |
| Fluvial Erosion Hazard Area Regulations | No      |   | <b>Programs</b>            |        |   |
| Emergency Management                    | No      |   | Open Space/                | No     |   |

|                                   |     |                               |                                |     |                            |
|-----------------------------------|-----|-------------------------------|--------------------------------|-----|----------------------------|
| Ordinance                         |     |                               | Conservation Fund              |     |                            |
| Stormwater Management Regulations | No  |                               | Right-of-way maintenance       | Yes | Ongoing                    |
| Highway Ordinance/Standards       | Yes | Updated in 2012               | Other                          |     |                            |
| Fire Permits                      | Yes | Permit Process in place       |                                |     |                            |
| Public Works Ordinance/Standards  | No  |                               |                                |     |                            |
| Building Code                     | No  |                               |                                |     |                            |
| <b>Administration</b>             |     |                               | <b>Staff</b>                   |     |                            |
| Fire Department                   | Yes |                               | Emergency Manager              | Yes | Delegated to FD            |
| Emergency Management Services     | Yes |                               | Floodplain Administrator (FPA) | Yes | 1979, Zoning Administrator |
| Policing Services                 | Yes |                               | Zoning/Code Administrator      | Yes |                            |
| Rescue Services                   | Yes |                               | Community Planner              | No  | Provided by NVDA           |
| Mutual Aid Agreements             | Yes | Member agreement              | GIS Services                   | No  | Provided by NVDA           |
| Planning Commission               | Yes |                               | Road Commissioner              | Yes | Public Works Director      |
| Zoning/Development Review Board   | Yes | Also have Design Review Board | Health Officer                 | Yes |                            |
| Mitigation Planning Comm.         | No  |                               | Fire Officer                   | Yes |                            |
|                                   |     |                               | Public Works Director          | Yes |                            |

## Federal Disaster Declarations, Caledonia County, 1954-2014

| Disaster #  | Date       | Incident Type    | Description                               |
|---|------------|------------------|---|
| 397   | 7/6/1973   | Flood            | Severe storms, flooding & landslides      |
| 518   | 8/5/1976   | Flood            | Severe storms, high winds & flooding      |
| 712   | 6/8/1984   | Flood            | Severe storms & flooding                  |
| 840   | 8/4/1989   | Flood            | Severe storms & flooding                  |
| 875   | 7/4/1990   | Flood            | Severe storms & flooding                  |
| 938   | 3/11/1992  | Flood            | Heavy rains, ice jams & flooding          |
| 1063  | 8/4/1995   | Severe Storm(s)  | Excessive rainfall, flooding              |
| 1184  | 7/15/1997  | Flood            | Excessive rainfall, high winds & flooding |
| 1228  | 6/17/1998  | Severe Storm(s)  | Severe storms and flooding                |
| 1307  | 9/16/1999  | Severe Storm(s)  | Tropical Storm Floyd                      |
| 1428  | 6/5/2002   | Severe Storm(s)  | Severe storms and flooding                |
| 1559  | 8/12/2004  | Severe Storm(s)  | Severe storms and flooding                |
| 1698  | 4/15/2007  | Severe Storm(s)  | Severe storms and flooding                |
| 1715  | 7/9/2007   | Severe Storm(s)  | Severe storms and flooding                |
| 1784  | 7/18/2008  | Severe Storm(s)  | Severe storms, a tornado & flooding       |
| 1790  | 7/21/2008  | Severe Storm(s)  | Severe storms and flooding                |
| 4001  | 5/26/2001  | Severe Storm(s)  | Severe storms and flooding                |
| 3338  | 8/26/2011  | Hurricane        | Hurricane Irene                           |
| 4022  | 8/27/2011  | Hurricane        | Tropical Storm Irene                      |
| 4140  | 6/25/2013  | Flood            | Severe storms and flooding                |
| 4163  | 12/20/2013 | Severe Ice Storm | Severe winter storms                      |
| 4178  | 4/15/2014  | Flood            | Severe storms and flooding                |
| <b>Source: FEMA Disaster Declarations Summary</b> |            |                  |   |

## Hazards History Checklist

### SUMMARY OF FORMS RETURNED BY PUBLIC AND FEEDBACK FROM OCTOBER 2, 1014 MEETING

Please note “possible” below if the hazard is possible but not all that likely to occur in town, and “likely” if there is a likely risk for this hazard in all or part of town. In the far right column, if you have memories of particular damaging events in town, please provide notes, such as how deep the snow got, whose roof blew off, and date.

