Town of Roxbury, VT
2018 Local Hazard Mitigation Plan

Prepared by Town of Roxbury and CVRPC

Contents

1. Introduction

The impact of expected, but unpredictable natural and human-caused events can be reduced through community planning. The goal of this Local Mitigation Plan is to make the Town of Roxbury more disaster resistant.

Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Based on the results of previous Project Impact efforts, FEMA and State agencies have come to recognize that it is less expensive to prevent disasters than to repeatedly repair damage after a disaster has struck. This Plan recognizes that communities have opportunities to identify mitigation strategies and measures during all of the other phases of emergency management – preparedness, response, and recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where the hazards are most severe, and identify local actions that can be taken to reduce the severity of the hazard.

Hazard mitigation strategies and measures alter the hazard by eliminating or reducing the frequency of occurrence, avert the hazard by redirecting the impact by means of a structure or land treatment, adapt to the hazard by modifying structures or standards, or avoid the hazard by preventing or limiting development.

2. Purpose

The purpose of this Local Mitigation Plan is to assist the Town of Roxbury in recognizing hazards facing their community and identify strategies to begin reducing risks from acknowledged hazards.

Roxbury understands that in order to apply for FEMA Hazard Mitigation Grant Program funding for mitigation projects, the Town must have a FEMA approved Local Hazard Mitigation Plan and the project must meet FEMA benefit-cost analysis criteria.

3. Community Profile

The Town of Roxbury is 40.6 square miles and is the southern-most town in Washington County. It is bordered by Northfield to the north, Brookfield (Orange County) to the east, Braintree (Orange County) to the south and Warren to the west. As stated in the *Roxbury Town Plan, 2001* Roxbury is "among the most rugged areas in the region." Elevations range from 880 feet along the river valleys to 3,060 feet at the peak of Rice Mountain. The northern portion of town drains into the Winooski Watershed via the Dog River and the southern portion drains into the Connecticut Valley Watershed via the Third Branch of the White River. The highest point of the Central Vermont Railroad is in Roxbury Village at an elevation of 1,007 feet above sea level. According to the U.S. Census Bureau, the geographical center of the State of Vermont is 3 miles east of Roxbury Village.

Roxbury is a bedroom community, as a majority of its residents commute to Northfield, Randolph, Barre, Montpelier, the Mad River Valley and beyond for work. According to the *Roxbury Town Plan, 2014*, and based upon 2010 US Census estimates, Roxbury has a total

population of 691 people living in approximately 400 housing units (35% of recorded housing units are classified vacant and/or seasonal dwellings).

The historic village settlement of Roxbury is located at the intersection of Route 12A and the Warren Mountain Road, and serves as the center of commercial, community life and essential services. This is the most densely developed part of town, and the majority of other development is scattered throughout the rural hills. Steep terrain limits larger scale non-residential development as compared to many other towns in the region. The 2014 Town Plan states that "with over 20 peaks exceeding 2,000 feet in elevation, the physical characteristics of the town will continue to have a profound effect on its future development."

Development is limited in about ¼ of Roxbury additionally because it is State Forest land. There are also a number of large timber holdings in the Town. Development located on the valley floors is limited by Flood Zones and impacted by high water table levels in some areas. The town predicts that future development will continue to be low-density scattered residential development.

Vermont Route 12A is the principle vehicular transportation corridor through Roxbury, with Vermont Route 12 providing access to East Roxbury in the northeastern corner. Town Highways constitute the majority of Roxbury's roads. The Warren Mountain Road is a heavily traveled road providing access to the Mad River Valley towns of Warren, Waitsfield and Fayston and the Sugarbush and Mad River Glen Ski areas. The railroad is another major transportation corridor through Roxbury. The railroad runs parallel to Route 12A. The New England Central Railroad transports freight and Amtrak provides passenger transport. Neither service stops in Roxbury, but these providers stop in Randolph to the south or Montpelier in the north.

In recent years, and since the LHMP was last updated in 2011, most new development has occurred as low-density, scattered residential development in the hills or low mountain elevations. Sixteen (16) new structures have been built in that 5 year time period. All were residential structures, either stick-built dwellings, log homes, mobile homes, or seasonal camps. The town predicts that future development will continue in this fashion. In the same time period, only 3 development permits were issued under the State Land Use Permitting regulations (Act 250). All of these were for electrical distribution lines to be constructed by the utilities serving Roxbury. At the time of writing this plan, there were no plans for new residential or commercial developments pending in permitting, or shared with local officials. The State of Vermont will be investing in repaving a few miles of Route 12A in Roxbury. The slow pace of development means that Roxbury's vulnerability to natural hazards has not changed a great deal since 2011, and will continue to be similar unless new major investments or investments in especially vulnerable areas are proposed.

4. Community Capacities

Services provided by the Roxbury municipality are overseen by a three (3) member volunteer Selectboard. The volunteer Planning Commission is charged with overseeing longer term

community planning, and developing the Municipal (Town) Plan, as well as the community's flood hazard area regulations.

The Town employs six staff members to carry out services to its residents on a daily basis. The following are the paid positions supported by the Town of Roxbury:

- Town Clerk
- Assistant Town Clerk
- 2 Full Time Road Crew
- 2 Per Diem Road Crew

Volunteer municipal officials fill all other roles necessary to operate municipal services and conduct hazard mitigation. Many individual volunteers fill multiple roles. Steve Twombly is the volunteer Emergency Management Director and Selectboard Vice-Chair. David McShane also serves on the Selectboard and is the Road Commissioner and representative to the Solid Waste Management District. Tim Martin is the Fire Dept. Chief and Forest Fire Warden. Alan Waterman is the Planning Commission Chair, E911 Coordinator, and Webmaster. Ryan Zajac is a School Director and also the Library Director. The Town's representative to the Regional Planning Commission is Gerald D'Amico, and the Town Health Officer Craig Sullivan.

The municipal budgeting process occurs on an annual basis, planning for a fiscal year from July through June. The budget is usually developed between early November and early January, and put to voter approval on the first Tuesday in March at Annual Town Meeting Day. The Selectboard is charged with developing and proposing the budget to the voters, including the Capital Budget. Individual municipal departments and committees (Highway Dept., Fire Dept., Clerks Office, School Directors) develop budget proposals that are submitted to the Selectboard, and the Selectboard meets at least once with each department and/or committee to discuss and finalize the proposals. After the budget has been adopted by vote of town residents, the Selectboard has the authority to modify it in cases of extraordinary circumstances; i.e. natural disaster, unexpected equipment/infrastructure failure (i.e., water well, power failure, major bridge/culvert failure). The budget is monitored several times a month by the Selectboard, Selectboard Assistant and elected citizen auditors.

Municipal revenues are generated primarily through levy of taxes on property value. Other major sources are federal & state payments to support the town school, aid from the Vermont Agency of Transportation for highways, and payments in lieu of taxes for land owned by the State of Vermont. The municipality also has the authority to incur debt through bonding. In the late 1980s the proportion of Roxbury revenues generated through local property taxes was about 42%. However, property taxes are moving again toward supporting 60-70% of town budgets as state aid for education have leveled off or declined, and expenses continue to rise.

Roxbury's transportation network is managed according to the 2013 Vermont Road and Bridge Standards. There are 44 miles of town highway in Roxbury, 3 miles of which are Class 2, 31.7 Class 3 and 10 miles Class 4. Class 2&3 highways receive financial aid and maintenance support from the State, whereas Class 4 roads are entirely the responsibility of the municipality. There are 7.7 miles of State Highway in Roxbury. Approximately 450 locally maintained culverts are in

the roadway network (2015 CVRPC Bridge & Culvert Inventory). According to the 2013 Town Report, the highway budget comprised 62% of the total FY13 municipal expenditures (school expenditures excluded). Adoption and implementation of the 2013 Road and Bridge Standards helps to reduce the overall vulnerability of Roxbury's highway assets to hazard damage.

The Washington Electric Co-op provides electrical service to residential and commercial development along Route 12 in the northeast corner of Roxbury, and parts of Bull Run in the central portion of the Town. The remainder of the town is serviced by the Green Mountain Power Corporation. A number of year round and seasonal dwellings are located "off-grid" and either generate their own power or have independent systems. Telephone and DSL internet service is provided by TDS Telecom in most areas. The southern portion of East Roxbury is served by a different provider.

The Roxbury Village School's water and sewage system serves the Union Congregational Church, the Town Library and a few nearby residences. The Windridge Tennis & Sports Camp uses small scale community wells for its water supply. All other homes and businesses rely on individual wells and springs for their water supply and private waste water treatment systems. As of July 1, 2007 the State of Vermont took over regulating all waste water permitting. The Town of Roxbury formerly administered a Sewage Ordinance to prevent water contamination by insuring adequate sewage disposal systems. Between 1991 and 2007, approximately 102 permits were issued for new or renovated construction.

Roxbury does not have a local police department and relies on the services of the Vermont State Police. The Town Constable assists the State Police and responds to nuisance situations but has no law enforcement authority.

Fire protection is provided by the Roxbury Volunteer Fire Department, consisting of about 6 active members with a Mutual Aid agreement with Departments in the surrounding region. The Roxbury Volunteer Fire Department also responds to emergency medical situations in conjunction with the Northfield Ambulance Service if needed. In a typical year, the fire department responds to approximately 20 calls per year, half are Roxbury emergencies, 2 mutual aid calls. Generally, more than half of the calls are fire-related, with the rest related to traffic accidents. The Roxbury Fire Department facility was constructed in 1960/2000 with 3 bays. The department is I.S.O certified (at present time has a 9/10 rating.) Currently there are five dry hydrant installations in Roxbury.

The Town of Roxbury has an approved Local Emergency Operations Plan that was adopted in 2016 and subsequently updated and adopted in 2017. The LEOP is adopted annually by May 1. The Municipal Offices are designated as the Emergency Operations Center. The Roxbury Village School is a Red Cross designated emergency shelter. It provides overnight and warming services, has 25 cots with space for more, and is equipped with a back-up generator. Roxbury is served by and is a member of Local Emergency Planning Committee #5, which supports Tier II Hazardous Materials planning.

The Town Plan, adopted in 2014, includes discussion, goals, and objectives in regards to flooding, groundwater protection, and emergency services in the *Physical Features, Natural & Cultural Resources* element and the *Community Utilities, Facilities & Services* element.

While Roxbury has not adopted land use development bylaws, the Town has adopted Inundation Hazard Area Regulations. The Town has participated in the National Flood Insurance Program since January 1986, which provides the community flood damage relief for enacting ordinances regulating floodplain land use. Roxbury's regulations prohibit new structures in the Special Flood Hazard Area. The regulations were last revised in 2010, and therefore the vulnerability of assets under the jurisdiction of these regulations has not been affected since the community last conducted hazard mitigation planning in 2011.

Roxbury is eligible under the Vermont Emergency Relief and Assistance Fund (ERAF) to receive state funding to match Federal Public Assistance funds after a federally declared disaster. Communities that take specific steps to reduce flood damage can increase the percentage of state funding they receive from 7.5% up to a maximum of 17.5%. At the time of this plan development, Roxbury has an ERAF rating of 17.5%. Roxbury has taken the specific steps to reduce flood damage by 1) participating in the National Flood Insurance Program, 2) adopting standards that meet or exceed the current Vermont Roads and Bridge Standards 2013, 3) adopting a Local Emergency Operations Plan which is renewed and adopted annually, 4) adopting a Local Hazard Mitigation Plan approved by FEMA, and 5) adopting Interim River Corridor protection standards. Maintaining these measures ensures Roxbury at least a 12.5% state contribution rating.

Roxbury has taken an additional 5th step to receive the current 17.5% rating. It is one of numerous communities that has adopted regulations for a subset of their watercourses prior to the ERAF Amendments that took effect on October 2014. Roxbury receives the 17.5% rating because it has adopted avoidance-based Flood Hazard Areas and therefore has approved Interim River Corridor standards. In order to retain eligibility under the River Corridor Plan criteria of the ERAF and qualify for the maximum 17.5% rate, Roxbury will need to update its Interim River Corridor standards to meet the Agency of Natural Resources (ANR) criteria. The deadline for completion is two years after ANR publishes a statewide river corridor map updated to include existing Phase 2 Stream Geomorphic Assessment (SGA) data. The data release, expected to occur at the end of 2016, has been delayed and the agency has not announced a new release date. The other option to qualify for the maximum ERAF rate is for Roxbury to enroll in the NFIP Community Rating System (CRS) and adopt a bylaw that prohibits new structures in the Flood Hazard Area.

Information on ERAF Eligibility Criteria – 17.5% State Share can be found at:
http://floodready.vermont.gov/sites/floodready/files/documents/ERAF17.5Criteria05282015.pdf

A copy of the criteria is an attachment to this plan.

National Flood Insurance Program Participation

The Town has been enrolled in the NFIP since January 1986 and is currently in compliance. The adopted 2010 flood hazard regulations regulate development in the NFIP floodplain according to Digital Flood Insurance Rate Maps that became official in 2013. The DFIRMs define the 100-year floodplain along the Dog River and the Third Branch of the White River. The Roxbury Inundation Hazard Area Regulations prohibits new structures, except small accessory structures, replacement water supply or wastewater treatment systems, bridges and culverts, and forestry and agriculture structures.

To maintain compliance with the NFIP, Roxbury will continue to follow NFIP requirements for close coordination with the Floodplain Management Section of the Vermont Department of Environmental Conservation. All applications will be submitted to the Floodplain Manager assigned to Roxbury. Elevation Certificates will be required of structures to be substantially improved in the Zones specified by the Inundation Hazard Regulations. Projects alleged or found to be in violation of the FHO regulations will be reported to the State NFIP Coordinator. This established channel of communication allows Roxbury to stay aware of changes in state or federal standards to which it must respond, and maintain communication with the Vermont Floodplain Management Section to monitor local program status.

Roxbury will also coordinate directly with the Vermont Department of Environmental Conservation, and the Central Vermont Regional Planning Commission, to stay apprised of pending floodplain mapping and any updates or revisions that may be subsequently necessary to Roxbury's flood hazard maps and standards.

Roxbury may qualify to enroll in the NFIP Community Rating System (CRS). The CRS Quick Check indicates that Roxbury can achieve the 500 point threshold to apply for Class 9 status. The community's prohibition of new structures contributes greatly to achieving potential CRS credit. The primary benefit of CRS enrollment is reduction of the premiums paid by flood insurance policy holders in the municipality. The administrative resources necessary for enrollment and ongoing program maintenance can be a significant challenge for municipalities with limited existing administrative capacity. This is an important consideration for communities prior to enrollment.

Specific Mitigation Programs, Projects and Activities

In addition to the general community capacities described above, specific mitigation programs, projects and activities that are ongoing or available in Roxbury are detailed in this section. The programs, projects and activities are listed by general types of mitigation strategies. Roxbury has the capacity to maintain these programs and initiatives using town staff and community volunteers described in the Community Capacities above. Unless otherwise noted, there is no need to expand or improve on these programs, projects and activities.

Community Preparedness Activities

- Capital Equipment Plan

Using its existing capacity, the Town will improve on its Community Preparedness activities over the next five years by developing a Capital Budget for highway infrastructure improvements, participating in trainings like the Rail Car Incident Response Course, and working with the utility companies to establish protocols for reporting outages and hazardous situations. These improvements are further detailed in section 6.3 of this Plan.

Land Use Planning/Management

- Dog River Geomorphic Assessment – River Corridor Plan – April 2009

Over the next five years, using its existing capacity, with support and technical assistance from CVRPC and the VT Floodplain Manager, the Town will improve on its Land Use Planning and Management in the administration of its Flood Hazard Regulations. Also, the Town will look at the Roxbury Flats area to strategize solutions with property owners on potential mitigation actions to reduce the risk from flooding of Flint Brook. In cooperation with the Agency of Natural Resources Rivers Management and Wetlands Programs, the Town will explore stream management practices to address the flooding that occurs in the South end of the Village related to the accumulation of woody debris and sediment in the streams. The Town does not have the ability to increase its own capacity or expertise to perform these land use and management improvements on their own and therefore will rely on outside expertise and technical support to help move them forward over the next five years. These improvements are further detailed in section 6.3 of this Plan.

Hazard Control & Protective Works of Infrastructure and Critical Facilities

- Highway Maintenance Programs
    - CVRPC Bridge & Culvert Inventory - 2015
    - Structural Assessment & Inventory of Bridges & Culverts - 2016

Using its existing capacity, the Town will improve on the Hazard Control & Protective Works of Infrastructure and Critical Facilities program over the next five years by working with partners such as Agency of Transportation, Agency of Natural Resources, CVRPC, and the electrical utilities to implement strategies identified in section 6.3 of this Plan. For example, the Town plans to address infrastructure at risk to erosion from water by conducting an assessment and a road erosion inventory. It also plans to upgrade and improve the culvert on Cram Hill Road.

- Dry Hydrants
    - Tracy Hill Road
    - Bull Run
    - Northfield Road

- Premo Road
- Ordway Rd.
- Rt.12A at Northfield Town Line

Public Awareness, Training & Education

- CPR Training maintained every 2 years
- School Fire Safety Program
- Red Cross trained volunteers

2011 Hazard Mitigation Project Status

The following chart provides an overview of Roxbury's proposed 2011 hazard mitigation actions along with their current status, reflecting the progress in local mitigation efforts. The town's project priorities have changed since 2011, due to dwindling availability of volunteer officials to coordinate the projects at the local level. The community has also been challenged to recruit new volunteers through the present. Without extra volunteer capacity, the town focused its mitigation project priorities on highway drainage and erosion mitigation projects coordinated by the Selectboard, Road Commissioner and Road Crew.

2011 Hazard Mitigation Project Status Table		
2011 Mitigation Project	**2016 Project Status**	**Explanation**
Develop an evacuation plan for the town in event of disaster.	Not Completed	Loss of Volunteer Capacity
Plan for protective action in town	Not Completed	Loss of Volunteer Capacity
Conduct a detailed study of the impact of railroad transport accidents.	Not Completed	Loss of Volunteer Capacity
Provide educational, explanatory materials regarding hazardous materials, risks to residents and property owners in town	Not Completed	Loss of Volunteer Capacity
		Continued on next page

2011 Mitigation Project	2016 Project Status	Explanation
Install drop down bars at most dangerous intersections	Partially Complete	Installed at Thurston Hill Rd. (Ellis Rd. Carrie Howe Rd. & Oxbow Rd. crossings still do not have drop down bars) The Vermont Agency of Transportation completes these installations and has final jurisdiction over which crossings receive upgrades.
Replacement and upgrade of culverts and bridges on – Route 12A, Bull Run Rd, Braintree Hill Rd, Carrie-Howe Rd, Warren Mtn Rd, and Oxbow Rd	3 Complete, Others No Longer a Priority	1 new bridge on Bull Run Rd., 2 new bridges on Braintree Rd., 1 new bridge on Carrie Howe Rd. Oxbow Rd. bridge upgrade proposed untenable liability risk to the town. The project is no longer a priority to the town.
Develop prioritized list of culvert/bridge replacement and upgrade projects	Ongoing	Will be updated and included in 2017 LHMP
Prepare and distribute or make available NFIP insurance and building codes, explanatory pamphlets or booklets	Complete	These are available at the municipal offices
Identify and become knowledgeable of existing NFIP non-compliant structures	Ongoing	Is still a priority for the community and will be included in 2017 LHMP
Work with ANR to analyze how to prevent non compliant structures in the future and bring existing non compliant structures into compliance	Ongoing	Is still a priority for the community and will be included in 2017 LHMP
Develop a post flood clean-up, decontamination and recovery plan / procedure	Not Completed	Loss of Volunteer Capacity
Flood proof Town Garage	Not Completed	Project became a lower priority than highway drainage and erosion mitigation after the 2013 thunderstorm
Projects identified in Dog River Corridor Plan – see Dog River Projects Table	Not Completed	Riparian vegetation along the rerouted section of the Dog River channel has grown in naturally since 2009 (no tree growth). Proposals to improve riparian buffer vegetation and remove berms close to the railroad and town garage are now low priority for the town. Most of the bridge projects proposed due to geomorphic compatibility issues are on State and

		railroad owned bridges out of the town's jurisdiction.
Purchase and have available an adequate number of standby generators for use on individual wells in town	Not Completed	No longer a priority – storage space is not available and shelters are available if drinking water fails
Develop loan / grant program for Town property owners to upgrade existing septic systems	Not Completed	The Vermont Dept. of Environmental Conservation started an On-Site Wastewater Loan Program in 2012 to which Roxbury property owners now have access.