| Natural Hazards    | How Likely?  | Where, when, level of loss  |
|--------------------|--|---|
| <b>Dam failure</b> | May be possible<br>“anything is possible”<br>(GMP) | 1976, north dam at Arnold Falls, blew a section away, rock-filled timber crib, replaced in 95 with concrete.<br><br>Robinsons log transfer station, washed away the bridge; Stiles Pond in Waterford but would flow to St J - earthen but very substantial; possible concern about sheltering displaced from other towns if the Moore or Comerford dams failed  |
| <b>Drought</b>     | ---  | '94 or '95 (landscaper – “no reason to mow, nothing was growing”) never had to institute water conservation   |
| <b>Earthquake</b>  | Low possibility                                    | 4/2004 – internal rattling of houses, things falling out of cupboards   |
| <b>Flood</b>       | Likely   | '27, May 26-7'11; 2012, 1973 similar to 2006 Riverfront Enterprises on Sleepers Brook(had a rare flash flood) had losses; Water flowed into Atheneum because outlet drain backed up and flooded; Lost multiple class 3 roads; isolated some folks; Passumpsic always floods (“that’s just what it does”) by Rte 5 – annual event but houses flooded in 2006 –had to get people out<br><br>WW treatment facility hasn’t been affected historically in a major way – but its deep basement can be flooded |
| <b>Hailstorm</b>   | Possible   | Have had vehicles damaged, glass broken in the past   |
| <b>Hurricane</b>   | Possible   | '38   |



## Local Hazard Mitigation Plan

|                                  |   |  |
|----------------------------------|---|--|
| <b>Ice Jams</b>                  | Likely  | Moose River '11, hired excavator to clear because it was flooding houses on Concord Ave and Elm St   |
| <b>Ice storm</b>                 | Likely  | '98, 2014 Jay Peak affected  |
| <b>Landslide/Land subsidence</b> | Likely – not a lot of damage                                    | May '11 – landslide from old RR bed onto High Street; “training” thunderstorms that rapidly follow each other; 13 thunderstorm events before Irene in 2011   |
| <b>Severe Winter Storm</b>       | Likely  | Oct 2006 – heavy wet snow –power outage for 3 days ; Valentines Day storm in 2008  |
| <b>Tornado</b>                   | Possible  | Hear warnings once/yr; “always turn out to be windshears which have less windspeed”- GMP;  |
| <b>Wildfire</b>                  | Anything is possible for a big one – likely to have little ones | Not likely to have a major one here but always have a few – Fire Chief Ruggles   |
| <b>Severe Thunderstorm</b>       | Likely  | May 2011 event, house fires from lightning and rescues from flooded homes and vehicles. GMP had about 90 crews working in this area; power was out for 3 days  |
| <b>Windstorm</b>                 | Likely  | Random trees, sometimes damage a house or car; St J is in a lucky place for “downsloping wind events” (GMP) because those come from being below mtns and the town is away from the Whites and the Greens |
| <b>Manmade Hazards</b>           | <b>How Likely?</b>  | <b>Where, when, level of loss</b>  |
| <b>Nuclear</b>                   | ---   | Too removed from sources   |
| <b>Chemical</b>                  | likely  | Small propane or oil spills – interstate and RR and interaction with waterways or Stiles Pond  |
| <b>Gas</b>                       | likely  | Propane leaks happen all the time, now CNG by tractor trailer for local use (hospital,   |

|   |                     |  |
|---|---------------------|--|
|   |                     | Weidman) - not been a issue  |
| <b>Major bridge, water system, road or other infrastructure failure</b> | Possible            | Sleepers River bridge by Allright springs  |
| <b>Large transportation incident</b>                                    | Likely              | Bonsai Bridge – common place to lose brakes, and at base of Rte 18 jct;<br>Cars went into the Passumpsic due to damage from storm before – dumped grain – no crude oil coming thru on RR |
| <b>Large structural fire</b>  | Likely              | 2000 (Daniels Block – deaths; O'Dean/Hale block and two commercial bldgs on Eastern Ave<br>2009 Main St<br>2012 Ravel Block  |
| <b>Infectious Disease Epidemic</b>                                      | Anything's possible | 1918   |

*If you can be contacted for photos or other documentation, please give your contact information, and the kind of information you have (photo, newspaper article...) below:*

*Name:*

*Best way to contact:*

*Type of Information:*

**Thank you!**

## 2005 Hazard Mitigation Plan Strategies

The following strategies were priorities resulting from the 2005 Hazard Mitigation Plan in St. Johnsbury; they are listed with current status.

**Table xx. 2005 Hazard Mitigation Plan Actions**

| <b>Project/Priority</b>  | <b>Mitigation Action</b>   | <b>Responsible</b>                                   | <b>Time Frame and Potential Funding</b>                                  | <b>Initial Implementation Steps</b>                                       | <b>2015 STATUS</b>                  |
|--|--|--|--|---|-------------------------------------|
| Municipal water security system<br>HIGH  | Protect public drinking water supply from contamination  | The Selectboard, Town Manager                        | 2005/6 – HMGP, PDM-C, FMA, Rural Development                             | Seek appropriate action & options. Obtain estimates; apply for funding.   | Adequately protected                |
| Extend municipal water to Interstate for emergency access OR install ponds every 2.5 miles in median. HIGH | Provide needed water for accidents or hazardous material incidents along 10-mile Interstate stretch. | Fire Chief, Town Manager                             | 2005/6 – HMGP, PDM-C, FMA, Rural Development, Homeland Security          | Need engineering plans and cost estimates first.                          | No longer relevant                  |
| Need funds to install sprinkler systems in downtown buildings. HIGH  | To protect from loss of life and property, especially for the older historic buildings.              | Fire Chief, Town Manager                             | 2005/6 – HMGP, PDM-C, FMA, Fire Safety grants, Rural Dev., Homeland Sec  | Seek appropriate grant source, obtain cost estimate and apply for funding | Little progress; still high concern |
| New Firehouse  | Need additional space to provide service for St. Johnsbury and surrounding towns.                    | Fire Chief   | 2006/7 – Rural Development, Vermont Community Development Prog.          | Seek appropriate grant source, obtain cost estimate and apply for funding | Little progress; still high concern |
| Extra generators for all shelters  | To provide power and municipal utilities when there is a loss of power.                              | Emergency Coord., Fire Chief, Town Man., Selectboard | 2005/6 – HMGP, PDM-C, FMA, Fire Safety grants, Rural Dev., Homeland Sec. | Seek grant source, obtain cost estimate and apply for funding             | Generators at 2 of 3 shelters       |
| GIS mapping of NFIP areas  | Identify flood areas with vulnerable structures consistent with Vermont GIS mapping                  | NVDA   | 2006/7 – FEMA FMA funds, HMGP or EMPG funds                              | Coordinated statewide NFIP mapping effort for all towns.                  | Complete ; maps available online    |

## Menu of 2015-2020 Mitigation Strategies

Following is the menu of mitigation strategies used by attendees at the December, 2014 meeting to score and prioritize hazard mitigation actions.

### A. ALL HAZARDS

1. Integrate hazard mitigation into municipal decisions by:
  - Incorporating findings and action strategies of the Hazard Mitigation Plan, along with the required Flood Resilience Element, into the comprehensive town plan.
  - Including hazard mitigation measures when upgrading or retrofitting town buildings and facilities.
2. Protect infrastructure and critical facilities by:
  - Incorporating mitigation retrofits for public facilities into the annual capital improvement program.
  - Engineering or retrofitting roads and bridges to better withstand hazards.
  - Determining whether there is a need for and establish any additional emergency shelters to serve any portions of the community that could get cut off from existing shelters.
  - Evaluating a transition to underground electrical infrastructure.
3. Create a local “Community Resilience Organization” (CRO) to promote broad public involvement in implementation of the local mitigation plan and to ensure mitigation actions are undertaken in a way that builds social cohesion through celebration. The committee’s responsibilities may include:
  - Increasing public awareness through publications and organized events.
  - Identifying and recruiting volunteers or neighborhood groups for community mitigation projects.
  - Preparing annual updates for inclusion in the town report.
4. Develop and implement a multi-hazard public awareness program to:
  - Provide information on all hazards and hazard mitigation measures.
  - Establish an annual “hazard awareness week” that promotes hazard awareness, offers workshops, maintenance and mitigation activities (e.g., culvert cleanouts).
  - Provide information on the town’s website regarding emergency preparedness and emergency services, including the location of local shelters and evacuation locations or routes.
  - Distribute hazard vulnerability checklists & emergency preparedness kits for local homeowners and businesses.