Ability to Expand Existing Municipal Policies & Programs

The majority of Roxbury's capacity to expand its existing hazard mitigation program is through taking advantage of assistance provided by state agencies and the Central Vermont Regional Planning Commission. State agencies such as the Division of Emergency Management and Homeland Security, Agency of Transportation, Agency of Natural Resources, and Agency of Commerce and Community Development provide guidance and technical assistance as well as funding resources which the Town may access to expand its mitigation programs. The Agency of Natural Resources is also an important partner as it manages the Roxbury State Forest, which covers a large portion of land acreage in Roxbury.

Community institutions and organizations such as the Vermont League of Cities and Towns and the Friends of the Winooski River can provide expertise, and in some cases direct man-power and/or financial resources, to assist the Town with carrying out hazard mitigation programming or projects.

The capital planning and budgeting process is also an important tool through which the municipality may work to incrementally grow revenues designated for specific hazard mitigation expenditures.

4. Planning Process

The Roxbury Local Hazard Mitigation Plan was originally developed as an Annex to the Central Vermont Regional Local Hazard Mitigation Plan. In 2011 the town moved to a standalone Plan. The current plan updates the 2011 plan and reflects changes in development, progress in local mitigation efforts and changes in the community's priorities.

The Central Vermont Regional Planning Commission (CVRPC) coordinated the Roxbury Local Hazard Mitigation Plan process in partnership with the Town of Roxbury. CVRPC Planner Gail Aloisio worked directly with the town. The Town Clerk, Tammy Legacy, and Selectboard Chair,

Steve Twombly, served as the primary points of contact for the planning process. The planning process was conducted over the course of May 2016 – April 2017. Primary guidance and oversight of the process was provided by a local hazard mitigation team comprised of the following local officials:

- Steve Twombly – Emergency Management Director & Selectboard Chair
- Dave McShane – Selectboard Member & Road Commissioner
- Jeremy Reed – Selectboard Member
- Tim Martin – Fire Dept. Chief & Forest Fire Warden
- Don Randall – Fire Dept. Captain & Secretary
- Alan Waterman – Planning Commission Chair, E911 Coordinator & Webmaster
- Ryan Zajac – School Board Vice Chair & Library Director
- Sally Archer – Administrative Assistant & Lister
- Loren Bent – Highway Foreman

The local mitigation team met over the course of May 2016 through February 2017 to review information about hazards and mitigation options in Roxbury, and provide local knowledge and professional opinions. A Kick Off Meeting was held on May 25, 2016, providing an overview of the planning process and schedule, and to brainstorm outreach activities (6 in attendance). On June 23, 2016, the team convened again to discuss the hazards that impact Roxbury (6 in attendance). The team determined the town's greatest overall vulnerabilities at the August 17, 2016 meeting, and assigned these hazards to be the focus of the plan. CVRPC then worked to develop a draft plan which was mailed for review and discussed on February 15th, 2017 (3 in attendance). The team also began brainstorming potential mitigation projects at this meeting. Mitigation project ideas were selected on March 1st & 6th, 2017 (7 members), to be presented for feedback from Roxbury residents at the March 7th Town Meeting (described below). The Town Meeting feedback results were reviewed before finalizing the mitigation actions. All team meetings took place at the Roxbury Municipal Offices.

Mitigation team meetings were not considered the most effective way to inform a general audience and incorporate their feedback into the plan. Therefore the public was not invited to attend. Events and activities that brought information and the collection of feedback out to the community in a convenient time and format were considered most effective. These activities are described below.

Preparation for the meetings included a review of the following existing plans, studies, reports and technical information by CVRPC staff:

- 2013 Vermont State Hazard Mitigation Plan
- 2014 Roxbury Town Plan
- 2016 Local Emergency Operations Plan
- 2013 Town Report
- 2013 Flood Insurance Study
- 2009 Dog River Corridor Plan
- 2012 UVM Extension Emerald Ash Borer Vermont Risk Ranking by Town

- 2011 & Draft 2016 Town of Northfield Local Hazard Mitigation Plans
- 2012 Draft Flint Brook Scoping Report.
- Roxbury Village School Source Protection Plan & 2016 Plan Update

The public, as well as neighboring communities, and regional and state entities were involved in the planning process in multiple ways. On July 4, 2016, CVRPC Planner Gail Aloisio staffed an information and input table at the Roxbury Fourth of July Celebration. Participants had the opportunity to ask questions about the planning process, and provide their feedback on hazards of most concern, and the most effective investments to address them.

Research and feedback on hazards, community capacities, community assets and potential mitigation projects was also conducted in coordination with other important stakeholders. Phone calls, emails and meetings were exchanged and held to involve the expertise of various state agencies, regional stakeholders and university extension offices.

The local mitigation team was presented with the results of the July community outreach tabling event and given the feedback from stakeholders, before choosing the most important hazards for the plan to focus on.

Residents had the opportunity to participate in another information and feedback table at the March 7th, 2017 Town Meeting Day. The voting residents of Roxbury gather annually on this day to decide a variety of town matters. Approximately 60 residents were in attendance and had the opportunity to vote informally for the most important mitigation projects. CVRPC staff was available at the table to answer questions and take comments, and the Draft LHMP (without an implementation plan) was on display. Results of the informal voting is included in the Pubic Engagement Documentation attachments.

A broader regional audience was solicited for feedback via the July CVRPC Newsletter. This newsletter described the plan and asked the readers for feedback via an online survey. The survey unfortunately did not receive any responses. Lastly, the draft plan was distributed directly in hard copy to Emergency Management Directors in neighboring municipalities, to solicit their comments. These towns are Warren (Jeff Campbell), Northfield (Lawton Rutter), Braintree (Selectboard), Granville (Mark Belisle) and Brookfield (Kevin Wheatley & John Benson). The EMDs were directed to submit their comments to Gail Aloisio at the Central Vermont Regional Planning Commission at aloisio@cvregion.com or 802-299-0389. They were also encouraged to share the plan with other local officials in their town. Comments stating general positive feedback were received from the Town of Braintree.

Documentation of opportunities for input on the plan are provided in the attachments to this plan.

Expertise of various state agencies, regional stakeholders and university extension offices included the following:

- VT Agency of Transportation, Rail Program, Dan Delabruere, Director

- Vermont Agency of Transportation, Highway District Engineers: Kevin Marchia and Ken Willoughby
- VT Agency of Transportation, District #4 Tech, Chris Bump, Project Manager
- VT Agency of Natural Resources (ANR), Department of Environmental Conservation (DEC), Regional River Scientist, Gretchen Alexander, Central Region
- VT Department of Forest, Parks and Recreation and UVM Extension Service, VT Urban & Community Forestry Program – Danielle Fitzko, Program Manager
- Roxbury Fish Hatchery, Roxbury Fish Culture Station, Adam Miller, Fish Culture Operations Manager and Jeremy Whalen, Hatchery Supervisor
- VT Emergency Management (VEM), Ben Rose, VEM Recovery and Mitigation Section Chief
- VT ANR, DEC, Drinking Water and Groundwater Protection Division, Tim Raymond, Engineering and Operations Section Chief; Waste Water and Water Supply program, Ernie Christianson, Regional Engineer Manager; Patty D'Avignon, Environmental Technician, Montpelier Regional Office; and Scott Stewart, Water Resources Division Hydrogeologist
- ANR DEC, WS WW Revolving Loan Funds, Jim Siriano
- VT ANR, DEC, Wetlands Program, Shannon Morrison, Washington County
- Bill Kirby, Facility Director Washington South Supervisory Union, Village School
- ANR Natural Resources Atlas
- Washington Electric Cooperative, Inc.
- Green Mountain Power, John Greenan, Engineer
- Department of Public Safety, Fire Safety Program, Todd Cosgrove, Hazardous Materials Team Chief
- Chris Davis, Citizens for Responsible Railroads
- VT ANR, DEC, Watershed Management Division, Clean Water Initiative Program, Jim Pease, Environmental Scientist
- DEC, Municipal Roads Program, Jim Ryan, Coordinator
- Ned Swanberg, ANR, Central Vermont Regional Floodplain Manager

5. Risk Assessment

5.1 Hazard Identification and Analysis

The local mitigation team performed an evaluation of the known hazards to the area and the risks the hazards pose. The natural disasters included in the table below were ranked to determine the worst threat hazards to Roxbury. Worst Threat Hazards, those hazards which posed the greatest risk to Roxbury and found to be the most significant, were identified based upon the likelihood of the event and the community's vulnerability to the event. The local

mitigation team asked three main questions in their evaluation, 1) what damage can happen given the Town's vulnerabilities, 2) how likely are they to occur, and 3) how damaging can they be. They looked at past occurrences at the town, county and state level for guidance. The methodology used is described in further detail below the table. Further discussion, associated mitigation actions, and follow-up is provided in this Plan.

Hazards not identified as a "worst threat" may still occur, but due to a low likelihood of the event and/or the community's vulnerability being limited to a routine emergency, this plan will not address the "non-worst threat" hazards (indicated by a blank box). Those hazards not found to pose the greatest threat to Roxbury such as drought, avalanches, earthquakes, tornadoes, ice jams, extreme heat, land/rockslide/debris flow, high wind, hail, highway rock cuts, terrorism (campus, school or cyber incident, etc.), wildfire/forest fire, structural fire, infectious diseases outbreak, dam failure, hazard material spills, and nuclear power plant failure are not addressed in this Plan due to low probability of impact or negligible potential impact and scarce community resources (time and money). Although high wind and hail had a medium likelihood of occurring, (will happen at least once in the next 10 years), the Planning Team considered the Towns vulnerability (minimal) to be a greater factor when determining whether or not to include these hazards in this Plan. Because high wind and hail occur in contained locations around Roxbury with limited and scattered property damage that does not interrupt essential services and has not caused injuries or fatalities they are removed from further analysis as a hazard in this Plan. Similarly, when the Planning Team considered wildfire and land/rockslides/debris flow, the low probability of occurrence in Roxbury took precedence over the moderate vulnerability/potential impact to the community and because of the low likelihood of occurrence they are removed from further analysis as a hazard in this Plan. Just because the town has not identified a hazard as a top priority or significant threat, does not mean the hazard will not occur in the future, they are just not the focus of this Plan. In Vermont, wildfires are not a common occurrence. The Vermont State Hazard Mitigation Plan states there has not been a major wildfire in Vermont in the last 50 years. The low occurrence of wildfires in Vermont is attributable to the local forest fire warden program, early detection measures, trained and equipped fire departments, and public education and outreach. The fires that do ignite tend to be small. Roxbury has not had a major wildfire. According to the VT State Hazard Mitigation Plan, landslides rarely occur and are caused by human or natural changes to groundwater flow that causes pore pressure changes in bank materials or removal of vegetation and undercutting of steep banks. A review of the Vermont State Hazard Mitigation Plan of November 2013 provides a greater explanation of these hazards and possible mitigation strategies to address them. Like the State of Vermont Hazard Mitigation Plan, Roxbury did not include the following hazards in the risk and vulnerability assessment due to the low occurrence, low vulnerability, and or geographic proximity: civil disturbance, coastal erosion, expansive soils, karst topography, sinkholes, tsunami, and volcano.

The following table reflects the hazards Roxbury feels can be expected, or at least are possible, to occur in Roxbury.

HAZARD ASSESSMENT

Hazard	Likelihood[1]	Community Vulnerability[2]	Worst Threat
Hurricane/Tropical/Severe Thunderstorm w/Power Outage	High	Severe	X
Flash Flood/Flood/Fluvial Erosion	Med	Severe	X
Extreme Cold/Winter Storm/Ice Storm w/Power Outage	Med/High	Moderate	X
Railroad Accident	Med	Moderate	X
Invasive Species (Emerald Ash Borer, etc.)	Med	Moderate	X
Water Supply Contamination	Med	Minimal	X
High Wind	Med	Minimal	
Hail	Med	Minimal	
Highway Rock Cuts	Med	Minimal	
Terrorism (campus, school or cyber incident, etc.)	Low	Severe	
Wildfire/Forest Fire	Low	Moderate	
Structural Fire	Low	Moderate	
Land/Rockslide/Debris Flow	Low	Moderate	
Infectious Diseases Outbreak	Low	Moderate	
Civil Disturbance	Low	Minimal	
Drought	Low	Minimal	
Ice Jam	Low	Minimal	
Avalanche	Low	Minimal	
Dam Failure	Low	Minimal	
Earthquake	Low	Minimal	
Tornado	Low	Minimal	
Expansive Soils	Low	Minimal	
Extreme Heat	Low	Minimal	
Nuclear Power Plant Failure	Low	Minimal	
Coastal erosion	Low	Minimal	
Karst topography	Low	Minimal	
Sinkholes	Low	Minimal	
Tsunami	Low	Minimal	
Volcano	Low	Minimal	

Just because the town has not identified a hazard as a top priority or significant threat, does not mean the hazard will not occur in the future, they are just not the focus of this Plan.

[1]Likelihood: **High** – Nearly 100% probability of happening in the next year
Medium – will happen at least once in the next 10 years
Low – will happen at least once in the next 100 years

[2]Community Vulnerability: **Severe** – the hazard presents the threat of disaster
Moderate - a hard hit, but doesn't constitute a disaster nor a routine emergency
Minimal - routine emergency

The community vulnerability or potential impact can be further defined as the severity and extent of damage and disruption. The three categories are further defined as:

> Severe: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.
>
> Moderate: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities) essential services are briefly interrupted; some injuries and/or fatalities.
>
> Minimal: Limited and scattered property damage; no damage to public infrastructure contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.

After being rated for each Likelihood and Community Vulnerability, hazards were ranked according to the most threatening combination of likelihood and community vulnerability. If hazards tied, the Local Mitigation Team determined which is more threatening by considering the magnitude of the hazard, prior impacts the hazard type has caused, the value of the community assets vulnerable to the hazard, the level of community preparedness or existing mitigation, and resources available to mitigate the hazard.

Hazards are clarified and reprioritized based on current town conditions and vulnerability. Similar to the 2011 LHMP, Roxbury still considers Flooding, Water Supply Contamination, and Railroad Transport Accidents to be among the worst threats to the community and its assets. Whereas in 2011 the community noted Extreme Cold/Winter Storms/Ice Storms to be among more routine winter weather emergencies, during the plan update process the community noted that loss of electrical services sets winter hazards apart. This specific hazard-impact combination has been added to the 2016 Worst Threat Hazards. For similar reasons, Hurricanes/Tropical Storms/Severe Thunderstorms with Power Failure have also been added as Worst Threats. In addition, although the Town cannot predict the future, recent changes in the climate have made old weather patterns less predictable and Roxbury, like the rest of Vermont, has seen an increase in the number and severity of storms, especially high intensity rainfall events, making this a higher threat hazard. The threat of Invasive Species affecting Roxbury's forests is a newly emerging natural hazard, which the community has added among worst threats.

The 2011 Roxbury Hazard Mitigation Plan was revised to reflect changes in priorities. This Plan (2016/2017) reflects changes from the 2011 plan related to the town's vulnerabilities to hazards and how Roxbury addresses them based on changes in priorities and the effects of the implementation of past mitigation actions and strategies. The implementation of several mitigation actions over the past five years, some not listed because the town considers them to be regular maintenance and program implementation measures, have reduced the town's vulnerability to specific hazards. Roxbury has benefitted from the collaborative approach to achieving mitigation on the local level, by partnering with Agency of Natural Resources (ANR), Vermont Agency of Transportation VTrans, Agency of Commerce and Community Development (ACCD), Division of Emergency Management and Homeland Security (DEMHS) to be renamed Vermont Emergency Management (VEM) effective July 1, 2017, Central Vermont Regional Planning Commission (CVRPC), Federal Emergency Management Agency (FEMA) Region 1 and other agencies, all working together to provide assistance and resources to pursuing mitigation projects and planning initiatives in Roxbury.

A discussion of each significant hazard is included in the proceeding subsections and a map identifying the location of each hazard is attached (See map titled *Hazard Analysis Map.*) Each subsection includes a list of past occurrences based upon County-wide FEMA Disaster Declarations (DR-#) plus information from national databases, local records, a narrative description of the hazard and a hazard matrix containing the following overview information as shown in the chart below. The information identified in the "Magnitude (Extent)" and "Likelihood" columns are based on the hazard ranking methodology as discussed in section 5.1 of this Plan.

Hazard	Location	Vulnerability	Magnitude (Extent)	Impact	Likelihood
Type of hazard	General areas within municipality which are vulnerable to the identified hazard.	Types of structures impacted	Minimal: Limited and scattered property damage; no damage to public infrastructure contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities. Moderate: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities) essential services are briefly interrupted; some injuries and/or fatalities. Severe: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.	Dollar value or percentage of damages.	High: Nearly 100% probability of happening in the next year. Medium: will happen at least once in the next 10 years. Low: will happen at least once in the next 100 years.

5.2 Worst Threat Hazards

Flooding/Flash Flooding/Fluvial Erosion

The Town of Roxbury experiences damage and threats from flooding in a number of different forms. The community is considering them together because of similarities, but also recognizes that mitigating risk from different types of flooding may call for different types of action. Roxbury is subject to inundation flooding by slower, less powerful waters, riverbank loss and erosive flooding from the power of moving water, quickly rising and receding flooded streams in the hill and mountain elevations, and inundation caused by ice jams.

Roxbury is hydrologically situated in a unique way on the border of two watersheds. The northern portion of the town drains into the Winooski Watershed via the Dog River and tributary brooks and streams. The southern portion drains into the White River Watershed via the Third Branch of the White River and tributaries. These watersheds in Roxbury are primarily forested and minimally developed.

Figure 1 Two Watersheds in Roxbury

The 2013 Washington County Flood Insurance Study describes the geographic characteristics of the Dog River valley, to include steep narrow valleys and a lack of natural stormwater detention areas such as lakes and swamps, which allows floodwaters to rise rapidly. Similarly, the duration of flooding is quite short, lasting from a few hours to one or two days. High intensity storms that do occur are typically of a tropical origin (USACE, 1982).

Indeed, many of Roxbury's surface waters are small, high gradient upland streams, with the exception of portions of the Dog River and Third Branch. The high gradient upland streams drain quickly off the sides of the mountains during a heavy precipitation event and can deliver a large amount of water to the lower gradient areas of the Dog and Third Branch in a short period of time.

Major tributaries of the Dog River in northern Roxbury are Sunny Brook and Bull Run. Sunny Brook drains 16 square miles (including neighboring Brookfield) as it flows through Roxbury, and the main stem of the Dog River drains 6.8 square miles of town. Other larger tributaries flowing to the Third Branch are Flint Brook and Sandusky Brook.

Roxbury's village is located in a flatter valley where the Dog River and other streams come off of the mountains and flow into wetlands adjacent to the village. The segment of the Dog flowing through the village is considered gentle gradient, with a slope of just 0.54% (2009, Dog River

Corridor Plan). When the river, streams and wetlands overfill, multiple portions of the village are subject to inundation flooding. The area is bisected by the railroad line running north-south. The railroad line parallels the Dog River along its eastern bank, cutting off access to its floodplain (Dog River Corridor Plan, 2009). The 1% annual chance flood (100 year flood) inundation area mapped by the National Flood Insurance Program (NFIP) is also bounded by the railroad line.

Figure 2 Roxbury Village

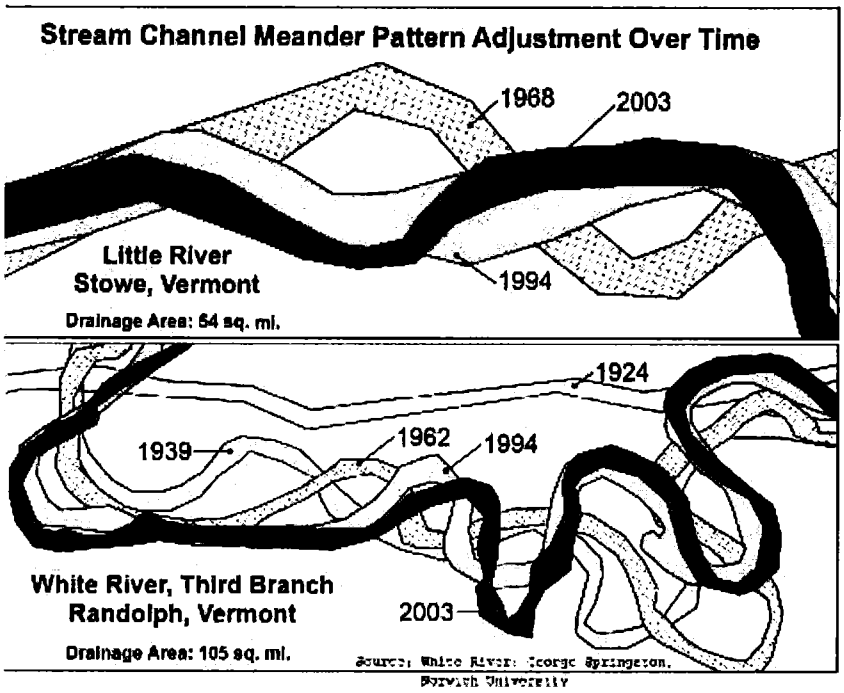
In 2009, a river restoration and drainage improvement project was conducted on a 550 foot segment of the Dog River in Roxbury's village. The segment had been straightened over the years, and depositing of sediment had blocked culverts under the railroad meant to allow water to drain away from the village on the eastern side of the railroad bed. The segment was given a more natural meandering path and a drainage swale, berm and sediment basins were constructed to allow water to again pass through the railroad culverts. The project reduced the frequency at which water would back up behind the blocked culverts on the eastern side of the tracks and flood nearby buildings or their basements. Tropical Storm Irene demonstrated that during greater magnitude floods, however, these buildings, and other areas of the village, are still susceptible to flooding. The railway culverts may also occasionally become blocked by beavers, leading again to risk of building or basement flooding.

A portion of Roxbury village was formerly served by a stormwater drainage system. This portion is not in the NFIP flood hazard area, but nevertheless experiences flooding, although somewhat

less frequent than the area affected by the restoration project described above. The system was filled and abandoned in the 1980's by the Vermont Agency of Transportation. The former service area is depicted in the Roxbury Village Hazard Analysis Map in the attachments. Local officials suspect that the drainage system contributed to reducing flood levels and basement flooding in this portion of the village. Unfortunately, very few state or local records have been retained of the stormwater system's intakes, lines and outfalls. Insufficient hydrologic and hydraulic analysis of flooding and drainage behavior in the village is available to definitively determine if re-installing a stormwater drainage system would reduce the risk of flood damage in this part of the village.

Fluvial erosion happens when the power of water to move dirt, soil and rock causes a river or stream to erode its banks and change course over time. This can happen somewhat slowly over the course of years, or dramatically during a single, high power, flow event. The extreme gouging, loss of roadways and yards, and re-positioning of stream beds during Tropical Storm Irene is an example of this phenomenon at its most dramatic. The graphics below showing the path and shape of two rivers in Vermont demonstrates how the course and position of the river will change over time.

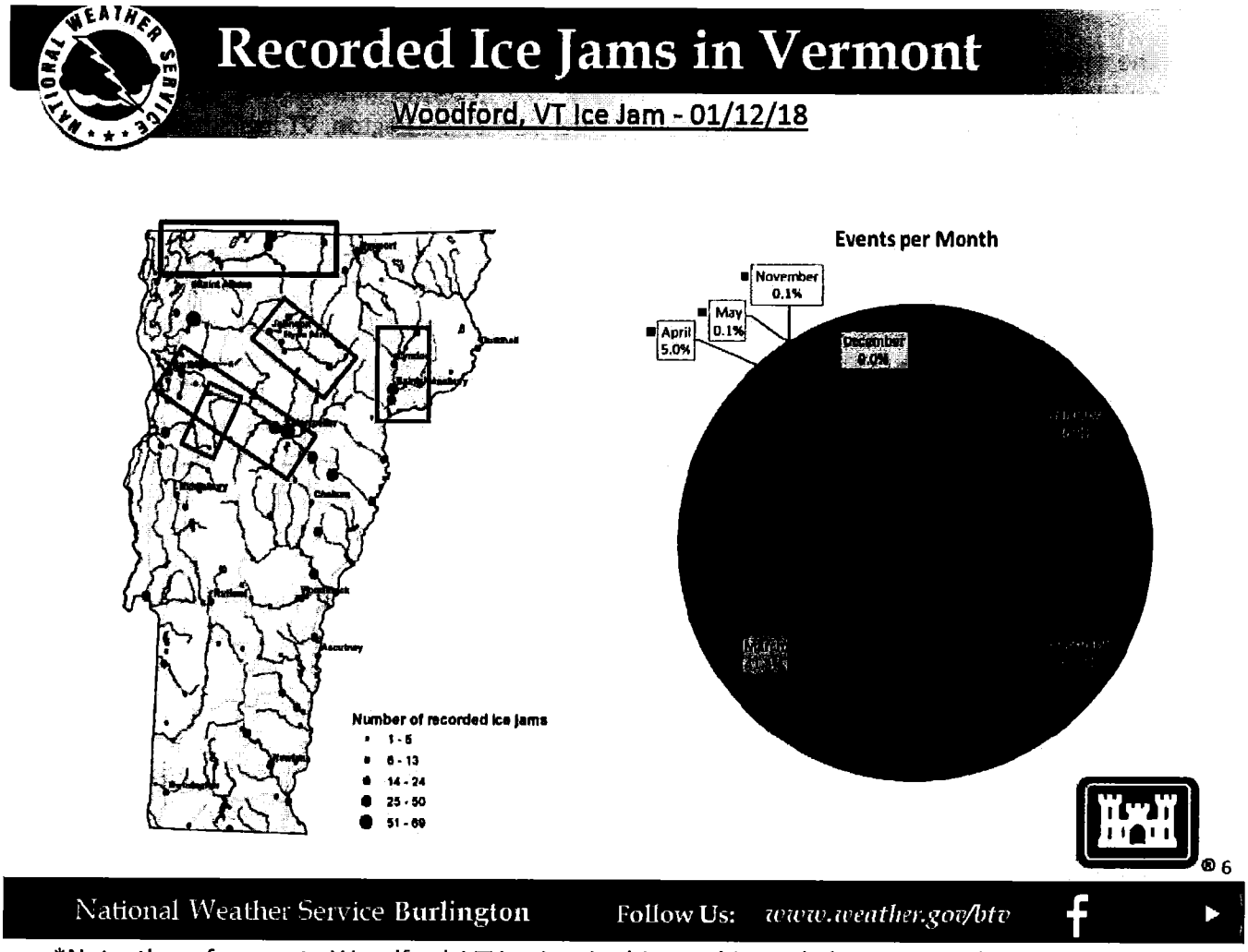
River Course and Position Change over Time:



All streams and rivers in Roxbury are subject to fluvial erosion. However, data on fluvial erosion damage in number of acres lost or erosion extent data for Roxbury is not available. The Vermont Agency of Natural Resources (ANR) has delineated areas that are likely to see more substantial erosion as the river changes course, at a magnitude that could cause significant property or infrastructure damage. These areas are called River Corridors. The Dog River, Third Branch, Bull Run, Sunny Brook, Flint Brook, and Sandusky Brook have all had River Corridor boundaries delineated by ANR. Municipalities have the option to regulate development in these hazard areas, however, these areas are not currently regulated by the Town of Roxbury.

The same areas of the village which are susceptible to inundation flooding as described above are also susceptible to ice jam inundation if the Dog River becomes jammed close to the village. According to Scott Whittier of the National Weather Service Burlington, VT ice jams are one of the three routine flooding triggers in Vermont. The other two triggers are rain and snow melt.

On a river, an ice jam is when chunks of ice create blockage in the flow of a river and cause areas behind the jam to flood. A jam site is the location where ice stops moving and blocks the channel. Ice jams often occur in narrow areas of rivers or at a change in channel slope, at an impediment such as bridge pylons/piers or where debris collects, and in areas where there is an intact ice cover; site of a freezeup jam. Ice jams often occur during winter rain events or during spring thaws when the upper layer of ice begins to melt and crack. Rapid snowmelt and heavy rains cause rise in rivers and the movement of ice. According to the National Weather Service, as a rule of thumb, there must be a water rise 2-3X the ice thickness to lift, move or break up the ice. The threat of ice jams is reduced with long gradual warming with no significant rainfall allowing the ice cover to thin, weaken and melt in place. The inundation of floodwaters caused by the ice jam can damage private and public property. According to the Vermont State Hazard Mitigation Plan, ice jams will occur in Vermont each year and "they are becoming more and more frequently noted." Vermont has 987 recorded events from the earliest Jam number in 1785 to the most recent Jam in February of 2017 according to the US Army Corps of Engineers ERDC Cold Regions Research and Engineering Lab (CRREL) ice jam data base (http://rsgisias.crrel.usace.army.mil). Vermont experiences the most, 41.3%, ice jams in the month of March followed by January at 26.9% and February at 17.7 % as depicted in the graphic below (slide #6 from the Power Point presentation by the National Weather Service, Burlington at the VEM 2018 Spring Flooding Seminar).



*Note, the reference to Woodford, VT Ice Jam in this graphic is a link to a You Tube video of the live ice jam.

History of Occurrences

The following table lists a History of Occurrences of flooding, flash flooding, and fluvial erosion events which have affected Washington County, or Roxbury specifically. Information is taken from the National Climatic Data Center (NCDC) Storm Events Database, FEMA Federally Declared Disaster Records and records of the flood gauge located at Northfield Falls. This gauge is approximately 9 miles downstream from Roxbury's village, on the Dog River. Due to the small population of the Town of Roxbury, specific data is difficult to obtain. Federal declared disaster numbers are noted where applicable. Data on the fluvial erosion damage in number of acres lost was not found for the events. Fluvial erosion extent data is unavailable.

Flooding/Flash Flooding/Fluvial Erosion

History of Occurrence

Date	Event	Location	Extent (magnitude) & Impacts - flood stage is 8 ft
April 15-18, 2014 DR 4178	Severe Storms and Flooding	Countywide	Extent data not available for this event.
6/25-7/11/2013 DR 4140	Severe Storms & Flooding	Roxbury, Countywide	Dog River, Northfield Falls Flood Gauge at 7.34 ft 2" Rain in 1-2 hours. Bridge on Rt. 12A near Cram Hill Rd. flooded. Rail bed flood damage in Roxbury halted train service
8/28/2011 DR 4022	Tropical Storm Irene	Roxbury, Statewide	Dog River, Northfield Falls Flood Gauge at 17.26 ft
5/27/2011 DR 4001	Flash Flood	County Wide	3-5" of rain
4/23-5/9/2011 DR 1995 & 4043	Severe Storms & Flooding	Countywide	Extent data not available for this event.
7/21 – 8/12/2008 DR 1790	Flash Flood	County Wide	2-5" of rain
7/9-11/2007 DR 1715	Flash Flood	County wide	3-6" of rain in 2 hrs
12/01/2006	Flood	Roxbury	8.50 ft, nearly 3" rain in Roxbury, minor flooding over Route 12A in Roxbury
5/18/2006	Flash Flood	Roxbury, Southern Washington County	2" Rain in a few hours, localized 3" in S. Wash. Cty. Several culvert & driveway washouts in Roxbury
1/18/2006	Flood; ice jam	Roxbury, Washington County	2.5" of rain
4/14/2002	Flood	County wide,	7.67 ft, 1-3" of rain countywide
12/17/2000	Flood	County Wide	3" of rain countywide

Date	Event	Location	Extent (magnitude) & Impacts - flood stage is 8 ft
5/11/2000	Flash Flood	Countywide	6.52 ft
9/17/1999 DR 1307	Tropical Storm Floyd	County Wide	4.97 ft, 5-7" rain county wide,
6/27/1998 DR 1228	Flash Flood	Roxbury, County Wide	6.66 ft, 3-6" rain countywide, 600 feet of railroad track undermined in & around Roxbury
7/15/1997 DR 1184	Flash Flood	County Wide	2-4" of rain
1/19/1996 DR 1101	Flood; ice jam	County Wide	7.41 ft
03/11/1992 DR 938	Flooding, Heavy Rain, Ice Jams	Statewide	Extent data not available for this event.
08/05/1989 DR 840	Severe Storms, Flooding	Statewide	10.16 ft
03/31/1987	Flood	Dog River	9.84 ft
8/10/1976	Flood	County Wide, Northfield	8.56 ft
6/30/1973	Flash Flood	Northfield, Countywide	11.57 ft
9/21/1938	Flood, Hurricane	County Wide	11.53 ft
11/03/1927	Flood	County Wide	Winooski River-Montpelier gauge downstream at 27.10 ft (flood stage = 15 ft)

The flood of 1927 is the greatest magnitude event Roxbury has experienced. A 250 year flood inundated the entire village, flooded a freight train stranded at the Roxbury landing, and damaged or destroyed thirty-five bridges in the town.

The most recent landmark flooding event in Roxbury was Tropical Storm Irene, which impacted all of Vermont heavily in August 2011. The storm produced flash flooding, fluvial erosion and inundation flooding. In Roxbury, nearly all of the buildings between the railroad and Rt. 12A in the village were flooded knee deep, or experienced basement flooding. Approximately 50 individual sites received damage to roads, bridges and culverts from storm water runoff and the Dog River. Altogether the municipality made $2 million worth of repairs to its infrastructure.

Tropical Storm Irene also caused major damage in the Roxbury Flats area south of the village on Rt. 12A. Flint Brook pushed over a retaining wall flooding Rt. 12A and undermining the New

England Central Railroad line. The floodwaters continued south along these parallel travel corridors to the Roxbury Fish Culture Station. This historic site and active hatchery was nearly destroyed, sustaining an estimated $500,000 in damage. The hatchery has been out of operation since the event. In the path of the flooded Flint Brook a cemetery was also damaged and the brook flowed around both sides of a residential structure. The Roxbury Flats area and hatchery were damaged in a similar fashion in December of 2006.

Events of varying lesser magnitude (extent) have also impacted Roxbury. The most recent significant event was in the summer of 2013. The night before the 4th of July holiday, a 2" storm moved through central Vermont, following over a month of above-average rainfall. Municipal highway infrastructure was damaged this time to a repair value of approximately $1 million. Cram Hill Road experienced the most serious washouts. As waters used it for a stream bed, Steele Hill Road was washed out lengthwise, and a large portion of gravel used to repair the road after Tropical Storm Irene was lost (The Northfield News, 7/11/2013). Bull Run, Fisher, Sullivan Hill, West Hill and Carrie Howe roads also sustained damage.

Data on the fluvial erosion damage in number of acres lost was not found for the events. Fluvial erosion extent data is unavailable.

Very little historical data is available documenting ice jams in Roxbury. This is not unusual as many ice jams are localized, occur quickly, and go unrecorded. The US Army Corps of Engineers CRREL Ice Jam database does not document any ice jams on record for Roxbury. However, local officials report that since 2000, at least one jam occurred on the Dog River that caused flooding in approximately half of the basements in the village. According to the data from the NOAA, National Centers for Environmental Information (NCEI) Storm database, ice jam flooding in the Dog River caused inundation flooding along Route 12A in Roxbury in 2006. On January 18, 2006, 2.5 inches of rain fell in Washington County causing ice jams to form on the Dog River in Berlin and Roxbury, on the Mad River in Warren and Waitsfield, and on the Winooski River in Middlesex and Moretown. Total property damage in Washington County for the event is recorded as 15k by NOAA NCEI storm database. The extent of damage in Roxbury is not recorded and specific information on damage data does not exist but locals say basement flooding and field flooding occurred. Although there has been no instances of flooding due to ice blockages since then, the potential for occurrence exists with the right spring conditions. The Town does not keep ice jam records and relies on local knowledge. There is a data gap in the recorded data for Roxbury with respect to ice jams.

The Town participates in the annual Spring Flood Seminars hosted by Vermont Emergency Management held in February/March to keep alert on spring conditions and ice out predictions by the National Weather Service of Burlington, Vermont. The Town routinely monitors the weather and VEM alerts and the Road Commissioner and Road Foreman monitor the Dog River as needed.

Risk

In addition to understanding the history of damages that have occurred in Roxbury, understanding how much property is at-risk also helps to predict how severe property damage losses, or threats to human safety, could be in the future.

A general sense of the property in Roxbury vulnerable to inundation flooding (including ice jams), flash flooding, and fluvial erosion can be achieved by determining how much property is in the 100 year flood plain mapped by the National Flood Insurance Program (NFIP), and in the River Corridor erosion hazard area mapped by the Agency of Natural Resources. The 100 year floodplain is the area where there is a 1% chance that flooding will happen in any given year. This area is referred to in Roxbury's Inundation Hazard Area Regulations (flood regulations) as the Special Flood Hazard Area.

Based on the results of overlaying the NFIP flood maps with the location of structures that have an E911 address, there are 5 structures in Roxbury's Special Flood Hazard Area. The structures located in this floodplain are primarily residential. By using median property values from the Roxbury grand list, a general sense of property value at-risk of loss can be calculated. There are 4 grand list parcels in Roxbury that have land in the floodplain, and may also have a structure(s) in the floodplain. The total value for these properties (land + structure) is $388,800. There are 67 grand list parcels in Roxbury that have some land in the floodplain, but do not have any structures (unimproved). The total value of these lands is $2,502,450.

There are no FEMA repetitive loss properties in Roxbury (2016 Dept. of Environmental Conservation Report).

Roxbury has more structures, and potentially more property value, in the ANR River Corridor than in the NFIP Special Flood Hazard Area. Thus there may be more property at risk to fluvial erosion than to inundation flooding. Twenty-nine (29) E911 structures are in the ANR River Corridor hazard area, as compared to 5 structures in the Special Flood Hazard Area. Seventy-six (76) grand list parcels have land in the River Corridor, and may also have a structure(s) in the River Corridor. These 76 properties (land+structures) are valued at $7,387,200. Some of this value is probably outside of the River Corridor (29 at-risk structures on 76 parcels), however, this value is still much greater than the maximum $388,800 value of land+structures affected by the inundation floodplain. There is $3,585,600 in value of unimproved parcels (land only) with a portion of the land in the River Corridor.

Local officials and residents have noted that there are a significant number of homes and structures outside of the NFIP mapped floodplain which have sustained flood damage nevertheless. Some are in the village, others at the bottom of streams coming off of the mountains, and at least two-dozen in the River Corridor fluvial erosion hazard area. The Town Garage is located on the edge of the floodplain and was almost flooded during the March 2011 flood event. To protect these community assets, it is very important for Roxbury to consider flood mitigation activities that help beyond the NFIP mapped floodplain.

Risk to Roxbury's highway drainage infrastructure was analyzed and assessed on the ground during the LHMP development process. CVRPC assisted Roxbury by conducting a Transportation Vulnerability Analysis. Bridges and culverts were first put through GIS analysis to determine

proximity to streams or floodplain, stream slopes, roadway slopes, and if structure width was adequate relative to stream width. Drainage structures determined to be at-risk based on these criteria were then evaluated in the field by the CVRPC Technician and local Road Foreman. Based on the combined results of these evaluations, the Road Foreman and Road Commissioner prioritized projects both for inclusion in the LHMP implementation plan, and for future project development. Project development efforts necessary for the less well defined projects is beyond the scope of the current LHMP planning process. A map of vulnerable structures, and the project development priorities list, are included in the attachments.

The Hazards Analysis Map in the attachments identifies areas and structures in the NFIP Special Flood Hazard Area (floodplain) and the ANR River Corridor.

Flooding/Flash Flooding/Fluvial Erosion Hazard Overview

Hazard	Location	Vulnerability	Magnitude (Extent)	Impact	Likelihood
Flooding/Flash Flooding/Fluvial Erosion	SFHA, River Corridor, Village, Roxbury Flats, Dog River, major Tributaries, Mountainous streams	Severe. Structures – 5 homes in SFHA, homes in village Rt12A homes at base of waterways; 29 structures in ANR River Corridor hazard area, Town Garage. Bridges and culverts – Cram Hill Rd., Raynor Road, Tenney Rd., Premo Rd., Steele Hill Rd., Bailey Rd. Oxbow Rd., Drown Rd., West Hill	Irene- 8+ ft Above flood Stage in Northfield Falls (closest gauge)	Data gap from Irene damages. other damages $500,000 for Town Garage land/ Equipment $400,000 per bridge	Medium

Railroad Transport Accident

The New England Central Railroad (NECR, a Genesee & Wyoming subsidiary) runs through Roxbury from north to south along the valley floor. It shares the valley corridor with state Route 12A and the Third Branch and Dog Rivers. Rail activity includes both Amtrak passenger service from St. Albans to Washington D.C. and cargo transport, from points south of Vermont all the way north to Canada. Cargo transport includes a variety of freight including hazardous materials including oil and propane. The primary incidents of concern to Roxbury are a railway collision, hazardous materials spill, or derailment.

An upgrade to the line has been underway in recent years, which will accommodate 286,000-pound cars for its entire length in Vermont. Between 2010 and 2012, most rail was replaced, and other upgrades were completed that restored increased operating speeds between St. Albans and White River Junction, including the Roxbury corridor. The Roxbury Subdivision of the line has

a track condition rating of Class 3, allowing operating speeds of up to 40 mph for freight trains and 60 mph for passenger trains. (Vermont State Rail Plan 2015)

Amtrak passenger service to St. Albans and points south passes twice a day. Neither service makes a stop in Roxbury, with passenger stations located 15 miles north in Montpelier and 15 miles south in Randolph. A rail siding currently exists in the village. The potential exists for additional rail sidings elsewhere in town.