### B. FLOODING (FROM HURRICANES, SEVERE THUNDERSTORMS, ICE JAMS OR SEVERE WINTER STORMS)

1. Develop the Flood Resilience Element as an update to the town plan. This should include:

- Policies and recommendations to reduce exposure and risk within known flood hazard areas, especially for critical facilities and infrastructure, including local roads and utilities.
  - Identification of appropriate land uses within known flood hazard areas.
  - Policies to protect natural resources in areas that provide floodplain protection such as riverbanks, wetlands, riparian buffers, farm and forest land and other undeveloped open space
2. Maintain partnerships to support floodplain management - including partnerships with adjoining towns, NVDA, regional service providers and state officials - to improve communication, facilitate coordinated planning and response, and to share resources.
  3. Update the town's flood hazard area regulations to further limit or restrict new development in known flood hazard areas to:
    - Require that floodplains be maintained as open space, and/or
    - Require that all new critical facilities (fire department facilities, emergency operations centers (EOC), shelters) be built 1-foot above the 500-year base flood elevation, and ensure that they are accessible during flood events, and/or
    - Prohibit new critical facilities and facilities for persons with special mobility needs within known hazard areas, and/or
    - Prohibit new animal shelters in known flood hazard areas, and/or
    - Limit the percentage of allowable impervious surface within the floodplain, and/or
    - Require stream buffers to reduce flooding impacts, stabilize stream banks and protect water quality, and/or
    - Require that new structures be elevated more than 1' above the base flood elevation, and/or
    - Require/enforce standard tie-downs of all propane tanks.
  4. Increase local flood risk awareness by:
    - Encouraging homeowners to purchase flood insurance.
    - Annually distributing flood protection safety pamphlets or brochures to the owners of flood-prone properties.
    - Educating citizens about safety during flood conditions, including the dangers of driving on flooded roads.
    - Educating property owners about options for mitigating their properties from flooding
    - Educating the public about securing debris, propane tanks, yard items, or stored objects that may otherwise be swept away, damaged, or pose a hazard if picked up and washed away by floodwaters.
    - Asking residents to help keep their culverts clear of debris.
  5. Increase community participation in the National Flood Insurance Program (NFIP):
    - Conduct an annual NFIP workshop to provide information and incentives for property owners to acquire flood insurance.
    - Encourage that the flood hazard bylaw administrator gain training for Certified Floodplain Manager (CFM) certification.
    - Require and maintain FEMA elevation certificates for all new and improved buildings located in floodplains.
  6. Consider floodplain management techniques that exceed minimum NFIP requirements, for example:
    - Incorporate a "No Adverse Impact" policy under local floodplain management programs.
    - Extend a higher freeboard requirement past the mapped floodplain to include the mapped river corridors.

- Annually notify the owners of repetitive loss properties of Flood Mitigation Assistance funding.
  - Strive to gain CRS status for St J, to reduce flood insurance premiums for citizens and increase state match for infrastructure improvements.
7. Apply for FEMA funding assistance to remove structures from flood-prone areas - to minimize future flood losses by acquiring and demolishing or relocating structures from interested property owners.
  8. Elevate structures susceptible to ice jams above the predicted height of scour or flooding.
  9. Maintain and update the town bridge and culvert inventory on VOBCT, and address problem sites as funding allows (see priority sites noted on p. xx ).
    - Require proper sizing, installation and maintenance of private culverts, or implement other measures to prevent private culverts from damaging municipal highway infrastructure and other property
    - Incorporate ice jam prevention techniques where appropriate.
  10. Encourage creation of new flood storage capacity through redevelopment by design when opportunities occur. New flood storage capacity could be gained by:
    - Creating parks and other open spaces in vulnerable locations,
    - Replacing a vertical wall along a river bank with a more gradual slope to create more room in the river channel for rising water
    - Creating a shallow depression in a lawn that can accommodate inundation
    - Redesigning buildings to enable the first floor or basement to be above base flood elevation rather than armoring the buildings to repel rising waters
  11. Encourage flood-proofing of private property in known flood hazard areas, including the river corridors, which may include the following:
    - Elevating structures so that the lowest floor is above the base flood elevation
    - Elevating driveways and private bridges above the base flood elevation to maintain dry access.
    - Raising utilities or other mechanical devices above expected flood levels.
    - Anchoring structures within the floodplain and river corridor.
    - Relocating utilities and water heaters above base flood elevation.
    - Using water-resistant materials and paints in construction and renovation.
    - Flood-proofing water supplies and wastewater systems.
    - Acquiring easements on flood-prone property, as funding or opportunities allow, to prevent new structures or storage of floatable hazards.
  12. Monitor and record local flood events by establishing local stream gages and record high water marks.
  13. Improve storm water management in planning public facilities and regulating new land use.
    - Preparing stormwater management and erosion control plans for all town facilities and infrastructure.

- Encouraging or requiring the use of green stormwater infrastructure and Low Impact Development (LID) techniques to slow and reduce storm water run-off. For example, vegetated buffers and islands, rain gardens, bio-swales, pervious drainage channels, minimizing pavement surface area, curbing, concrete drainage channels
- Adopting a “zero discharge policy” for stormwater in subdivision and site design proposals.
- As applicable, requiring developers to construct onsite retention ponds for stormwater management and firefighting.

#### C. LIGHTNING

1. Protect critical facilities and infrastructure (incl. communications infrastructure) by:
  - Installing lightning protection devices and methods, such as lightning rods and grounding;
  - Installing and maintaining surge protection on critical municipal electronic equipment.
2. Increase public awareness of lightning dangers and safety precautions.

#### D. SEVERE WIND, FROM HURRICANES, SEVERE THUNDERSTORMS AND WINTER STORMS

1. Protect public buildings, town roads and power lines from wind damage through regular tree pruning, maintenance and upkeep.
2. Retrofit public buildings and critical facilities to reduce future wind damage by:
  - Improving roof coverings.
  - Anchoring roof-mounted heating, ventilation, solar and air conditioning units.
  - Retrofitting buildings with load-path connectors to strengthen structural frames.
  - Avoiding placement of flagpoles or antennas near buildings.
  - Upgrading and maintaining existing lightning protection systems to prevent roof cover damage.
  - Protecting traffic lights and other traffic controls from high winds; converting traffic lights to mast arms.
3. Increase public awareness of severe wind by providing information on property maintenance and building retrofits.
4. Encourage use of natural protection using landscape and vegetation as wind buffers in site design proposals.