History of Occurrences

A train derailment occurred in August 1996 at the Thurston Hill Rd crossing when the Amtrak Vermonter collided with an empty logging truck (United Press International Archives). Five people suffered minor injuries and the truck driver was taken to the hospital. At the time the crossing was marked with a warning sign but no automatic barrier. The speed of the train at the time of the accident was not reported. Vermont's Hazardous Waste Spills Response team responded to the scene out of concern that diesel had been released, but no spill had occurred (VT DEC Spill Site List Database).

In 2009, a freight train struck a UPS truck at the intersection of Route 12A and Oxbow Road. According to news reports, the railroad crossing was marked with a railroad crossing sign, but there are no lights or crossing bars. The train had one engine and twelve freight cars. Upon impact, the freight train traveled approximately 900 feet before coming to a stop. Damages to the freight train were minimal; however, the UPS truck was totaled. Damage and emergency service related costs were roughly $100,000.

On October 5, 2015, the Amtrak Vermonter Train 55 derailed after hitting a rock slide lying on the tracks in Northfield near Bull Run Road and Vermont Route 12A. The rock slide is said to have occurred naturally in the early morning hours. Five cars left the track including the engine and coach car which went into the brook below the track. Four passengers and three crew members sustained non-life-threatening injuries in the accident. Although this event occurred in neighboring Northfield, it occurred close to the Roxbury town line.

Risk

There are five roadway crossings over the NECR line in Roxbury, each of which is a side local road off of state Rt. 12A. They are Thurston Hill, Oxbow Rd, Carrie Howe Rd, Warren Mountain Road, and Ellis Rd. Thurston Hill Road and Warren Mtn. Road have been installed with a drop down gate warning system. All of the other crossings have at-grade warning devices without a drop down gate. The Roxbury Local Emergency Operations Plan lists these five crossings as vulnerable during some emergency incidents and important to check. Crossing installations and other data on rail infrastructure in Roxbury can be viewed on the Vermont Rail Asset Inventory Web Map at:
http://www.arcgis.com/apps/Viewer/index.html?webmap=ff0fe051ac8d40038e95730063802b9c.

The Vermont Association of Snow Travelers snowmobile trail network also has at-grade railroad crossings. It is unknown in how many places the trails cross the rail line in Roxbury, however snowmobile-train accidents have occurred in neighboring towns and is a risk of which to be aware.

Jurisdiction

Roxbury municipal officials have encountered challenges in mitigating the risk of a railroad accident because the municipality does not have any jurisdiction over the rail infrastructure, its maintenance or the operations and car contents of the services using the line. Roxbury does have first response capacity in the case of an incident, and the Local Emergency Operations Plan designates the Fire Department as the lead in the case of a Hazardous Materials Incident in particular.

Risk Reduction Opportunities

Since local authorities do not have control over the rail itself the best options for carry out mitigation efforts are by building capacity in accident prevention and response, staying informed about rail policy and decisions in Vermont, and advocating for Roxbury's interests with the rail companies, service operators and the Vermont Agency of Transportation.

The Vermont State Rail Plan guides the policies and priorities of the State of Vermont for maintaining and enhancing the rail system. The plan is updated periodically, last in 2006 and in 2015, and sets broad priorities on the amount of emphasis to be given to upgrading segments of track, improving railroad bridges, increasing safety of highway-rail at grade crossings and measures to address other safety concerns such as hazardous materials accidents. Municipalities have the opportunity to provide input in this process by submitting formal comments, attending public meetings and participating in their Regional Planning Commission's close involvement in the process.

VTrans currently uses a "Rail-Highway Crossing Sufficiency Rating" to prioritize crossings for warning system improvements. The information used to develop the hazard index is updated annually and considers over a dozen factors. The crossings with the highest hazard index are then reviewed by diagnostics teams in the field and an appropriate treatment is recommended. Although the rating system is somewhat formulaic, it is important for local officials to advocate for involvement in the process. Crossings may have low accident prediction rates, but nevertheless may be hazardous, because of geometric characteristics or other unique factors.

Identifying a responsive contact with both the Agency of Transportation and the NECR and service operators can also help Roxbury advocate for itself and prevent foreseeable accidents. Within the Agency of Transportation, the Policy & Planning Strategic and Modal planning unit focuses on modal planning for railways. The AOT Rail Program makes more day to day decisions about the management of the rail infrastructure networks in the state. Private railway ownership and service operators often have public relations liaisons specifically tasked with addressing

public concerns. Roxbury may pursue these contacts or collaborate with the Regional Planning Commission to reach AOT contacts as well.

A citizen advocacy group exists in Vermont called Citizens for Responsible Railroads. The members represent various communities and have been successful in establishing relationships with railroad companies and the AOT. Their focus is on railroad safety, and citizens and local officials can join as members for free to stay informed on railroad safety policy issues, opportunities to advocate, and other news. The organizations website is: https://citizensforresponsiblerailroads.wordpress.com

The local Fire Chief and Department, as well as Emergency Management Director, have the responsibility to be prepared to respond and command a railroad accident incident. Opportunities to build preparedness can be accessed via the Vermont Dept. of Public Safety, the Vermont Fire Association and Academy and the Regional Planning Commission and Local Emergency Planning Committee #5. The Dept. of Public Safety periodically holds a free 1-day Rail Car Incident Response Training. This awareness-level training program educates rural responders, managers, and administrators on freight rail car incidents involving hazardous materials. The training is typically held on a weekend and continuing education credits can be earned by completing it. Hazmat training for municipal officials is also offered by the State HAZMAT Team, as well as the Vermont Fire Academy.

Railroad Transport Accident Hazard Overview

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Railway Transport Accident	1,000' buffer (500' either side of rail) Village	Vehicles & passengers, Residential Development, Municipal buildings –Village School, Town Library; United Congregational Church. Roadway crossings at : Thurston Hill, Oxbow Rd, Carrie Howe Rd, Warren Mountain Road, and Ellis Rd.	Moderate	Value of buildings, # injuries, infrastructure repair costs. Specific estimates unavailable	Medium

Water Supply Contamination

In Roxbury's village, drinking water supply is provided by groundwater. The village was developed compactly along the north-south railroad line and parallel Route 12A, experiencing major growth after 1848, when the rail road arrived. According to local knowledge, most of the homes and businesses in the village were constructed in the latter 19th and early 20th century. This compact development, the proximity to transportation corridors, and the probable age of the occupied homes and businesses has led to some concerns for the risk that groundwater drinking supplies in the village could become contaminated.

Six private drinking water wells register in the village area in the Vermont Natural Resources Atlas, however approximately 32 occupiable structures are located in the village. As there is only one permitted public (large scale) drinking water supply well in the village, it can be assumed that most structures obtain drinking water from a private groundwater well. The permitted public

water supply serves the Roxbury Village School. According to the Water Supply Source Protection Plan for the system, there are 12 private on-site wastewater treatment systems within 500 feet of the school's wellhead. The Source Protection Plan also identifies underground gasoline and fuel oil storage tanks, and the railroad, Route 12A and Tracy Hill Road transportation corridors, as other potential sources of contamination from a leak or spill of hazardous materials.

According to local knowledge, the water table in the village area is high, which is also evidenced by the proximity of wetlands at the north and south village boundaries, and the occurrence of flooded basements at times when the Dog or Third Branch rivers flood. Soil composition is locally understood to be comprised of both gravel and clay. On-Site Wastewater Disposal ratings are available for soils from the Vermont Dept. of Environmental Conservation, however, they only classify soils to a depth of 6 feet, which may disregard treatment capacity of soils if it is present at greater depths. The entire area of soils in Roxbury's village has the same wastewater disposal rating.

Based on the age of the homes and businesses in the village, their compact proximity, and anecdotal reports of some failed systems and some on site wastewater treatment systems that have not been modernized since the homes or businesses were constructed, there is some concern in the community that inadequate wastewater treatment could lead to contamination of nearby drinking wells.

Risk

The risk of this problem to occur is not scientifically well defined, however the community does have options to better determine the vulnerability of the water supplies and to plan for taking measures that reduce the risk. To date, the Dept. of Environmental Conservation's databases do not have record of any violations of private drinking well or on-site waste water treatment systems holding a permit (1/20/2017 Compliance & Enforcement Division). Local anecdotal knowledge also indicates that wells which have been tested have not had findings of dangerous contaminant levels. Well testing in the State of Vermont is generally voluntary, except in specific circumstances. State law does not require drinking wells to be tested when properties are sold. Addressing a failed or deficient system is the responsibility of the property owner. It is also worth note that sewage that has made its way to the ground surface due to a deficient system is not necessarily indicative of groundwater contamination. Each may occur in concert, or separately. Surfaced sewage is, however, a threat to public health via skin contact and the environmental health of surface waters it may reach.

In order to more accurately define the risk of water supply contamination from wastewater, village residents, or the Town of Roxbury, have both public and private options to pursue with the help of expert scientists and engineers. All can be done with the assistance of State of Vermont drinking water protection programs, or independently. Each is also voluntary on the part of the property owner, and no property owner would be required to participate or allow access to their property without their consent.

Voluntary well-monitoring allows peace of mind that problems will be detected. It can also monitor for increasing levels of particular contaminants that may be indicative of a coming danger. This can be pursued individually, in clusters, or village wide by private residents, or with

support from the municipality or state funds. Usually a sampling and monitoring schedule is set up seasonally and tests for contaminants such as nitrates or fecal coliform.

A less direct way to better define drinking water contamination risk in the village would be to understand the factors that influence this risk. This can be accomplished by gathering information on soils, geology, or hydrology, or by conducting an infrastructure inventory. An infrastructure inventory would provide a clearer picture of risk by understanding things such as:

- Surveying actual condition of wastewater treatment systems
- Measuring distances between wells and nearby wastewater systems to determine if distances are safe
- Identifying systems that would need modernizing to meet current regulations if they were to need replacement
- Identifying specific contributing risk factors and factors that are not contributing to risk
- Determining indicators of risk such as patterns of system failure or troubles under specific conditions (such as after rain-storms)

Risk Reduction Opportunities

In addition to more accurately determining risk, there is assistance available for village residents to move directly to implementing solutions. Some of these options are available to the municipality, others to individual property owners, and others to entities such as non-profit community utilities.

The Vermont Drinking Water State Revolving Loan Fund is available to explore options for determining and addressing conflicts between water supply and wastewater treatment, including alternatives to traditional "big pipe" systems. The Water and Wastewater Planning Loan Program allows municipalities or non-profit community utilities to hire an engineer or scientist to help evaluate alternatives and project costs to identify a solution that works best for the community. The village of Warren used this program when they found that businesses could not expand because they did not have enough space to increase in-ground wastewater treatment. Drinking water protection zones were occupying too much ground space. The community could not finance a traditional centralized water and wastewater system. By exploring alternative options, they determined that drilling new wells and hooking multiple users onto them would free up space in the village that could then be used for expanded wastewater treatment capacity, and expanded business capacity.

The planning program can conduct infrastructure inventories as described above, soil and ground water studies, and project costs of various engineering alternatives (or non-engineering alternatives) so that the community can consider a variety of potential solutions. The loans are given on a 5 year term at 0% interest. Planning studies typically cost in the $10,000-$20,000 range. The municipality or community utility is not obligated to construct a new system after completing a study. If the community does chose to proceed, loan funds are available for design and construction.

Individual owners of single family residences may also access the Vermont On-Site Loan Program for the repair or replacement of failed systems. The minimum loan amount is $3,000 and owners must meet income qualifications. Applicants must also have the Vermont Drinking and Groundwater Protection Division confirm that the system needs repair or replacement and applicants must demonstrate that they have been denied financing by traditional financing entities.

Water Supply Contamination Hazard Overview

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Water supply contamination	- Village - Along Railroad - Development within Floodplain	Residential and Municipal buildings Windridge Tennis and Sports Camp, Town Library, Village School, United Congrega-tional Church, Roxbury Fire Station, Town Garage	No documented contamination of drinking wells to date	$ 15,000 or more	Medium

Hurricane/Tropical/Severe Storms Causing Power Outage

Hurricanes and tropical storms are violent rain storms with strong winds that have large amounts of rainfall and can reach speeds up to 200 mph. Hurricane season is between the months of June and November. These types of storms originate in the warm waters of the Caribbean and move up the Eastern seaboard where they lose speed in the cooler waters of the North Atlantic. High wind events are sustained winds over 40 mph and/or gusts greater than 58 mph. A severe thunderstorm is a thunderstorm that contains any one or more of the following three weather conditions: hail that is 3/4 of an inch or greater in diameter, winds 58 miles per hour or greater, and/or tornadoes. Severe storm events can occur late spring and early summer as temperatures increase in the summer season. The frequency and intensity of hurricanes, tropical storms, and severe storms is expected to increase with climate change.

Although all of these types of storms also cause flooding related hazards in Roxbury, flooding hazards are profiled specifically under Flooding/Flash Flooding/Fluvial Erosion. Other than flooding, the hazards and impacts of greatest threat to Roxbury due to severe storms are those that cause electrical service outages. Wind is the most likely hazard to cause power outages, when trees are blown onto the lines or the lines themselves topple. Lightening, and rarely hail, may also contribute damage to electrical transmission infrastructure, causing users to loose service.

The following table lists a History of Occurrences of severe storm events which have affected Washington County, or Roxbury specifically (National Climatic Data Center (NCDC) Storm Events Database and FEMA Federally Declared Disaster Records).

Hurricane/Tropical/Severe Storms Causing Power Outage

History of Occurrences

Date	Event	Location	Extent (magnitude) & Impacts
02/29/2016	Strong Wind	County Wide	Wind gusts of 35 to 45 MPH. Isolated to scattered tree limbs and power lines downed by wind.
10/07/2013	Strong Wind	State Wide	Reports of tree branches on utility lines in Washington County.
01/20/2013	Strong Wind	County Wide, State Wide	Winds in excess of 50 MPH. Numerous reports of tree or power line failures statewide. Estimated 10,000 without power statewide
10/29/2012	Hurricane/Superstorm Sandy	Statewide	15 to 30 MPH winds with frequent gusts in excess of 40 MPH. Scattered damage to trees. 35,000 residents statewide without power.
8/28/2011 DR 4022	TS Irene	Statewide	~6" rain , Montpelier flood gauge at 19.05 feet (flood stage is at 15 feet)
5/26/2011 DR 4001	Severe Storm, hail, flash flooding	County Wide	1" hail, 3-5" of rain, 50 knot winds. Quarter to dollar size hail reported in neighboring Northfield.
7/21/2008	Severe storms, flooding	County Wide	Extent data unavailable for this event.
8/25/2007	Severe Storms	County Wide	55 knot wind gusts, 1" hail
7/9/2007 DR 1715	Severe Storms, hail, flooding	County Wide	1"-2.75" hail,
6/19/2006	Severe storms	County Wide	50 knot winds, downed trees and power lines
8/1/2005	Severe Storm	County Wide	1" hail, 55 knot winds
9/16/1999 DR 1307	Tropical Storm Floyd	Statewide	Tropical Storm; Montpelier flood gauge at 9.30 feet, 5-7" rain county wide

Date	Event	Location	Extent (magnitude) & Impacts
6/27/1998 DR 1228	Severe Storms	County Wide	$2M in damages, 3-6" rain across county
5/29/1998	Severe Storms	County Wide	50 knot winds, heavy rains, downed trees and power lines
7/15/1997	Severe Storms	County Wide	2-4" of rain, Not a historical crest
8/4-6/1995 DR 1063	Severe storms, flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
7/23/1990 DR 875	Severe Storms, flash flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
8/4/1989 DR 840	Severe Storms, Flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
6/7/1982	Severe Storms	New England	14" of rain, $276 M damages
8/5/1976 DR 518	Hurricane Belle	Statewide	Gale force winds, 2 deaths
7/3/1964	Hail	County Wide	1.5" hail
9/22/1938	Hurricane	Statewide	Category 1 force winds

No high wind events have been documented in Roxbury, and little specific documentation of events and damage have been kept. The assessment of risk related to this hazard is based on the history of severe storms and damage affecting the county, and local knowledge of frequency, impacts and vulnerability.

The Northfield Ridge, which borders Roxbury has been evaluated for wind power development; and found to experience average wind speeds of 5-21 mph.

Hurricane/Tropical/Severe Storms Causing Power Outage Hazard Overview

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Severe Storms Causing Power Outage	Town Wide	Electric transmission Infrastructure, Residents dependent on electric heat and medical equipment, Town Garage, Village School, Town Library, elderly and vulnerable population, Large trees, town infrastructure, culverts/ bridges, forested areas in town, crops, roads, tall buildings, farms.	55 knot winds 2.75" hail	Roxbury specific impacts not documented. $2M in damages across county.	High

Beaufort Wind Chart – Estimating Winds Speeds

Beaufort Number	MPH Range	MPH Average	Terminology	Description
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
	13-18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
	19-24	22	Fresh breeze	Smaller trees sway.
	25-31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32-38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	42	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	50	Severe gale	Light structure damage.
10	55-63	60	Storm	Trees uprooted. Considerable structural damage.
11	64-73	70	Violent storm	Widespread structural damage.
12	74-95	90	Hurricane	Considerable and widespread damage to structures.

Webpage: http://www.weather.gov/lwx
Twitter: @nwslwx
Facebook: NWSNorthernIndiana

Extreme Cold/Winter Storm/Ice Storm Causing Power Outage

A winter storm is defined as a storm that generates sufficient quantities of snow, ice or sleet to result in hazardous conditions and/or property damage. Ice storms are sometimes incorrectly referred to as sleet storms. Sleet is similar to hail only smaller and can be easily identified as frozen rain drops (ice pellets) that bounce when hitting the ground or other objects. Sleet does not stick to wires or trees, but in sufficient depth, can cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surfaces coating the ground, tress, buildings, overhead wires and other exposed objects with ice, sometimes causing extensive damage. Periods of extreme cold tend to occur with these events.

One of the major problems associated with ice storms is the loss of electrical power. Major electric utility companies have active, ongoing programs to improve system reliability and protect facilities from damage by ice, severe winds and other hazards. Typically, these programs focus on trimming trees to prevent encroachment of overhead lines, strengthening vulnerable system components, protecting equipment from lightning strikes and placing new distribution lines underground.

History of Occurrences

The following table lists a History of Occurrences of severe winter weather events which have affected Washington County, or Roxbury specifically (National Climatic Data Center (NCDC) Storm Events Database and FEMA Federally Declared Disaster Records).

Snow and/or ice events occur on a regular basis. Recent significant events have included:

Extreme Cold/Winter Storm/Ice Storm Causing Power Outage
History of Occurrences

Date	Event	Location	Extent (magnitude) & Impacts
02/05/2011-02/06/2011	Winter Storm	Countywide	10 to 15 mins of thundersnows occurred with sleet & snowfall accumulations of 6 to 10 inches throughout Washington County
03/06/2011 – 03/07/2011	Winter Storm	Countywide	15-30" of snowfall across Washington County. Statewide, nearly 10,000 customers lost electrical power, nearly all school districts closed on the 7th.
11/23/2011	Winter Storm	Countywide	5-12" of heavy, wet snow across Washington County.
12/26/2012	Winter Storm	Countywide, Statewide	9-18" snowfall in Washington County. 18" in Roxbury.
03/19/2013-03/20/2013	Winter Storm	Countywide, Statewide	6-14" of snowfall across Washington County. Unusual high amount of vehicle

Date	Event	Location	Extent (magnitude) & Impacts
			accidents involving tractor trailers across portions of the State.
03/12/2014 – 03/13/2014	Winter Storm	Countywide, Statewide	12-20+" of snowfall across Washington County. 24" in East Roxbury
12/09/2014 – 12/11/2014 DR 4207	Winter Storm	Countywide, Statewide	6-24" of heavy, wet snowfall across county. Resulted in widespread power outages and vehicle accidents in Washington County.
01/03/2015 – 01/04/2015	Winter Weather	Countywide, Statewide	3-5" of snowfall with ice accumulation up to 1/10" across Washington County.
01/07/2015 – 01/08/2015	Extreme Cold/Wind Chill	Countywide, Statewide	Lows of 15-25 Degrees below 0 in Washington County.
01/18/2015- 01/19/2015	Winter Storm	Countywide, Statewide	2-6" of wet snowfall across Washington County. Isolated power outages, numerous vehicle accidents.
02/01/2015 – 02/28/2015 UNDECLARED DISASTER	Cold/Wind Chill	Countywide, Statewide	Average temp was 13 to 17 degrees below normal statewide. Statewide, damage to infrastructure, frozen water mains, etc. totaled at least $1 million.
02/02/2015 UNDECLARED DISASTER	Winter Storm	Countywide, Statewide	6-12" of snowfall in Washington County. Numerous vehicle accidents.
02/16/2016	Winter Weather	Countywide, Statewide	2-4" of snowfall with 1/10th" of ice accretion across Washington County.

By observing winter storm watches and warnings, adequate preparations can usually be made to lessen the impact of snow, ice and sleet, and below freezing temperature conditions on the Town of Roxbury. Providing for the mass care and sheltering of residents left without heat or electricity for an extended time and mobilizing sufficient resources to clear broken tree limbs from roads, are the primary challenges facing community officials. Roxbury should plan and prepare for these emergencies. That planning and preparedness effort should include the identification of mass care facilities and necessary resources such as cots, blankets, food supplies and generators, as well as debris removal equipment and services. Sheltering areas in Roxbury include the elementary school, church and camp. The Town encourages residents who are in remote locations to be equipped with generators and backup fuel supplies in the event of prolonged power outages and travel restrictions.

Extreme Cold/Winter Storm/Ice Storm Causing Power Outage Hazard Overview

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Extreme Cold/Winter or Ice Storm in conjunction with power failure	Town Wide	Elderly & handicapped populations, remote structures, Village Homes, old/under insulated structures, Farms, utilities, trees, water supply, telecommunic-ations, Village School, Town Garage	Below freezing and severe wind chill factor for multiple days; depends on severity of event; 18+" snow in March 2011 storm	Depends on severity – additional sheltering/ plowing/ emergency services costs for town	Med/High

Invasive Tree Pests (Emerald Ash Borer, etc.)

Some non-native species of plants and animals are able to proliferate to the detriment of native species, natural communities, and ecosystem functions. These organisms often have no natural predators and can out-compete native species, greatly reducing biodiversity and altering ecosystems. Such invasive exotic species pose a number of environmental, economic, and human health threats.

Roxbury is concerned in particular about invasive tree pests. These include Asian longhorn beetle, emerald ash borer, and hemlock wooly adelgid. The community values its forests for reasons that could be threatened by poor tree health and die offs that these pests can cause. Invasive tree pests have not yet been documented in Roxbury, however they have been documented in other parts of Vermont and surrounding states. The magnitude of infestation can be measured in acres affected or cordage of wood from tree die off.

According to the 2014 Roxbury Town Plan, over 85% of the town's land surface is forested. The community values the wildlife habitat and water protection afforded by the healthy forests, as well as the recreational and aesthetic benefits it offers. Seven thousand acres of land in Roxbury is enrolled for timber management in Vermont's Use Value Appraisal Program, administered by the Agency of Natural Resources. Forest in timber management has economic value to the landowners, the 4% of Roxbury residents working in forestry or timber harvest, and to the 25% of Roxbury residents who heat their homes with wood (2014 Town Plan).

In addition to understanding the degree to which Roxbury values its forests, determining the vulnerability of the community to this hazard also depends on the prevalence of tree species that are susceptible to infestation, and the ability of the pests to make their way to Roxbury.

Each pest species targets certain tree species. The Emerald Ash Borer targets ash, and the Hemlock Wooly Adelgid, hemlock. Asian longhorn beetle has some preference for maple, but will infest any hardwood, except oak. Therefore the amount of each of these species in Roxbury delineates the potential extent (magnitude) of impact. Local level data about the species composition of Roxbury's forest is not available. County level data is only available on ash species, from the U.S. Forest Service Forest Inventory Assessment. It demonstrates that White ash makes up about 5.3% of all trees in Washington Co. (including seedlings). Green and black ash species are minimal.

Evaluating the pathways which invasive tree pests have to get to Roxbury can also help to define the Roxbury forest's vulnerability to experiencing this hazard. The University of Vermont extension conducted a risk assessment of Vermont towns for Emerald Ash Borer (EAB) to be introduced. The study inventoried locations where EAB infested wood might be brought into each town. Locations such as nurseries, sawmills, public campgrounds, firewood dealers, log trucking routes, seasonal residences and rail lines were inventoried, along with other potential entry points. Towns with higher numbers of overlapping introduction pathways are considered higher risk. The distance of the town from known infestations (in New York and Canada) was also factored in (within 50 miles). Roxbury's risk via introduction pathways is considered very low. Higher risk communities in Washington County are Montpelier, Waterbury, Barre City and Duxbury, with higher incidences of pallet risk locations, wood importers, tourist attractions, and nurseries.

To gain a more accurate determination of the vulnerability of Roxbury's forests based on species composition, the community has the opportunity to participate in the EAB Preparedness & Response Planning process with the UVM Extension. The program starts with a roadside tree inventory to count ash trees. The amount of ash trees along roadsides is then used to predict the composition of Roxbury's whole forest. By gathering volunteers to survey about 10% of Roxbury's roads, the community can find out just how much ash is at risk.

With a more accurate definition of the risk, Roxbury can then chose which mitigation activities would be most effective. One option is to write an EAB Preparedness Plan that outlines how to minimize the impacts of ash sickness and die off to forest ecosystem and economic values. One item many communities address is how to deal with clearing high volumes of dead trees falling in roadways.

Another option is for local volunteers to train as Forest Pest First Detectors. These volunteers learn how to identify the first signs of infested trees, organize other volunteers to screen for the pests, and report any detections regularly to the Vermont Urban and Community Forestry Program. The Urban and Community Forestry Program offers trainings a few times a year in various locations around the state.

Invasive Tree Pests (Emerald Ash Borer, etc.) Hazard Overview

Hazard	Location	Vulnerable Assets	Extent	Impact	Likelihood
Invasive Tree Pests	Forest stands of susceptible tree species	Ecological and recreational assets, timber stands and sugar bushes, 85% of Roxbury's forested land area, 7,000 acres enrolled in timber management in Vermont's Use Value Appraisal Program; loggers, fire wood industry, wood product industry, Town Forest, Town Road ways and Scenic roadways, groundwater, wildlife habitat, farmers.	Not yet documented	Unknown – data gap	Medium

6. Mitigation

6.1 Hazard Mitigation Goals & Strategies

The goal of this Hazard Mitigation Plan is:

- To take actions to reduce or eliminate the long-term risk to human life and property from:
  - Flooding/Flash Flooding/Fluvial Erosion & Ice Jam
  - Hurricane/Tropical/Severe Thunderstorms Causing Power Outage
  - Extreme Cold/Winter Storms/Ice Storms Causing Power Outage
  - Railroad Accidents
  - Water Supply Contamination
  - Invasive Tree Pests

Specific hazard mitigation strategies related to goals of the Plan include:

- Ensure existing and future drainage systems are adequate and functioning properly
- Preserve and prevent development in areas where natural hazard potential is high
- Build capacity of municipal staff and volunteer officials to lead and carry out hazard mitigation programs, projects and activities
- Ensure that all residents and business owners are aware of the hazards that exist within Roxbury and ways they can protect themselves and their property

- Ensure that emergency response services and critical facilities functions are not interrupted by natural hazards

6.2 Town Plan (2014) Goals that Support Hazard Mitigation

In order to ensure that comprehensive community planning takes into account priorities of the hazard mitigation planning process, and that the LHMP process works within broad community goals, the two planning processes are used reciprocally to inform each other. The LHMP is an important source of information for defining Town Plan goals related to flood resilience, land use, location of development, and community infrastructure. As the Roxbury Inundation Area Regulations must be in conformance with the Town Plan, mitigation goals adopted into the Town Plan must also be reflected in the flood hazard regulations.

The 2011 LHMP was reviewed during development of the 2014 Town Plan. The goals and objectives listed below are excerpted from Chapters of the Town Plan incorporating hazard mitigation issues.

<u>Physical Features, Natural & Cultural Resources Element:</u>

Goal: Maintain, preserve and enhance Roxbury's natural and cultural resources.

Objective 1: Protect or enhance the quality of Roxbury's surface and groundwater resources.

A. Encourage the maintenance of undisturbed, naturally vegetated buffer strips along stream corridors and significant wetlands.

D. Carefully designate and enforce wellhead protection areas for present and future public water supplies.

E. Carefully regulate future development within designated flood hazard areas.

Objective 2: Promote the responsible and efficient use of Roxbury's land resources (forests, agricultural and mineral) to ensure their sustained use, compatibility with surrounding land uses and aesthetics, and the protection of natural resources.

A. Encourage the development of forest management plans for state and private forests which provide for sustainable use and protection of natural resources.

B. Strongly discourage large-scale clear cutting of private and state-owned forests.

E. Encourage landowner participation in private conservation programs (Forest Legacy Program, Current Use, Vermont Land Trust) to protect the town's land resources

F. Prohibit development about 1800 feet above sea level and on land that has more than a 25 degree slope

Goal: To protect life and property from natural disasters, including flooding and flash flood events.

Objective 1: New development in identified flood hazard, fluvial erosion, and river corridor protection areas is avoided. If new development is to be built in such areas, it does not exacerbate flooding and fluvial erosion.

A. Replacement and upgrade of priority culverts and bridges identified in 2011 Local Hazard Mitigation Plan.

B. Explore possible strategies to flood-proof the Town Garage

C. Prepare and distribute or make available NFIP insurance and building codes, explanatory pamphlets or booklets

Objective 2: The protection and restoration of floodplains and upland forested areas that attenuate and moderate flooding and fluvial erosion is encouraged.

A. Identify possible areas susceptible to flood hazards that could be preserved as open space to maintain their ability to store floodwaters during future events.

Objective 3: Flood emergency preparedness and response planning is encouraged

A. Develop a post flood clean-up, decontamination and recovery plan/procedure

Transportation Element:

Goal: Ensure safe and dependable roadways for the residents of Roxbury at a reasonable cost.

Objective 2. Continue to upgrade and improve the serviceability of the class 3 road network by scheduled surface grading, and construct and improve drainage facilities as required.

Objective 3. Investigate the need for developing regulations for new roads and bridges that don't come under State jurisdiction.

Objective 4. Discourage road growth especially in any steep or hard-to-maintain areas.

Objective 5. Explore possible expansion of cooperation with other towns for best use of resources in road maintenance and plowing.

Goal. Cooperate with State agencies and utilities as regards road and railway development and maintenance.

Objective 2. Establish a working relationship with New England Central Railroad in their maintenance of track-bed, etc., and explore possible use of the rails for future commercial activities.

Community Utilities, Facilities and Services Element:

Goal: Continue to provide Roxbury with excellent fire protection services with trained volunteers and well maintained equipment.

Action Plan:

- Complete the installation of dry hydrants at the identified areas of greatest need.
- Use available opportunities to publicize/advertise the need for volunteers.
- Continue to support "the fund" on a yearly basis for eventual replacement of the 1989 First response truck

Goal: Improve communication and cooperation among town groups and officials.

Objective 1. Community members are encouraged to strengthen the links between home, community and school through their personal involvement.

Objective 2. The town encourages active volunteer membership in community organizations.

Goal: Provide for the municipal and educational needs of the town while maximizing the efficiency and cost effectiveness of these services.

Objective 5. Evaluate the benefits of developing a capital budget for town government facilities and services as a means of stabilizing tax rates.

Land Use Element

Goal: Maintain and preserve the town's rural residential character of a compact village surrounded by rural countryside.

Objective 1: Investigate need for land-use regulations which recognize distinct districts and regulate land use activities to ensure compatibility with the purpose of the respective districts.

b. Maintain the Forest Reserve District for the purpose of protecting significant forest resources and headwater streams and to limit development in areas with steep slopes, shallow soils, wildlife habitat, fragile features, scenic resources and poor access to town roads, facilities and services.

Goal: Manage land use in order to encourage protection of open lands, support for commercial business, revitalization of the village, protection of the forests, streams and wildlife habitat.

Objective 1: Promote the efficient use of land and inhibit the further suburbanization of our rural landscape.

d. Through an ongoing planning process, ensure that capital improvement planning is coordinated with land use planning.

Goal: With citizen participation, establish a reasonable balance between land use planning and rights of individual land owners.

Objective 1: To balance the necessary restrictions of land use regulations with the reasonable expectations of landowners.

b. Continue administering and enforcing the Town's ordinances and regulations, and reviewing those ordinances on a regular basis and making revisions as deemed appropriate.

6.3 Proposed Hazard Mitigation Programs, Projects and Activities

The state emphasizes a collaborative approach to achieving mitigation on the local level, by partnering with ANR, VTrans, ACCD, Regional Planning Commissions, FEMA Region 1 and other agencies, all working together to provide assistance and resources to towns interested in pursuing mitigation projects and planning initiatives.

The Hazard Mitigation Activities Matrix below lists mitigation activities in regards to local leadership, partners, possible funding resources, timeframe for completion, and prioritization.

The projects were selected and prioritized by considering them according to the particular hazard addressed, its overall risk to the community, the likely benefit of the proposed project for mitigating that risk, and the cost of the project. Other factors such as financial resources available, community support, and available staff capacity for project implementation were also weighed by the local hazard mitigation team. Factors were considered qualitatively, except when specific cost, financial or other measurement information was available. Final prioritization also had to be weighed against overall staff capacity to bear the total work load scheduled at any point through the five year implementation cycle, including help from outside technical and consulting assistance. As a guide, when determining the cost/benefit of the project the team considered a project with a cost >$100,000 to be high, >$25,000 - $100,000 medium, and <$25,000 to be low. When looking at the benefit of a project, a project that addressed public safety was high, a project that addressed infrastructure and or general maintenance was medium, and a project that addressed aesthetics/functionality was low.

The team considered how these various factors balanced each other, in a spectrum from highly important projects, to projects that should be pursued after the others. Highest priority projects had a very high risk to the community and a mitigation solution that was likely to mitigate most of the problem. The costs of the high priority projects were attainable by the municipality, or funding assistance was readily available. Highest priority projects also enjoyed strong community support and staff capacity was available to carry them out. Medium priority projects had a moderate risk to the community and a mitigation solution that was likely to mitigate some of the problem and the action is less critical. The municipality had a limited ability to cover the cost of a medium priority project and usually funding required a significant match. Medium priority projects had some community support and limited staff capacity to carry them out; usually having to shift work loads. Lowest priority projects were of lower risk to the community, had solutions that did not mitigate very much of the problem, or were extremely expensive or with no financial assistance available. Projects for which there was little community support or available staff capacity would also be low priority.

	High Priority Project	Medium Priority Project	Low Priority project
COST	<$25,000 (low)	>$25,000 - $100,000 (med.)	>$100,000 (high)
BENEFIT	addressed public safety	addressed infrastructure &/or general maintenance	addressed aesthetics/functionality
Risk to Community	High community vulnerability	Medium community vulnerability	Low community vulnerability
Mitigation Solution	Likely to mitigate most of the problem	Likely to mitigate some of the problem	Likely to mitigate little or none of the problem
Funding	readily available/attainable	Limited funding; may require a significant match	No financial assistance available
Staff Capacity	Available to carry out	Limited capacity	Little or no capacity
Community Support	strong	average	weak

In some cases the factors were mixed. For example, a project might be very expensive, and unpopular, but the risk to the community is so great that officials must use their judgment to act in the best interest of the community. In this case, if the project cost or funding assistance can be spread out over several years, the team would prioritize this project as medium or high. Other various combinations of factors required the Mitigation Team to balance factors against each other to decide on the most appropriate prioritization. Numerical quantities were not assigned to balance the factors, however the Team considered each prioritization in the scope of the other projects, LHMP priorities and overall community priorities.

Roxbury understands that in order to apply for FEMA funding for mitigation projects that a project must meet FEMA benefit cost criteria. The Town must also have a FEMA approved Hazard Mitigation Plan in effect.

A chart documenting the mitigation projects considered and the factors considered is included as an attachment. The strategies will be implemented using the existing Town capacity.

<u>The Hazard Mitigation Project Schedule Prioritization</u>:

1. Work with VT DEC (ANR) to analyze how to prevent non-compliant structures in the future and to identify and bring existing non-compliant structures into compliance –

   Cost: Low
   Benefit: High
   Priority: Low

   Consideration: This action is a low priority despite the benefit of life safety and low cost. The Town is enrolled in and currently in compliance with NFIP. Roxbury updated their Flood Hazard Regulations in 2010 which prohibit new construction in the Special Flood Hazard Areas reducing the community vulnerability. Currently there are only 5 existing structures in the SFHA and no repetitive loss properties. This project is of lower risk to the community and had little community support.

2. Take actions to reach a consensus decision of which mitigation project to pursue to protect Roxbury Flats from flooding of Flint Brook.

Cost: Low to High depending upon activities included. (for example, a buyout is extremely expensive)
Benefit: High
Priority: High

Consideration: This project is a high priority despite the potential for high cost because the risk to the community is high, the mitigation actions are likely to solve most of the problem, there is strong community support and the activities are eligible for federal and state funding. A Scoping Report was released by Santec in late 2013 with alternatives for consideration.

3. Explore stream management permitting at the south end of Roxbury village where flooding occurs.

Cost: Medium
Benefit: Medium to High
Priority: Medium

Consideration: The project will address infrastructure and or general maintenance and may benefit life safety if the hazard of fluvial flooding can be reduced by the action. The project will require coordination, cooperation, and state permitting which may take time and patience. The action has community support and is likely to mitigate some of the problem. The topic of stream permitting is controversial. Outside funding is required and the proposed funding source requires a significant match.

4. Better Roads Erosion Inventory & Capital Budgeting: Conduct assessment to develop budgeting plan for highway infrastructure improvements that address water quality and fix infrastructure at-risk to erosion from water

Cost: Low (Grant awarded)
Benefit: Medium
Priority: High

Consideration: This project has received grant funding so the cost to Roxbury is low and the project will benefit Roxbury in planning for its Infrastructure; road erosion inventory and assessment and development of a Capital Budget. The project has short and long range benefits. The community support for the project is strong and the town has the capacity to carry it out with technical support provided by CVRPC, ANR and AOT staff. The project will assist the town in compliance with the new Water Quality regulations affecting VT.

5. Apply for 2017 Better Roads grant to fix culvert on Cram Hill Road (1.84 miles from Rt.12A) that washes straight across road causing some damage. Aug. 2013 Hydraulic Study.

Cost: Medium
Benefit: Medium to High
Priority: High

Consideration: This project will benefit the town infrastructure and general maintenance. Reducing or eliminating the damage has a secondary benefit of public safety.

Funding is readily available from AOT. There is strong community support for this project. The project is a follow up measure to the 2013 Hydraulic Study that was completed for the Town. Town capacity can be augmented by technical support provide by CVRPC and AOT staff. The community is vulnerable and it is in the communities best interest to rate this as a high priority.

6. Participate in next Rail Car Incident Response Course offered by VT Dept. of Public Safety or State Fire Academy

   Cost: Low
   Benefit: High
   Priority: Medium

   Consideration: The training is free but requires an eight hour time commitment plus transportation and food costs to be covered by the municipality, town official, or First Responder. Participation is subject to schedule availability and course offering. The course is an awareness level training course that addresses public safety and town infrastructure. It is important for Roxbury to take advantage of training opportunities and as such is a medium priority.

7. Establish protocols with GMP & Wash. Electric for reporting imminent hazards threatening the electrical system

   Cost: Low - Medium
   Benefit: Medium to High
   Priority: High

   Consideration: Power outages and downed power lines and trees are a hazard for Roxbury that impacts the most vulnerable populations. Therefore, assuring protocols are in place to communicate effectively with the utility companies in the event of hazardous situations threatening the electrical system is a high priority. The benefit of this project to public safety and critical infrastructure is extremely high. The cost to the community can vary and be scattered depending upon the event. Preventative practices can help reduce that cost. The community is vulnerable and it is in the communities best interest to rate this as a high priority. There is strong support in the community for this project.