#### E. UNSAFE TRAVEL OR EXTENDED POWER OUTAGES, FROM SEVERE WINTER WEATHER OR THUNDERSTORMS

1. Return to capital budgeting to plan for, budget and maintain town roads for safe winter travel.
2. Require or install “living snow fences” (trees, hedgerows) near critical road segments.
3. Protect power lines by clearing and maintaining town road rights-of-way and working with local utilities to ensure that utility corridors are cleared and maintained.
4. Require burial of utilities serving new development, especially those providing for vulnerable people or services, or in locations with high likelihood of damage to above-ground utilities
5. Protect buildings and infrastructure, especially critical facilities
  - Conducting engineering studies of snow/ice load capacity of at-risk facilities, critical facilities, key institutions & other buildings of concern

- Retrofitting public buildings as needed to withstand snow loads and prevent roof collapse.
  - Adequately insulating public buildings and facilities.
  - Adding generator capacity where possible
6. Plan and organize assistance for vulnerable residents during extreme storms.
    - Identifying residents who are vulnerable to severe winter hazards, including freezing temperatures and power outages.
    - Planning for and organizing outreach and assistance.
    - Maintaining community shelter(s) with generators and fuel to last through extended power outages.
  7. Increase public awareness of severe winter storms by distributing information about:
    - Common winter hazards
    - Family and traveler emergency preparedness
    - Winter driving safety tips
    - The installation of carbon monoxide monitors and alarms and the safe use of heaters.
    - Services available to vulnerable residents (incl. Vermont 211 C.A.R.E.).
    - Advice on use of electric vehicles as generators, if the appropriate switch is in place to temporarily disconnect the structure from the grid.
    - Available weatherization and heating assistance programs, and how to protect pipes from freezing.

#### F. FIRE HAZARDS (STRUCTURAL)

1. Gain public support and funds to replace the historic fire station and facilities, which are no longer adequate for the need (see p ). Construct a well-designed, modern emergency service facility at a location that can serve downtown St. Johnsbury and is secure from extended disaster events itself.
2. Consider improving back-up response capacity of St. Johnsbury during widespread major events when neighboring FD's are not available for support due to emergency w/in their own jurisdictions.
3. Work with downtown building owners via the Chamber of Commerce to address structural vulnerability to fire, as resources allow, by developing and implementing a prevention plan for the downtown:
  - Maintaining inventory of buildings: age, materials, construction, condition and other risk factors
  - Maintaining inventory of sprinkler systems and needs
  - Evaluating need for fire walls and/or other preventative improvements
  - Determining insurance status of structures, especially regarding liability risk
4. Increase public awareness of local fire hazards and prevention via:
  - Promoting private property maintenance to prevent fires, including chimney maintenance
  - Requiring local fire permits for any outdoor, controlled burning



- Collaborating with local or other relevant insurance brokers to educate property owners about prevention
- 5. Continue to maintain mutual aid agreements with neighboring communities, even though St. Johnsbury is largely the donor of services.

#### G. HAZARDOUS MATERIALS ACCIDENTS

1. Continue training (required by state) for emergency responders, including an emergency exercise around a major rail accident in the downtown that involves chemicals.
2. Gain funding to maintain an adequate supply of specialized foam for hazardous materials spills.
3. Post emergency numbers and advice in public places (whom to call if a spill happens and how the public should respond to a broad gas leak, such as propane).
  - Developing public information sheets on how the town will respond, what residents should do in such an emergency, and where or how they can get information in an event
4. Maintain coordination with the EMS District and Northeast Vermont Regional Hospital, to ensure sufficient treatment capacity is available for hazardous materials injuries.
5. Identify at-risk locations and discourage siting of new development or critical facilities in those areas.
6. Discourage siting of high-risk hazardous materials facilities near sensitive areas such as drinking water supply, surface water bodies, schools, high-density residential areas, and critical facilities

#### H. MAJOR INFRASTRUCTURE FAILURE

1. Continue to seek public support for successful bond vote to replace ancient screw pumps in the wastewater treatment plant and to replace the aerial water line crossing the Moose River.
2. Continue to seek state and federal funding to replace the two critical infrastructure elements noted above before a major failure of the systems occurs.

## Modified STAPLEE Strategy Scoring Results

The following table shows STAPLEE scoring results from the December, 2014 public meeting. After the meeting, the planning team compared average scores for the three groups and normalized the results. The highlighted strategies are those that scored highly enough, or that the town officials felt were most important, to be included in the 2015-2020 Hazard Mitigation Plan for St. Johnsbury.

For each mitigation action strategy, participants evaluated potential cost, benefit and feasibility using the criteria defined below.

1 = Highly effective, beneficial or feasible

1 = Low cost (< \$5,000)

0 = Neutral

0 = Moderate cost (\$5-50,000)

-1 = Ineffective or not feasible

-1 = High cost (>\$50,000)

### STAPLEE Mitigation Strategy Scoring Worksheet

| Mitigation Strategy  | Social/<br>Political<br>Readiness | Admin and<br>Technical<br>Feasibility | Range of<br>Public<br>Benefit | Range of<br>Environ'l<br>Benefit | Local<br>Cost | Outside<br>Assistance<br>Available | Total<br>Score |
|--|-----------------------------------|---------------------------------------|-------------------------------|----------------------------------|---------------|------------------------------------|----------------|
| A1 a. Integrate hazard mitigation plan into town plan                                | 1                                 | 1                                     | 1                             | 1                                | -1            | 0                                  | 3              |
| A1 b. Include haz mit in town facility upgrades                                      | 1                                 | 1                                     | 1                             | 1                                | -1            | 1                                  | 4              |
| A2 a. Include needed haz mit, in line above, in capital budget                       | 0                                 | 1                                     | 1                             | 1                                | -1            | 1                                  | 3              |
| A2 b. Improve equipment & facilities at primary dispatch site                        | 0                                 | 1                                     | 1                             | 1                                | -1            | 1                                  | 3              |
| A2 c. Create secondary dispatch site for backup                                      | 0                                 | 1                                     | 1                             | 1                                | -1            | 1                                  | 3              |
| A2 d. Get backup generators for all emergency shelters                               | 1                                 | 1                                     | 1                             | 0                                | 0             | 1                                  | 4              |
| A2 e. ID parts of town that could be cut off and establish any add'l needed shelters | 1                                 | 1                                     | 1                             | 0                                | -1            | 1                                  | 3              |
| A2 f. Evaluate burying electrical utilities  | -1                                | 1                                     | 1                             | 0                                | -1            | 1                                  | 1              |
| A3. Appoint a CRO to build broad community resilience                                | -1                                | 1                                     | 1                             | 1                                | 1             | 0                                  | 3              |

Local Hazard Mitigation Plan

| Mitigation Strategy  | Social/<br>Political<br>Readiness | Admin and<br>Technical<br>Feasibility | Range of<br>Public<br>Benefit | Range of<br>Environ'l<br>Benefit | Local<br>Cost | Outside<br>Assistance<br>Available | Total<br>Score |
|--|-----------------------------------|---------------------------------------|-------------------------------|----------------------------------|---------------|------------------------------------|----------------|
| A4. Develop/implement public education & outreach program                          | 1                                 | 1                                     | 1                             | 1                                | 0             | 0                                  | 4              |
| B1. Develop Flood Resilience element in town plan update                           | 0                                 | 0                                     | 0                             | 0                                | 1             | 0                                  | 1              |
| B2. Maintain regional partnerships to support floodplain mgt                       | 1                                 | 0                                     | 0                             | 0                                | 1             | 1                                  | 3              |
| B3a. Update flood hazard bylaws to prohibit development in floodplns               | 0                                 | 1                                     | 1                             | 1                                | 0             | 1                                  | 4              |
| B3.b Require new critical facilities be 1' above 500 yr BFE                        | 1                                 | 1                                     | 1                             | 0                                | 0             | 1                                  | 4              |
| B3c. Prohibit new critical facilities in known hazard areas                        | 1                                 | 1                                     | 1                             | 0                                | 0             | 1                                  | 4              |
| B3d. Limit new impervious surfaces in floodplain                                   | 0                                 | 1                                     | 0                             | 1                                | 1             | 1                                  | 4              |
| B3e. Require stream buffers (site plan review and subdivision)                     | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | -1             |
| B3f. Require/enforce propane tank tie-downs  | 0                                 | 1                                     | 1                             | 1                                | 0             | -1                                 | 2              |
| B4a. Promote purchase of flood insurance   | 1                                 | 1                                     | 1                             | 0                                | 0             | 0                                  | 3              |
| B4b. Distribute flood protection info to residents in flood hazard areas           | 1                                 | -1                                    | 1                             | 0                                | 1             | 0                                  | 2              |
| B4c. Education and outreach to all residents on individual flood hazard mitigation | 1                                 | 1                                     | 1                             | 0                                | 1             | 0                                  | 4              |
| B5a. Conduct annual NFIP workshop  | 1                                 | 0                                     | 1                             | 0                                | 1             | 1                                  | 4              |
| B5b. Encourage ZA to gain CFM certification  | 1                                 | 0                                     | 1                             | 0                                | 1             | 0                                  | 3              |
| B5c. Require elevation certificates for structures in flood hazard areas           | 0                                 | 0                                     | 0                             | 0                                | 1             | 0                                  | 1              |
| B6a. Institute No Adverse Impact into flood hazard bylaw                           | 1                                 | 0                                     | 1                             | 1                                | 0             | 0                                  | 3              |
| B6b. Extend BFE requirements to structures within river corridor                   | 0                                 | 0                                     | 0                             | 1                                | 0             | 0                                  | 1              |