Hazard Mitigation Projects Schedule

Hazards Mitigated	Mitigation Action	Local Leadership	Partners	Possible Funding Resources	Project Time Frame Start & End	Priority
Regulatory Flood Mitigation Measures						
Flooding/ Flash Flooding/ Fluvial Erosion & Ice Jam	Work with VT DEC (ANR) to analyze how to prevent non-compliant structures in the future and to identify and bring existing non-compliant structures into compliance	Selectboard, Planning Commission, Local Floodplain Administrator	CVRPC, VT DEC State Floodplain Manager	CVRPC Technical Assistance, Town Budget	Spring 2017-Spring 2018	Low
Non-Regulatory Flood Mitigation Measures						
Flooding/ Flash Flooding/ Fluvial Erosion	Take actions to reach a consensus decision of which mitigation project to pursue to protect Roxbury Flats from flooding of Flint Brook. Such activities could include: • identify interests & build consensus of property owners in Roxbury Flats neighborhood. • buyout, elevate, or flood proof vulnerable homes • other options developed in consultation with property owners	Selectboard	CVRPC, VTrans, DEMHS, NECR	Town Budget, Other TBD	Fall 2017-Fall 2022	High
Flooding	Explore stream management permitting at the south end of Roxbury village where flooding occurs. Coordinate presentation, on site meeting, and discussion with permitting authorities, the municipality, and landowners to determine under what circumstances removal of woody debris and sediment, or other active management projects, could be permitted.	Selectboard	ANR Rivers Managmnt. & Wetlands Divisions	FEMA Hazard Mitigation Grant Program	Spring 2017-Summer 2018	Med
Transportation						
Flooding/ Flash Flooding/ Fluvial Erosion	Better Roads Erosion Inventory & Capital Budgeting: Conduct assessment to develop budgeting plan for highway infrastructure improvements that address water quality and fix infrastructure at-risk to erosion from water	Selectboard & Road Commissioner/ Foreman	ANR, Agency of Transportation, CVRPC	ANR Better (Back) Roads (grant	Summer-Winter 2017	High

Hazard Mitigation Projects Schedule

Hazards Mitigated	Mitigation Action	Local Leadership	Partners	Possible Funding Resources	Project Time Frame Start & End	Priority
				already awarded)		
Flooding/ Flash Flooding/ Fluvial Erosion	Apply for 2017 Better Roads grant to fix culvert on Cram Hill Road (1.84 miles from Rt.12A) that washes straight across road causing some damage. Aug. 2013 Hydraulic Study.	Road Commissioner	ANR, Agency of Transportation, CVRPC	ANR Better (Back) Roads	Spring 2017-Summer 2017	High
Railroad						
Railroad Transport Accident	Participate in next Rail Car Incident Response Course offered by VT Dept. of Public Safety or State Fire Academy	Fire Chief & Emergency Management Director (EMD)	VT Dept. of Public Safety, State Fire Academy	No Cost Training	October 7, 2017 @ Berlin, VT (Next offering not scheduled but Spring 2018 possible)	Med
Severe Storm or Severe Winter Weather Causing Power Outage						
Severe Storm or Severe Winter Weather Causing Power Outage	Establish protocols with GMP & Wash. Electric for reporting imminent hazards threatening the electrical system	EMD, Road Foreman, Fire Chief	GMP, Washington Electric, CVRPC	Town Budget, Volunteer resources	Start & Complete in June 2017	High

6.4 Plan Maintenance

The Roxbury Local Hazard Mitigation Plan will be monitored and evaluated annually at a September Select Board meeting. This will allow the Selectboard to determine the status of mitigation projects before developing the next fiscal year budget over the course of the fall. The Selectboard will note projects completed and underway and whether or not the project is meeting the communities' goals for hazard mitigation. The Selectboard will note projects to be continued or started during the next fiscal year. Looking ahead at the timing of mitigation projects, the Selectboard will be able to plan ahead for them by adding any appropriate projects, or continued financial support, into the budget.

Individual staff or volunteer officials responsible for each project will report to the Selectboard at this annual September meeting on the status of their project(s) and their evaluation of the effectiveness of the project at achieving Roxbury's hazard mitigation goals. This status and evaluation will be noted in the meeting minutes, and a copy of the minutes filed with the Local Hazard Mitigation Plan by the Town Clerk.

Review and evaluation by the Select Board will also occur within three months after every federal disaster declaration and as updates to town plan/inundation regulations and river corridor plans come into effect. CVRPC will help with updates or if no funding is available, the Town Clerk and Select Board will update the LHMP.

The process of monitoring and evaluating the plan will include continued public participation through public notices posted on the municipal website and notice in the municipal building inviting the public to the scheduled Select Board (or specially scheduled) meeting(s) to give feedback. Also invited in the future will be the VT Agency of Natural Resources (VT ANR), as they are able to provide assistance with NFIP outreach activities, models for stricter floodplain zoning regulations, delineation of fluvial erosion hazard or River Corridor areas, and other applicable initiatives. These efforts will be coordinated by the Town Clerk and Local Floodplain Administrator.

The 5 year update process, will be undertaken by the Town Clerk, Emergency Management Director, Local Floodplain Administrator and appropriate staff and volunteer officials leading up to the expiration of this plan. Ideally, this update and adoption process will begin one year before this plan expires. If priorities for mitigation projects change or new actions are identified in the five year interim period, this can be noted in the Selectboard minutes and attached to the Plan for future reference and incorporation into the next updated plan. During the 5 year period with an approved, unexpired plan, the plan can be amended by the Selectboard without FEMA approval. Prior to the expiration of this plan, the plan will be submitted for re-adoption following the update process outlined in the schematic found in the Attachments section.

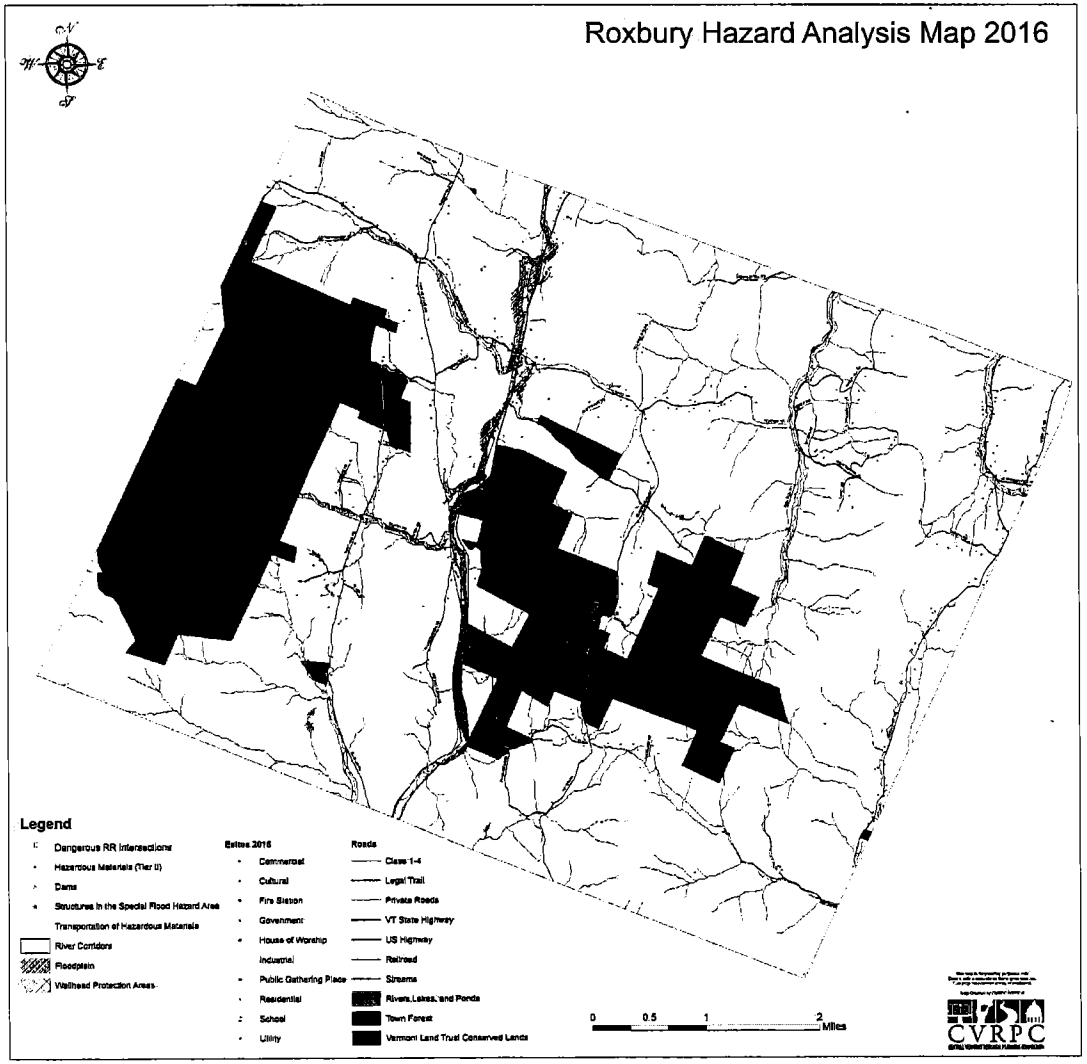
6.5 Integration into Other Planning Mechanisms

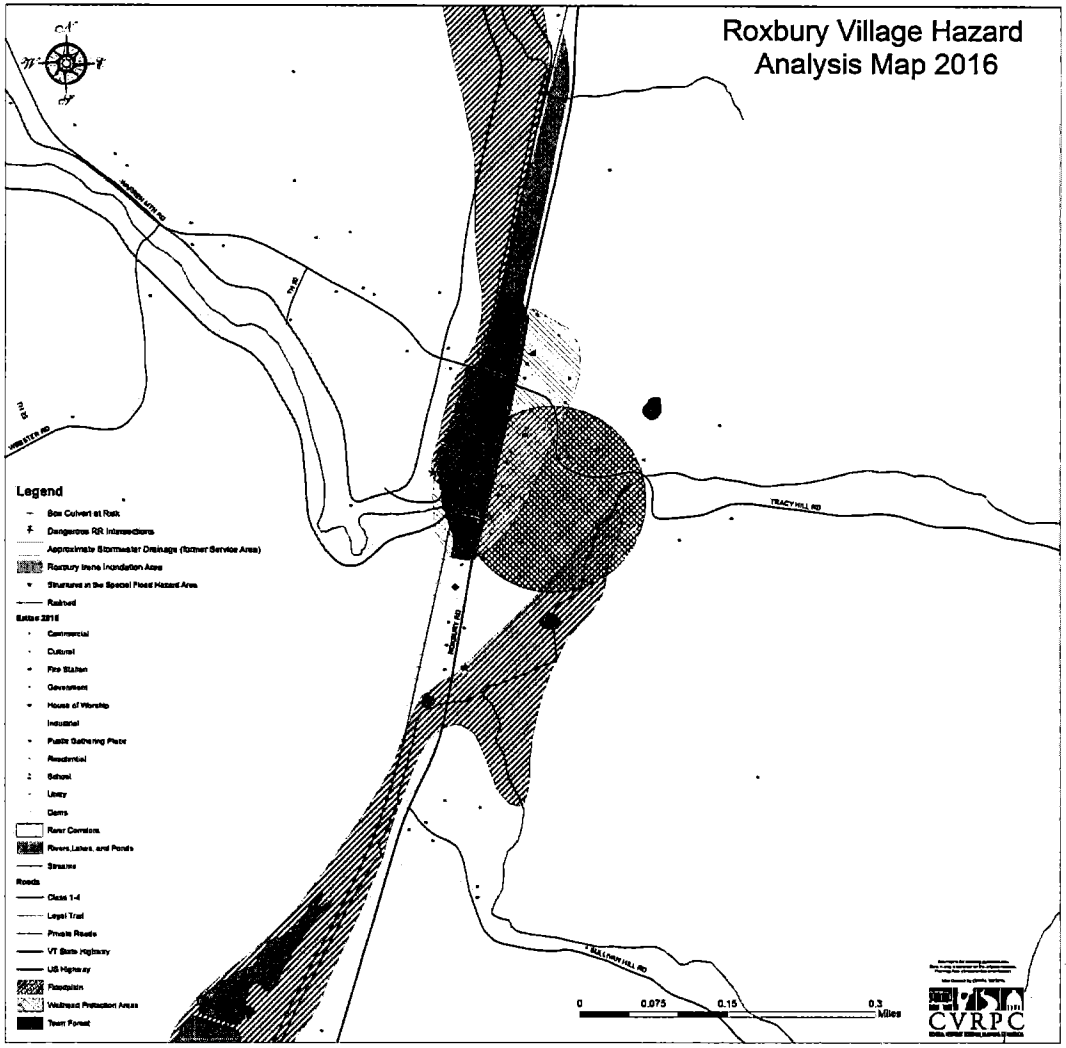
Roxbury shall also incorporate mitigation planning into other planning processes to reflect and integrate, as appropriate, the goals of this plan. The primary processes will be budgeting and the Town Plan. The LHMP will be integrated into budgeting as described above. The Town Plan will be updated in 2019, and includes data and information gathering and goal setting that can incorporate data and goals from the LHMP.

The Local Emergency Operations Plan (LEOP) is formally updated once a year after Town Meeting and the list of primary contacts is updated to address any appointment of new officers. It identifies important hazard areas to check during an emergency, vulnerable sites and populations, emergency shelters and lists Tier II sites. The LEOP should reflect the hazards identified in the Local Hazard Mitigation Plan and any review undertaken by the Selectboard, especially at the annual review meeting held in September.

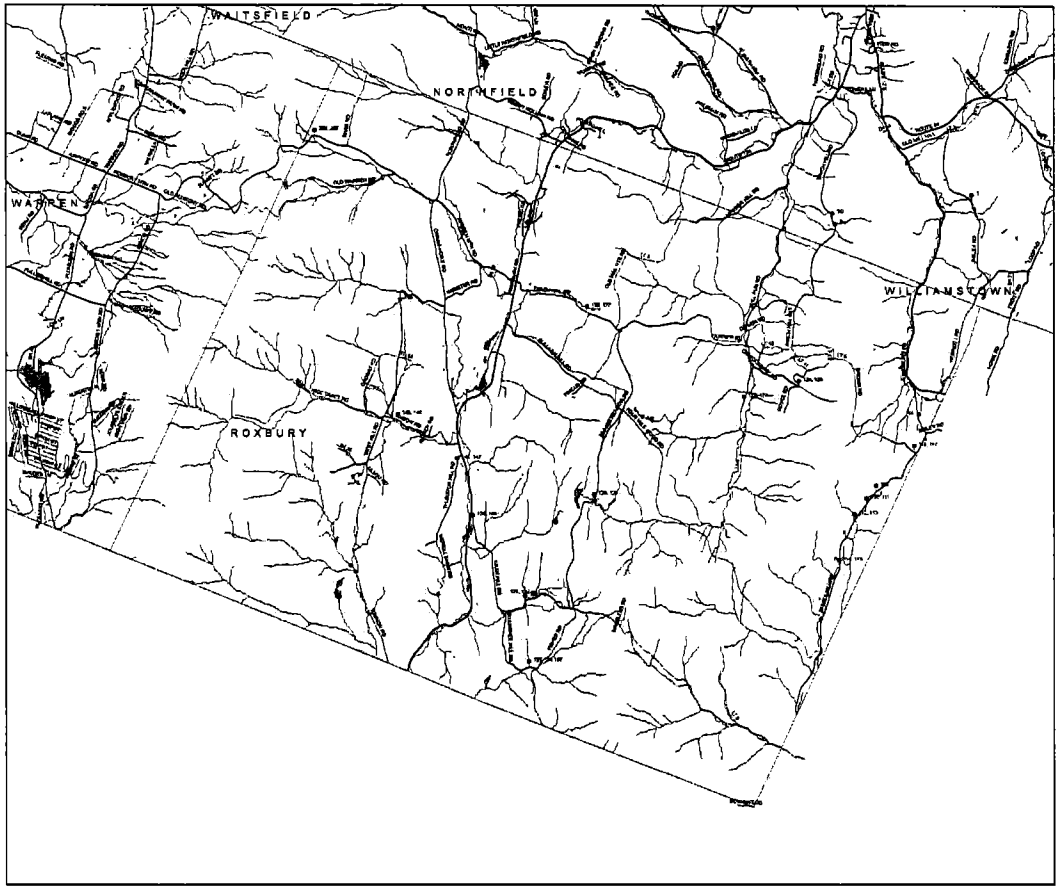
Attachments

- Hazard Analysis Map
- Roxbury Village Hazard Analysis Map
- Transportation Vulnerability Assessment Map
- Bridge & Culvert Project Development Priorities
- Potential Mitigation Action Analysis & Prioritization Chart
- NFIP Community Rating System Quick Check
- Emergency Relief & Assistance Fund Eligibility criteria – 17.5% State Share
- Dog River Corridor Plan Projects Table and Map
- Dog River Corridor Plan Fluvial Erosion Hazard Zone Map
- Hazards from previous Hazard Mitigation Plan which are no longer considered a significant hazard
- Public Engagement Documentation
- 5 year plan maintenance and review process
- Certificate of Adoption


Roxbury Hazard Analysis Map 2016
Legend
Dangerous RR Intersections
Hazardous Materials (Tier II)
Dams
Structures in the Special Flood Hazard Area
Transportation of Hazardous Materials
River Corridors
Floodplain
Wellhead Protection Areas
Enhes 2016
Commercial
Cultural
Fire Station
Government
House of Worship
Industrial
Public Gathering Place
Residential
School
Utility
Roads
Class 1-4
Legal Trail
Private Roads
VT State Highway
US Highway
Railroad
Streams
Rivers, Lakes, and Ponds
Town Forest
Vermont Land Trust Conserved Lands
0 0.5 1 2 Miles
CVRPC


Roxbury Village Hazard
Analysis Map 2016
Legend
Box Culvert at Risk
Dangerous RR Intersections
Approximate Stormwater Drainage (former Service Area)
Roxbury Irene Inundation Area
Structures in the Special Flood Hazard Area
Railroad
Existing 2016
Commercial
Cultural
Fire Station
Government
House of Worship
Industrial
Public Gathering Place
Residential
School
Library
Dams
River Corridors
Rivers, Lakes, and Ponds
Streams
Roads
Class 1-4
Legal Trail
Private Roads
VT State Highway
US Highway
Floodplain
Wetland Protection Areas
Town Forest
TRACY HILL RD
HOLLMAN HILL RD
0
0.075
0.15
0.3
Miles
CVRPC

Transportation Vulnerability Analysis Map



Town of Roxbury

Legend

- GPS Sites for Potential Flood Resiliency Improvements
- Install Cross Culverts

Roads

- Class 1-3
- Class 4
- Forest Roads and Private
- VT State, US and Interstate
- Legal Trail and Discontinued

ID	Comment	photo
0	culvert undersized	9068, 9087, 9088, 9089
1	culvert undersized	9010, 9011
2	culvert undersized	9046, 9047
3	culvert undersized	9066, 9069
4	culvert undersized	
5	culvert undersized	
6	undersized w/ encroachment	9080,9084, 9087
7	culvert undersized	9088, 9089
8	culvert undersized	9089, 9090
9	culvert undersized	9102, 9103
10	culvert undersized	9104, 9105
11	culvert undersized	
12	undersized	9080, 9081, 9082
13	not clear road/culvert	9099

N

CVRPC

Bridge & Culvert Project Development Priorities

Roxbury LHMP 2017 — Bridge and Culvert — July 26th, 2016

Transportation Vulnerability Analysis — Project Development Priorities

Site	Road	Structure	ID#	Notes	Funding Status
below Bailey Rd.	Lower Steele Hill Rd.	culvert	Local ID #20004	After 7/3/2013 roadway inspection FEMA "The Doctor" recommended upsize to 4' culvert for insurance purposes as washes into dooryard of nearby mobile home. Deep roadbed over culvert, 8-10 feet of fill.	no resources investigated yet, B(B)R idea
probably 110 &111	Steele Hill Rd.		Local ID 20017 & 20015	by beaver pond. Could be improved along with Local ID#20004 in bundled project	
114, 115. 112,113. 110,111. 109. 116, 117. & unnumbered	Steele Hill Rd.	All are Steele Hill culverts		5-10 year project to fix erosion & upsize culverts according to CVRPC GIS Tech. may need equipment not owned by town???	
over Sunny Brook	Tenney Rd	bridge	TH 17 BR 47??	July 2014 Hydraulic Study - also in need of structural repair. temporary repair made. Long term repair needed.	$400,000 estimated cost
"Site 4"	Raynor Rd	culvert		Conduct new Hydraulic Study (Oct. 2011 Hydraulic Study outdated)	no resources investigated yet
"Site 1"	Drown Rd	culvert		Aug. 2013 Hydraulic Study - functioning but needs to be replaced eventually. Lower priority	
"Site 2"	Drown Rd	culvert		functioning but needs to be replaced eventually. Lower priority	
2.25 miles from TH 23 Carrie Howe Rd.	West Hill Rd	culvert		May 2013 Hydraulic Study	financing development needed
TH 26 BR 42	Oxbow Rd.	bridge	TH 26 BR 42	Feb. 2012 Hydraulic Study & Dec. 2013 DRAFT Stantec Flint Brook/Oxbow Rd. Scoping Report. Four alternatives were assessed in 2013 but none were satisfactory to all stakeholders. The project has not moved forward since then.	lack of stakeholder consensus impedes project > financing
1.84 miles from Rt.12A - photos 133/134	Cram Hill Rd	culvert		Aug. 2013 Hydraulic Study, less priority b/c stream washes straight across road vs. eroding along shoulder. Included in LHMP implementation Plan b/c adequate financing likely available	will seek 2017 Better Roads grant appl.