| Mitigation Strategy  | Social/<br>Political<br>Readiness | Admin and<br>Technical<br>Feasibility | Range of<br>Public<br>Benefit | Range of<br>Environ'l<br>Benefit | Local<br>Cost | Outside<br>Assistance<br>Available | Total<br>Score |
|--|-----------------------------------|---------------------------------------|-------------------------------|----------------------------------|---------------|------------------------------------|----------------|
| B6c. Annually notify repetitive loss structure owners of HM \$'s                 | 1                                 | 0                                     | 0                             | 0                                | 1             | 0                                  | 2              |
| B6d. Aim to gain CRS status, to improve state match                              | 1                                 | 1                                     | 1                             | 0                                | 0             | 1                                  | 4              |
| B7. Apply for FEMA buyouts of flooded structures                                 | 1                                 | 1                                     | 0                             | 0                                | 0             | 1                                  | 3              |
| B8. Apply for FEMA \$'s to elevate structures subject to ice jam damage          | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| B9a. Seek funding to address top priority town culverts and bridge               | 1                                 | 1                                     | 1                             | 1                                | 0             | 1                                  | 5              |
| B9b. Culvert/driveway permits  | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| B9c. Incorporate ice jam prevention where appropriate                            | -1                                | 0                                     | 1                             | 1                                | 0             | 0                                  | 0              |
| B10. Promote flood storage capacity via site design                              | 0                                 | 0                                     | 0                             | 0                                | 0             | 1                                  | 1              |
| B11. Education & outreach on floodproofing private property                      | 0                                 | 0                                     | 0                             | 0                                | -1            | 1                                  | 0              |
| B12. Establish high water marks (get info from power companies operating dams)   | 1                                 | 1                                     | 0                             | 0                                | 1             | 1                                  | 4              |
| B13a. Prepare stormwater mgt plans for town facilities                           | -1                                | 0                                     | 0                             | 0                                | 0             | 1                                  | 0              |
| B13b. Promote LID stormwater mgt in site plan review                             | 0                                 | 0                                     | 0                             | 0                                | 0             | 1                                  | 1              |
| B13c. Adopt zero discharge policy for site plan review and subdivision proposals | -1                                | 0                                     | 0                             | 0                                | 0             | 1                                  | 0              |
| C1. Install lightning protection in critical facilities                          | 0                                 | 0                                     | -1                            | 0                                | 0             | 1                                  | 0              |
| C2. Outreach and education on lightning dangers & precautions                    | 0                                 | 0                                     | 0                             | -1                               | 0             | 0                                  | -1             |
| D1. Tree maintenance to protect public bldgs, roads, powerlines                  | 0                                 | -1                                    | 1                             | 0                                | -1            | 1                                  | 0              |

| Mitigation Strategy   | Social/<br>Political<br>Readiness | Admin and<br>Technical<br>Feasibility | Range of<br>Public<br>Benefit | Range of<br>Environ'l<br>Benefit | Local<br>Cost | Outside<br>Assistance<br>Available | Total<br>Score |
|---|-----------------------------------|---------------------------------------|-------------------------------|----------------------------------|---------------|------------------------------------|----------------|
| D2. Retrofit public buildings and infrastructure to reduce wind damage  | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| D3. Outreach to private maintenance to protect from wind damage   | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| D4. Encourage landscaping as wind buffer in site plan and subdivision review  | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| E1. Re-institute capital budgeting to maintain road infrastructure  | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| E2. Require hedgerows on critical road segments in site plan, subdivision review                                    | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| E3. Keep utility corridors maintained   | 0                                 | -1                                    | 1                             | 0                                | -1            | 1                                  | 0              |
| E4. Require burial of utilities in new developments   | 0                                 | -1                                    | 0                             | 0                                | -1            | 1                                  | -1             |
| E5a. Conduct studies of snow/ice load capacity of critical facilities   | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| E5b. Retrofit buildings as needed to prevent roof collapse  | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| E5c. Adequately insulate public buildings and facilities  | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| E5d. Add generator capacity to housing/facilities for seniors   | 0                                 | 1                                     | 1                             | 0                                | 0             | 1                                  | 3              |
| E6a. Plan and organize assistance for vulnerable residents  | 1                                 | 0                                     | 1                             | -1                               | 0             | 1                                  | 2              |
| E6b. Communicate emergency resources to vulnerable/elderly residents  | 1                                 | 0                                     | 1                             | 0                                | 0             | 1                                  | 3              |
| E7a. Public education/outreach on hazards related to severe winter storms   | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| E7b. Train back up Emergency Director   | 1                                 | 1                                     | 1                             | 0                                | 1             | 1                                  | 5              |
| E7c. Create a system to identify vulnerable people and check on them  | 1                                 | 1                                     | 1                             | 0                                | 1             | 1                                  | 5              |
| E7d. Practice building evacuation plans in militia-unit residences, especially those housing vulnerable populations | 1                                 | 0                                     | 1                             | 0                                | 1             | 0                                  | 3              |

| Mitigation Strategy   | Social/<br>Political<br>Readiness | Admin and<br>Technical<br>Feasibility | Range of<br>Public<br>Benefit | Range of<br>Environ'l<br>Benefit | Local<br>Cost | Outside<br>Assistance<br>Available | Total<br>Score |
|---|-----------------------------------|---------------------------------------|-------------------------------|----------------------------------|---------------|------------------------------------|----------------|
| F1. Gain public support and funds for new fire station                    | -1                                | 1                                     | 1                             | 1                                | -1            | 1                                  | 2              |
| F2. Consider improving back-up response capacity in major fire            | 1                                 | 1                                     | 1                             | 1                                | -1            | 0                                  | 3              |
| F3. Develop and implement a fire prevention plan for downtown             | 1                                 | 1                                     | 1                             | 1                                | 0             | 0                                  | 4              |
| F4. Public outreach on fire prevention                                    | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| F5. Maintain mutual aid agreements with neighboring fire depts            | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| G1. Conduct emergency exercise for downtown rail accident w/chemicals     | 0                                 | 1                                     | 1                             | 1                                | 1             | 1                                  | 5              |
| G2. Maintain an adequate supply of specialized foam                       | 0                                 | 1                                     | 1                             | 1                                | 0             | -1                                 | 2              |
| G3. Develop and post public information sheets                            | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| G4. Maintain coordination with EMS District and NVRH                      | 0                                 | 0                                     | 0                             | 0                                | 0             | 0                                  | 0              |
| G5. ID at-risk locations and discourage new development there             | 0                                 | 1                                     | 1                             | 1                                | 0             | 0                                  | 3              |
| G6. Discourage siting of hazardous materials near critical facilities     | 1                                 | 1                                     | 1                             | 1                                | 1             | 0                                  | 5              |
| H1. Seek funding to replace screw pumps in the wastewater treatment plant | 1                                 | 1                                     | 1                             | 1                                | -1            | 1                                  | 4              |
| H2. Seek funding to replace water line across the Moose River             | 1                                 | 1                                     | 1                             | 1                                | -1            | 1                                  | 4              |

THE RECORD • WEDNESDAY, DECEMBER 3, 2014

ST. JOHNSBURY

## TOWN PLANNING FOR DISASTER

Meeting Thursday To Focus On  
Flooding, Fire, Accidents

BY TAYLOR REED

Staff Writer

St. Johnsbury is planning for disaster.

The second of two brainstorming sessions to update the town's Hazard Mitigation Plan is scheduled Thursday during a special meeting of the St. Johnsbury Planning Commission at 6 p.m. in the Main Street municipal building. Residents are encouraged to attend and participate.

"We'd really love to have a good showing of people from the community," said Sue Cherry, chairwoman of the planning commission. "I think we're looking for citizen information. We have information from professionals but what we don't want to lose is the folks who have knowledge around their own properties. The more eyes the better."

Focal points include flooding, fire, thunderstorms, high winds, harsh winters, and power outages. Transportation accidents and chemicals spills are also at issue.

Participants on Thursday will devise action plans and score them. The focal points were developed at the first brainstorming session in October.

The meeting Thursday includes refreshments.

Dave Ormiston, the assistant town manager, stresses the importance of a hazard mitigation plan. It boils down to money.

"Hazard mitigation planning is a measure that municipalities can take to reduce local costs for infrastructure repair after a disaster," Ormiston said. "By completing a FEMA Hazard Mitigation Plan, St. Johnsbury will meet requirements to be granted a lower local contribution rate when using federal disaster assistance funds. Hazard mitigation planning allows communities to identify projects that reduce the impacts and costs of disasters to property by moving it out of harm's way, fortifying structures or educating property owners."

The mitigation plan renders St. Johnsbury eligible for FEMA programs that provide grants for impact reduction projects, Ormiston said. Examples include elevating structures above floodplains, bolstering bridges and culverts to accommodate heavier stream flows, and fortifying public buildings against snow and wind.

Northeastern Vermont Development Association is assisting St.

## REFERENCES

### [REFERENCES TO COME]

**Passumpsic River Basin Stream Geomorphic Assessment Reports:** <https://anrweb.vt.gov/DEC/SGA/finalReports.aspx>

Caledonian Record Articles:

- <http://caledonianrecord.com/main.asp?SectionID=180&SubSectionID=778&ArticleID=67555>



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