Based on review of CVRPC Transportation Vulnerability GIS Analysis Field Observations with Road Foreman, June 2016, and additional observations and recommendations of Road Foreman 7/26/2016

Potential Mitigation Action Analysis & Prioritization Chart

Name	Hazard & Vulnerabilities Mitigated	Mitigation Action	Financial Resources Available	Cost, Match, Vol./Staff Capacity Required	Benefit for Mitigating Risk Community Support Staff/Vol. Capacity Available Overall Cost/Benefit Conclusion	Selection &/or Priority
Regulatory Flood Mitigation Measures						
Fluvial Erosion & River Corridors	Fluvial Erosion	Conduct community input project to evaluate if there are benefits and community support for adding to the Flood Hazard Bylaws to conform w/state River Corridor requirements, allowing Roxbury to maintain 17.5% ERAF State Share	Municipal Planning Grant, EMPG	Host River Scientist Presentation, 3-4 outreach activities	Community support expected to be very low	Not Selected
Fluvial Erosion & River Corridors	Fluvial Erosion	If community elects to bring FHO regs into conformance with State Models, make and adopt necessary revisions.	Municipal Planning Grant, EMPG	2-3 PC meetings, adoption hearings	Community support expected to be very low	Not Selected
NFIP Outreach	Flooding in mapped floodplain	Improve outreach, education & publicity about the Inundation Hazard Area Regulations - Website: alert to NFIP & regulations, overview (why & what is it), post regulations & a map, contact info for AO & BoA - other outreach @ events, town meeting, town report, community newsletter, in mailings & w/deed/property info	CVRPC Technical Assistance	website update, disseminate info, host presentation, event announcements	Significant benefit for mitigating risk, however community support indicated via outreach lower than other projects	Not Selected
Floodplain Admin. Capacity	Flooding in mapped floodplain	Maintain & improve local Floodplain Administration capacity through trainings, conferences and consultation with RPC and State resources	CVRPC Technical Assistance, Town Budget	most trainings & conferences low-cost or free, 1-2 trainings/conf. per year, phone calls/meetings w/CVRPC & VT DEC	Significant benefit for mitigating risk, however community support indicated via outreach lower than other projects	Not Selected
Prevent Non-Compliant Structures	Flooding in mapped floodplain	Work with VT DEC (ANR) to analyze how to prevent non-compliant structures in the future and to identify and bring existing non-compliant structures into compliance	CVRPC Technical Assistance, Town Budget	1-2 calls/meetings w/VT DEC, meetings/calls with property owners, records review, site visits	Very strong likelihood to mitigate vulnerability of flood damage, capacity through technical assistance and training available	Selected
Non-Regulatory Flood Mitigation Measures						

Name	Hazard & Vulnerabilities Mitigated	Mitigation Action	Financial Resources Available	Cost, Match, Vol./Staff Capacity Required	Benefit for Mitigating Risk Community Support Staff/Vol. Capacity Available Overall Cost/Benefit Conclusion	Selection &/or Priority
			Transportation			
Better Roads Erosion Inventory	Flooding, Flash Flooding & Fluvial Erosion: highway infrastructure at risk to erosion from water	Conduct Road Erosion Assessment to develop capital budgeting plan for highway infrastructure improvements to address water quality and infrastructure at risk to erosion from water	ANR Better Roads grant already awarded	$15.5K Project Cost, 20% Match, 40 hours local staff time	Benefit of mitigating vulnerability is strong, financial and technical assistance resources are readily available and already committed to Roxbury	Selected
Priority Bridges & Culverts	Flooding, Flash Flooding & Fluvial Erosion: bridge & culvert projects	Bridge & Culvert projects prioritized for implementation (1 project or project development; see table in attachments)	ANR Better Roads, VTCP		Benefit of mitigation will be strong, resources likely to be available for 1 project, remaining project scopes need further definition and financing for next development	Selected

Name	Hazard & Vulnerabilities Mitigated	Mitigation Action	Financial Resources Available	Cost, Match, Vol./Staff Capacity Required	Benefit for Mitigating Risk Community Support Staff/Vol. Capacity Available Overall Cost/Benefit Conclusion	Selection &/or Priority
	prioritized by Road Foreman					
			Water Supply Contamination			
			Railroad			

Name	Hazard & Vulnerabilities Mitigated	Mitigation Action	Financial Resources Available	Cost, Match, Vol./Staff Capacity Required	Benefit for Mitigating Risk Community Support Staff/Vol. Capacity Available Overall Cost/Benefit Conclusion	Selection &/or Priority
Severe Storm or Severe Winter Weather Causing Power Outage						
Transmission Hazard Protocol	Severe Storm or Severe Winter Weather Causing Power Outage	Establish protocols with GMP & Wash. Electric for reporting imminent hazards threatening the electrical system	Town Budget, Volunteer resources	3-4 meetings or phone calls	Municipal officials consider to have strongest feasibility of mitigation benefit for the local capacity resources necessary to implement it	Selected
Power Restoration	Severe Storm or Severe Winter Weather Causing Power Outage	—Negotiate with utilities for higher priority power restoration for town	Town Budget, Volunteer resources	several meetings w/utility officials	Feasibility of benefit lower than others against level of limited capacity	Not Selected
CARE	Severe Storm or Severe Winter Weather Causing Power Outage	—Conduct outreach to vulnerable residents about CARE: Citizens Assistance Registration for Emergencies	Town Budget	printing of registration forms, set up and/or announcement at Town Meeting	Feasibility of benefit lower than others against level of limited capacity	Not Selected
Town Office Generator	Severe Storm or Severe Winter Weather Causing Power Outage	Obtain generator for Municipal Offices (EOC)	Town Budget	price, obtain bids for installation	Funding resources not readily available	Not Selected
Invasive Tree Pests						
Tree Inventory & Preparedness Plan	Invasive Tree Pests (Emerald Ash Borer, etc.)	Take actions to evaluate Roxbury's risk to invasive tree pests with more accuracy 1. Invite the Forest Pest Outreach Coordinator to present the available information on Roxbury's risk, and the options available for prevention/mitigation 2. Conduct a roadside tree inventory to more accurately define tree species composition of Roxbury's forests 3. develop a Preparedness Plan or undertake other appropriate mitigation actions depending on risk, volunteer capacity and other factors	UVM Extension & ANR Community Forestry Technical Assistance	1-2 meetings, 1-2 day in the field, recruiting volunteers	Overall vulnerability was determined to be lower than perceived based on additional research. Community support likely to be low.	Not Selected
First Detector Training	Invasive Tree Pests (Emerald Ash Borer, etc.)	Participate in or publicize Forest Pest First Detector Training	No Cost Training	1 day training	See above.	Not Selected

NFIP Community Rating System Quick Check

CRS Quick Check

Community Name	Town of Roxbury	State	VT	BCEGS	10
NFIP Number		FIRM Effective Date			
Population		Current FIRM Date			
Application Date		County	Washington		

Chief Executive Officer	CRS Coordinator
Name	N/A
Title	
Address	
Address	
CRS Coordinator's phone	Fax
CRS Coordinator's e-mail	

Section		Prerequisites	Met	Can Meet	Enter
211	a(2)	Have you had a Community Assistance Visit that concluded you are in full compliance with the NFIP?			
	a(4)	How many repetitive loss properties are there in your community?			0
	a(4)	What is your repetitive loss category? (A = no rep losses, B = 1 - 9, C = 10 or more)			A
	a(5)	Have you maintained flood insurance policies on all buildings that have been required to have one?			
213	a	How many buildings are in your community's Special Flood Hazard Area?			6
	a	How large is your community's Special Flood Hazard Area (in acres)?			203

		CRS Activities and Elements	Now	Could	Credit	Max
310	a	Will you keep FEMA Elevation Certificates on all new buildings and substantial improvements in the SFHA?	38	0	38	38
	b	Do you have FEMA Elevation Certificates on buildings built before your CRS application?		12	12	12
320	a	Are you willing to publicize that you will read FIRMs for inquirers and keep a record of what you told them?		30	30	30
	b	Do you provide inquirers with other non-insurance related information that is shown on your FIRM?			20	20
	c	Do you provide information about flood problems other than those shown on the FIRM?	20		20	20
	d	Do you provide information about flood depths?	20		20	20
	e	Do you provide information about special flood-related hazards, such as erosion, subsidence, or tsunamis?		20	20	20
	f	Do you provide information about past flooding at or near the site in question?		20	20	20
	g	Do you provide information about areas that should be protected because of their natural floodplain functions?	0	20	20	20
330	a	Enter 2 points for each flood-related informational brochure, flyer, or other document that is set out for the public to pick up.	0	2	200	200
	a	Enter 4 points for each flood-related newsletter, presentation, or other outreach project that is implemented every year.	0	0		
340	a	Do real estate agents actively advise house hunters if a property is located in a Special Flood Hazard Area?	25		25	25
	b	Are there state or local requirements that sellers must disclose whether a property has been flooded?			15	15
	c	Do real estate agents give house hunters a brochure or handout advising them to check out the flood hazard before they buy?	0	0	7	7
350	a	Do you have any flood-related references in your public library?			2	20
	c	Do you have flood-related information or links on your community's website?	15		15	100
360	a,b	Do you visit homes and help people determine how they could reduce their flooding or drainage problem?			25	85
	c	Do you talk to people about sources of financial assistance for flood or drainage protection measures?		5	5	15
370		Have you reviewed all your community's flood insurance policies and analyzed where coverage should be improved?		0	15	110

CRS Quick Check

		Community Name	Town of Roxbury	State	VT		BCEGS	10
410	a	Have you conducted your own flood studies and do you use the data when regulating new development?				50	50	250
	a	Do you provide (or require the developer to provide) base flood elevations in approximate A Zones?			50		50	100
	b	Did your community contribute to the cost of a Flood Insurance Study (e.g., provided cash or a base map with better topography)?				0	20	200
420	a	What percentage of your Special Flood Hazard Area is kept as park or other publicly preserved open space?			0%	0%	0%	100%
		The percentage is multiplied by 1,450 to obtain the score.			0	0	0	1,450
	c	Are some of those parks or other publicly preserved open spaces preserved in or restored to their original natural state?			15		15	350
	e	Does your community have density transfers or other regulations to encourage developers to keep the SFHA as open space?			0		15	250
	f	What percentage of your SFHA is zoned for minimum lot sizes of 5 acres or larger?			0%	0%	0%	100%
		The percentage is multiplied by 300 to obtain the score.			0	0	0	600
430	a(1)	Does your community prohibit filling or require compensatory storage in all or parts of the SFHA?			100		100	250
	a(2)	Does your community prohibit certain types of buildings from all or parts of the SFHA?			100		100	1,000
	a(3)	Does your community prohibit or limit the storage of hazardous materials from all or parts of the SFHA?			10		10	50
	b	Does your community have a freeboard requirement?				80	80	500
	c	Do you have compaction and erosion protection requirements for fill that is used to support buildings?				30	30	30
	d	Do you track building improvements and repairs cumulatively and add the values up to reach the 50% threshold?			0	0	0	90
	d	Do you define substantial damage to include two floods in 10 years with average damage at 25% of the building's value?			0	20	20	20
	f	Do you require critical facilities to be protected to the 500-year flood level?			0	20	20	30
	g	Do you require a nonconversion agreement signed by the permit applicant for an elevated building?			0	30	30	240
	h	Does your community enforce the International Building and Residential Codes (IBC and IRC)?			40		40	50
		If your BCEGS class is 5/5 or better, your BCEGS credit is calculated automatically.				0	0	50
	i	Do you have regulations that ensure that every new building will be built to be protected from local drainage flooding?			0		13	120
	o	Enter 5 points for every CFM or graduate of an EMI NFIP course, up to a maximum of 25 points.			0	0	0	25
	o	Do you keep paper records at a secure offsite storage site or scan them and back up the files?			0	5	5	5
440	a	Is your FIRM on a local geographic information system (GIS) layer and does the GIS also show streets and parcels?				0	50	150
	b	Have you kept copies of all your old FIRMs?			10		10	15
	c	Use the handout, "CRS Credit for Benchmark Maintenance," to see if there are any qualifying benchmarks in the National Spatial Reference System.			X	X	5	21
450	a	Do you require new developments to build stormwater retention or detention basins?			0	0	50	350
	c	Do you have permit records that show that you require new developments to control erosion from construction projects?			0	0	10	40
	d	Do you have permit records that show that you require new stormwater facilities to include water quality provisions?			0	0	23	20
510	a	Have you adopted a floodplain management or hazard mitigation plan that has been approved by FEMA?			50		50	368
	c	Have you adopted a plan to protect aquatic or riparian species or other natural floodplain functions?				15	15	100
520		Enter 3 points for every building that has been cleared out of the floodplain up to a maximum of 190 points.			3		N/A	2,250
530		Enter 2.4 points for every pre-FIRM building that has been elevated voluntarily, up to a maximum of 160 points.			0	0	N/A	1,600
540	a	Do you have a documented program to regularly inspect streams, ditches, and other channels and to remove debris when found?			0	0	40	200
	c	If you have credit for 540.a, do you have a capital improvements program for drainage improvements?			0	0	30	30

CRS Quick Check

		Community Name	Town of Roxbury	State	VT		BCEGS	10
	d	If you have credit for 540.a, do you have an ordinance the prohibits dumping debris, junk, grass, etc., in drainageways?		0	0			
	e	If you have credit for 450.a, do you have a program to regularly inspect storage basins and to remove debris when found?		0	0			
610	a - d	Do you have a system for getting notification when flooding is expected (more than listening to the radio)?		25				
		Do you have a flood response plan (or flood annex to the emergency plan) that specifies what to do after a flood notification?			25			
		Do you have a master list of critical facilities in the floodplain and arrangements for special warnings to them?			25			
	e, f	Are you a StormReady or TsunamiReady community? (see www.stormready.noaa.gov/).		0	0			
620	a - e	Do you have a levee, a levee maintenance program, and a levee failure warning and response plan (similar to 610 a-d)? Is there an annual outreach project sent to properties in the area that would flood if the levee were overtopped?		0	0			
630	a	Is your community threatened by a failure of an upstream dam? If so, enter the credit for the state's dam safety program, i.e., the value for "SDS" from the "Dam Safety Scores" tab in this Excel file.		0	0			
	b - e	Do you have a dam failure warning and response plan (similar to 610 a-d)? Is there an annual outreach project sent to properties in the area that would be flooded if the dam failed?		0	0			
710		Enter your county's growth rate, i.e., the value for "CGA" from the right column on the "Growth Rates" tab in this Excel file.		1.03	1.03			
				Now	Could			
			Total	531	396			
			Total "Now" + "Could"		927			
			Product	1.06	1.85			
			Potential CRS Class	9	9			

Emergency Relief & Assistance Fund Eligibility Criteria – 17.5% State Share

BACKGROUND:

The Emergency Relief and Assistance Fund (ERAF) rule was amended in September 2012, which created a sliding scale framework for cost share on the non-federal match requirements for FEMA Public Assistance Grants. The new ERAF rule took effect in October 2014. To qualify for the maximum state cost share of 17.5%[1] of the non-federal match, municipalities have two options; 1) Enroll in the National Flood Insurance Program Community Rating System and adopt a bylaw that prohibits new structures in the Flood Hazard Area, or 2) Adopt River Corridor protection standards that meet Agency of Natural Resources (ANR) criteria.

DEFINITIONS:

Administrative Officer means a person appointed by the community's legislative body for a term of three years to administer the bylaws literally and shall not have the power to permit any land development that is not in conformance with the community's bylaws. Please see 24 V.S.A. §4448 for the appointment and powers of administrative officer.

Appropriate Municipal Panel means a planning commission performing development review, a board of adjustment, a development review board, or a legislative body performing development review, as that term is defined in 24 V.S.A. §4303.

Flood Hazard Area means the land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year and shall have the same meaning as "area of special flood hazard" under 44 C.F.R. § 59.1.

River Corridor means the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in 10 V.S.A. §1422, and for minimization of fluvial erosion hazards, as delineated by the Agency in accordance with the ANR Flood Hazard Area and River Corridor Protection Procedures[2].

[1] To qualify for at the 17.5% state match level, communities must adopt one of the 17.5% options in this document, in addition to the four basic ERAF mitigation measures to qualify at the 12.5% level.
[2] Available at: http://watershedmanagement.vt.gov/rivers/docs/FHARCP_12.5.14.pdf

River Corridor Protection Area [3] means the area within a delineated river corridor subject to fluvial erosion that may occur as a river establishes and maintains the dimensions, pattern, and profile associated with its dynamic equilibrium condition and that would represent a hazard to life, property, and infrastructure placed within the area. The river corridor protection area is the meander belt portion of the river corridor without an additional allowance for riparian buffers.

Streams/Rivers: The state will use the most current "Vermont Hydrography Dataset" (VHD) for defining streams/rivers within a community.

Option 1 - Community Rating System

Eligibility to receive the 17.5% state share under this option has two requirements: Enrollment in the Community Rating System (CRS), as well as specific CRS Activity requirements.

Enrollment in the Community Rating System (CRS) is done through FEMA Region 1. As a first step, communities need to conduct a *CRS quick check* self-assessment and close out a successful Community Assistance Visit (CAV) with FEMA Region 1. ANR Regional Floodplain Managers are available to assist communities and serve as a liaison with FEMA. Please note that enrollment in the CRS program typically takes 12-18 months to complete.

In addition to enrollment in CRS, communities must be receiving credit under Activity 430 (Higher Regulatory Standards) for having a flood hazard bylaw that prohibits new structures in their FEMA-mapped Flood Hazard Areas. Model bylaws prohibiting new structures in the Flood Hazard Area are available here: http://watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm.

Option 2 – River Corridor Protection

A. To qualify under the River Corridor Protection option, a community must:
   i. Adopt a River Corridor or River Corridor Protection Area overlay for all streams and rivers draining greater than two square miles.
   ii. Adopt a small streams setback as part of their flood hazard/river corridor bylaws. The setback must be a minimum of 50' from top of bank for streams with a watershed area less than two square miles. The setback shall be regulated as the River Corridor for streams draining less than 2 square miles.
   iii. Adopt a minimum regulatory requirement for River Corridors or River Corridor Protection Areas consistent with the Flood Hazard Area & River Corridor Protection

[3] The River Corridor Protection Area is synonymous with Fluvial Erosion Hazard (FEH) Area.

Procedure[4] or be at least as restrictive as those outlined in the ANR Municipal Guide to Fluvial Erosion Hazard Mitigation.

B. Communities that adopted partial[5] River Corridor Protection Area standards prior to the ERAF rule going into effect on October 23, 2014 have enjoyed an early adopter status. To retain the 17.5% state share, communities will need to do the following within two years of ANR publishing a statewide river corridor map updated to include existing Phase 2 Stream Geomorphic Assessment (SGA) data[6].
   i. Adopt a River Corridor or River Corridor Protection Area overlay for all streams and rivers draining greater than two square miles.
   ii. Adopt a small streams setback as part of their flood hazard/river corridor bylaws. The setback must be a minimum of 50' from top of bank for streams with a watershed area less than two square miles. The setback shall be regulated as the River Corridor for streams draining less than 2 square miles.
   iii. Adopt a minimum regulatory requirement for River Corridors or River Corridor Protection Areas consistent with the Flood Hazard Area & River Corridor Protection Procedure or be at least as restrictive as those outlined in the ANR Municipal Guide to Fluvial Erosion Hazard Mitigation.

[4] The Flood Hazard Area & River Corridor Protection Procedure provides exceptions to the No Adverse Impact river corridor requirement and accommodates infill, redevelopment, and existing development within river corridors – see section VII(2)(B): http://watershedmanagement.vt.gov/rivers/docs/FHARCP_12.5.14.pdf. The infill/redevelopment river corridor exceptions shall also apply to the small streams setback area.

[5] A number of communities have adopted regulations for a subset of their watercourses (buffer setbacks, Phase 2 data-generated FEH overlays, or avoidance-based Flood Hazard Areas) prior to the ERAF Amendments taking effect in October, 2014.

[6] Upon written request from the Selectboard, ANR may allow for an extension to accommodate the municipal planning cycle. ANR anticipates publishing a statewide river corridor layer, updated with Phase 2 data, in calendar year 2016.

Communities interested in adopting river corridor protection standards should contact the ANR Regional River Scientist to determine data availability, applicability of existing municipal regulations, and options available to the community. ANR, VLCT, and regional planning commission staff will provide technical assistance to interested towns in qualifying for increased state cost share under the new ERAF rule under the River Corridor criterion.

Regional River Scientists (http://watershedmanagement.vt.gov/rivers/docs/rv_scientistregions.pdf)

Staci Pomeroy (Northern Region): Staci.Pomeroy@state.vt.us

Gretchen Alexander (Central region): Gretchen.Alexander@state.vt.us

Shannon Pytlik (Southern Region): Shannon.Pytlik@state.vt.us

Milly Archer, Vermont League of Cities and Towns; marcher@vlct.org

Regional Planning Commission Contacts: http://www.vapda.org/

Additional Resources:

ERAF:

http://floodready.vermont.gov/find_funding/emergency_relief_assistance

CRS:

http://www.fema.gov/media-library-data/20130726-1708-25045-7720/99032_nfip_small_brochure.pdf

https://www.fema.gov/national-flood-insurance-program-community-rating-system

http://crsresources.org/

River Corridors:

http://floodready.vermont.gov/flood_protection/river_corridors_floodplains

http://floodready.vermont.gov/flood_protection/river_corridors_floodplains/river_corridors

http://floodready.vermont.gov/RCFAQ

River Corridor Mapping:

http://floodready.vermont.gov/assessment/vt_floodready_atlas

http://anrmaps.vermont.gov/websites/anra/

Dog River Corridor Plan Project Table and Map

Table 7.3. Dog River Site Level Opportunities for Restoration and Protection - Town of Roxbury

Project #; Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#1 M2I-C	Fair Not Evaluated	Recently relocated section of channel along Roxbury Road	Improve riparian vegetation	Moderate priority. Number of landowners unknown	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Field to forested buffer	Town of Roxbury
#2 M2I-D	Fair F III	Runs close to railroad and Town Garage	Improve near bank vegetation and riparian buffer	Low priority due to limited room for planting	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Commercial to forested buffer	Town of Roxbury, Landowners
#3 M2I-D	Fair F III	Runs close to railroad and Town Garage; railroad is heavily bermed	Remove berms	Low priority as berms are protecting the railroad	Restore floodplain access, but still would be limited by railroad	Moderate to high costs	None	Town of Roxbury, railroad

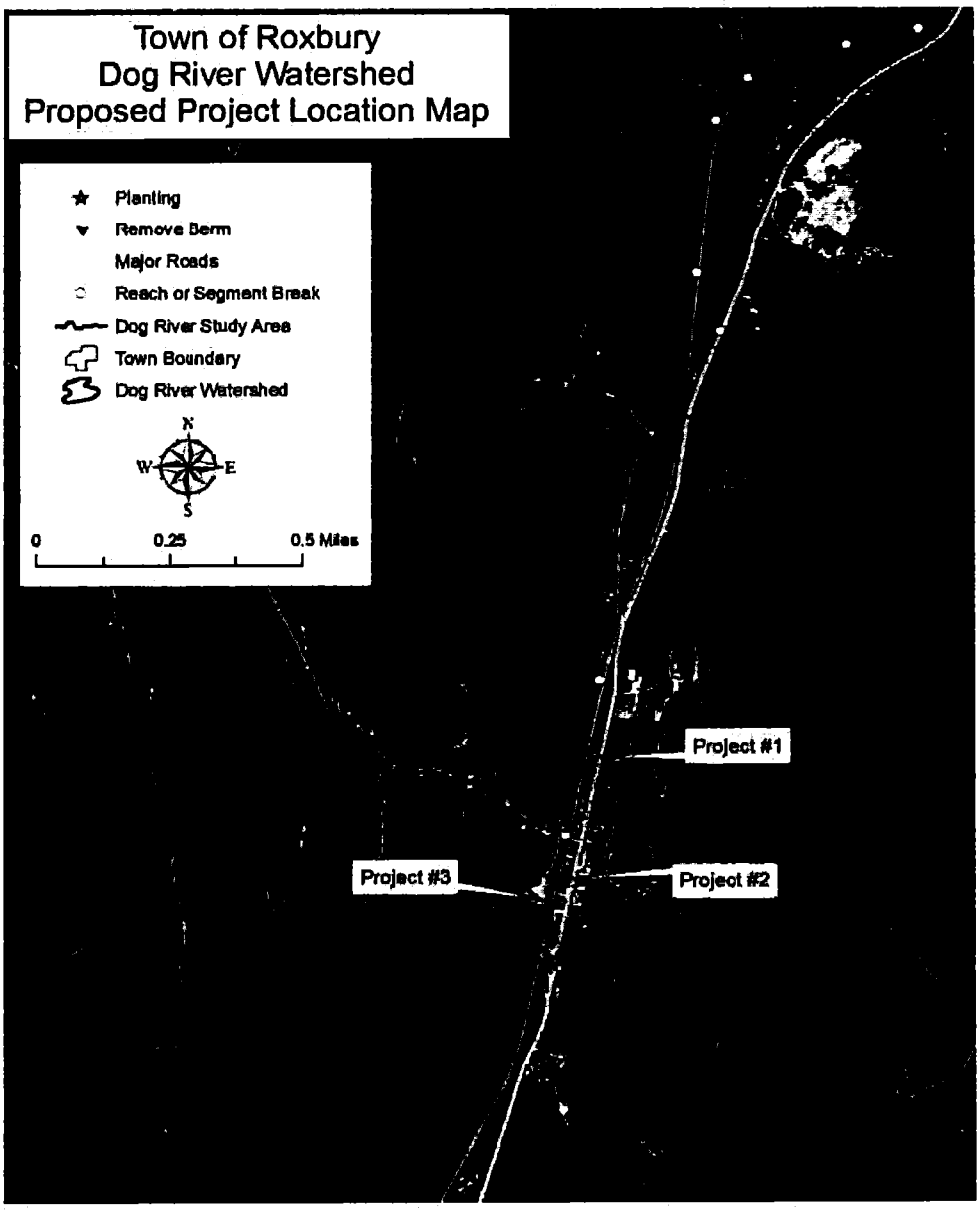


Figure 7.6 Proposed project location map for the Town of Roxbury, Dog River watershed

Fluvial Erosion Hazard Zone Map

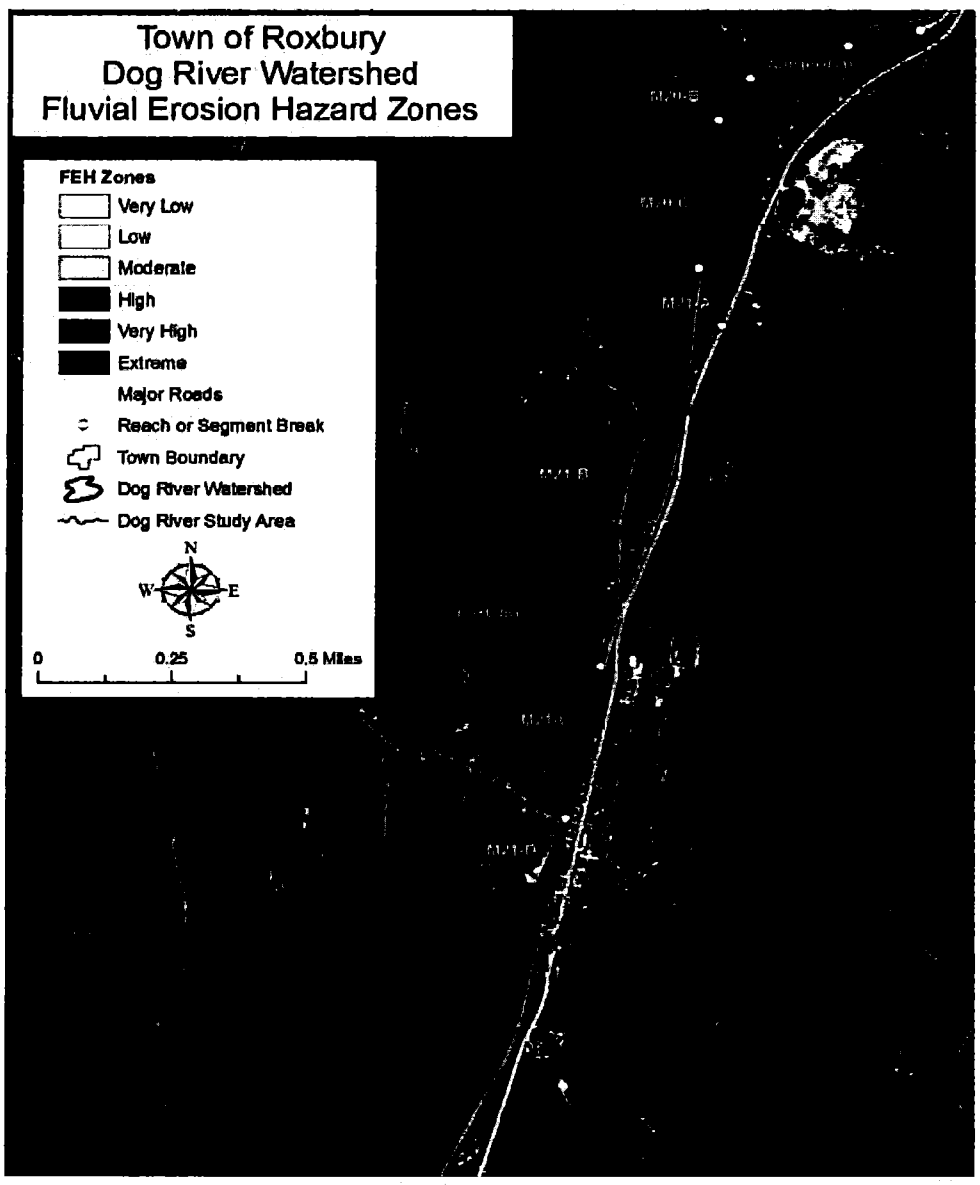


Figure 7.3. Draft Fluvial Erosion Hazard Zone Map for the Town of Roxbury - Dog River watershed

Hazards from previous Hazard Mitigation Plan which are no longer considered a significant hazard

For historical data purposes only

Wild Fire/Forest Fire

FEMA indicates there are three classes of wild land fires – surface fires, ground fires and crown fires, with the most common type indicated as a surface fire. Surface fires burn slowly along the forest floor, killing and damaging trees. Ground fires burn on or below the forest floor and are usually caused by lightning. Crown fires move quickly by jumping along the tops of trees. Crown fires can spread quickly during windy conditions. In Roxbury, there have been no known occurrences of wildfires; however, changing land use patterns and weather conditions may increase Roxbury's vulnerability. The rural nature and vast tracts of forested land can make Roxbury susceptible to forest fires. During rare drought occurrences, fire danger may be high.

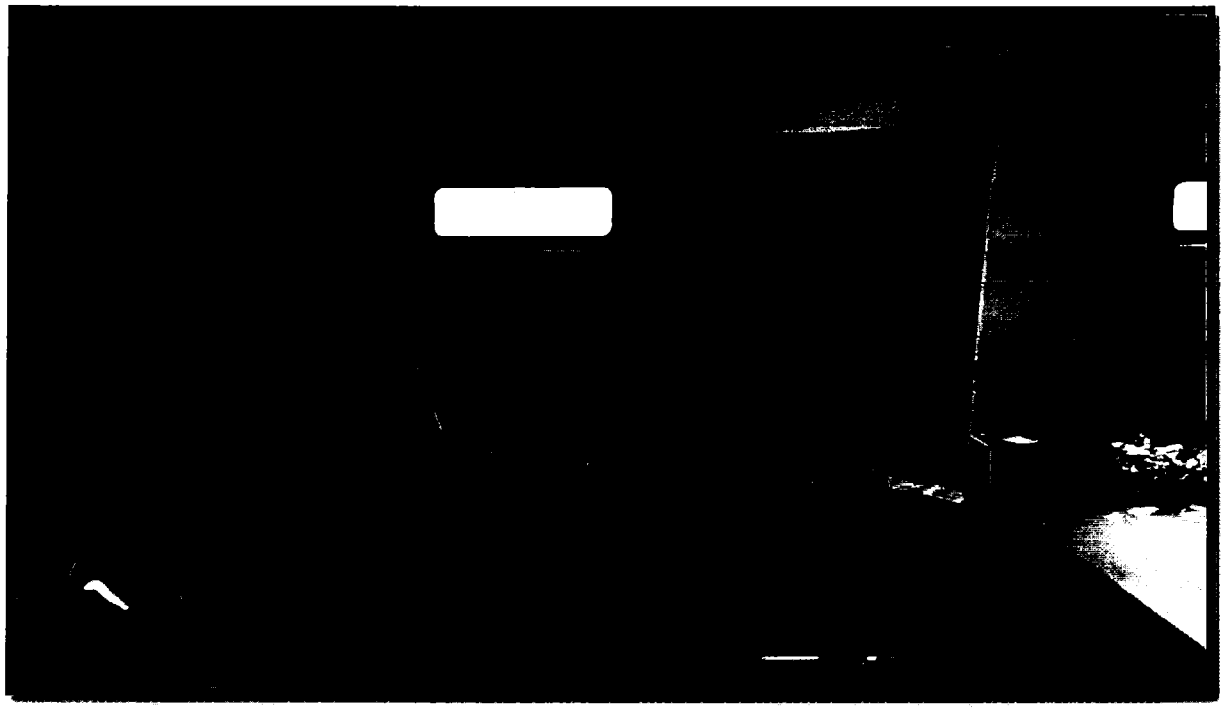
The State of Vermont does have a Forest Management plan in place which addresses forest fire concerns. The 2010 State Forest Management Plan includes several goals regarding forest fire prevention. The Plan states that although the risk of forest fire is low in the State of Vermont, that the State still performs controlled burns on a small during the spring season. To help prevent local forest fires, the State works with local planning commissions to develop Community Wildlife Protection Plans. These plans help towns to identify and mitigate wildfire risk. A common mitigation measure prescribed in the plan is through controlled burns with onsite State support.

The Forest Division also runs the Town Forest Fire Warden program. This program requires towns to have appointed fire wardens. The forest fire program focuses on prevention, fire awareness and fire fighter safety.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Wildfire	Town Wide – areas outside Village development	Large Parcels of forested land, homes near urban forest interface, power lines	25% of Roxbury (State Forest Lands)	Depends on severity of event	Medium

Public Engagement Documentation

Information & Input Booth at Roxbury 4th of July Celebration, 2016



Screen Shot of July CVRPC Newsletter

Municipal Planning Grants

FY17 MPG Program Description

online grants management system

Application Questions

For additional information on these rules please visit >> http://www.manufacturedhousinginstallation.com/

Share your opinions: How should towns reduce risks to property from natural disasters?

Are you a resident, taxpayer or neighbor of Fayston, Northfield or Roxbury? Do you work there, run your business, or commute through every day? These towns are working to make sure the services they provide are there for you even when nature chooses to give them its worst. Fayston, Northfield and Roxbury are planning for ways to avoid damage to roadways, utilities, businesses, homes, etc., and they would like to know what is most important to you! If you might be affected by harsh winter weather, severe storms, or other of nature's hazards in Fayston, Northfield, or Roxbury, please fill out a survey!

Choose the applicable link to provide your opinions:

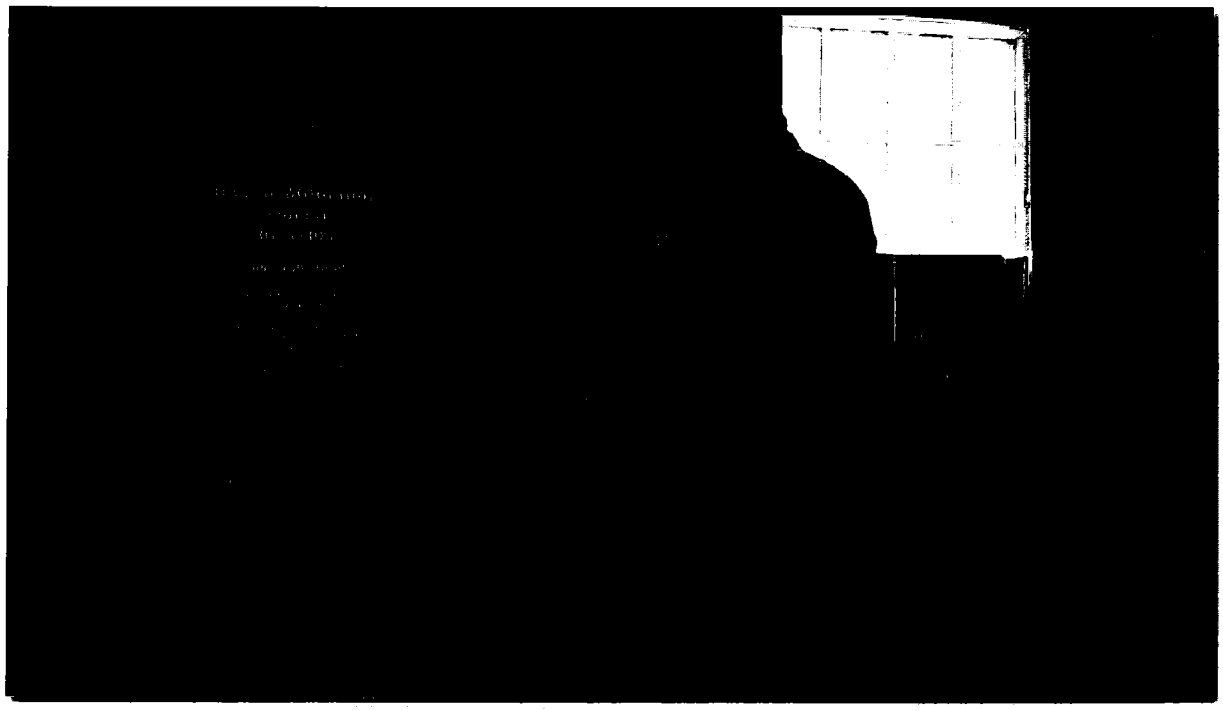
Fayston Natural Hazards Survey
Northfield Natural Hazards Survey
Roxbury Natural Hazards Survey

Location Affordability in the Central Vermont Region

Did you know that increased transportation costs begin to offset the savings on the cost of housing when

2016.11.12-18 Gail... | crs_quick_check_... | 2016 8.19 Northfie... | 2016.10.12 CRS Mi... | 2016.11.16 D

Dot Voting & Information Table at Annual Town Meeting Day – March 7th, 2017



Town Meeting Public Input Results

March 7th, 2017

An information table at Town Meeting Day was set up to collect feedback from Roxbury residents on which hazard mitigation projects they think are most important for Roxbury. Responses are summarized as follows:

Hazard Mitigation Projects 2017-2022

Which projects should Roxbury undertake between 2017 and 2022?

Results:

Mitigation Project Option	Description	Number of Votes
Culverts, Bridges & Roadways	Invest more municipal resources in designing and building culverts, bridges and roadways to withstand severe rain and flooding events	15
Homes & Infrastructure at Roxbury Flats	Re-engage with State agencies and landowners to protect homes, the Oxbow Road bridge, Rt. 12A and the railroad	14
Stream Management at South End of Village	Explore stream management permitting at the south end of Roxbury village where flooding occurs	12
Electrical Outage Prevention Measures	Dedicate extra municipal resources to advocating for increased outage prevention measures from Green Mountain Power and Washington Electric	9
Floodplain Permitting Outreach	Increase outreach to residents regarding Roxbury's Inundation Hazard Area Regulations	4
Railroad Safety Measures	Dedicate extra municipal resources to advocating for increased railway safety measures with the New England Central Railroad and the Vermont Agency of Transportation	1

Central Vermont Regional Planning Commission

March 13, 2017

Lawton Rutter
EMS Chief/Emergency Management Director
Northfield Ambulance Facility
31 Dog River Drive
Northfield, Vermont 05663

Greetings, Lawton,

The Town of Roxbury would like to invite your comment on its Draft 2017 Local Hazard Mitigation Plan. A copy of the plan is included with this letter. As the policies and programs pursued by Roxbury have the potential to affect neighboring communities, Roxbury would like to invite your feedback. Roxbury has identified projects that will help prevent future damage and losses due to flooding, stream-highway erosion conflicts, railroad accidents, and severe storms and winter weather causing power outages. Highlights from the projects identified in the plan include:

- Conduct a Better Roads Erosion Inventory and create a Capital Budget for improving road segments and structures to better withstand erosion.
- Explore the possibility of active stream management at the south end of the village to mitigate flooding from Sullivan Brook and the Third Branch of the White River.
- Participate in the next Rail Car Incident Response Training offered by the VT Dept. of Public Safety

Your comments may be submitted to myself at Central Vermont Regional Planning Commission at aloisio@cvregion.com or 802-299-0389. We also encourage you to share the plan with other local officials in your town.

Thank you very much for your input.

Gail Aloisio
Assistant Planner
aloisio@cvregion.com

29 Main Street Suite 4 Montpelier Vermont 05602
802-229-0389 E Mail: CVRPC@CVRegion.com

Public Comment Summary

The Roxbury Draft Local Hazard Mitigation Plan was circulated for public comment between March 10th and April 10th, 2017. It was mailed directly to Emergency Management Directors in all towns abutting Roxbury, as well as residents who had signed up to receive a copy of the draft. The solicitation for comments was also posted to CVRPC's website.

The following summarizes comments submitted:

Linda Morse
Braintree Conservation Commission
Friday, March 24, 2017

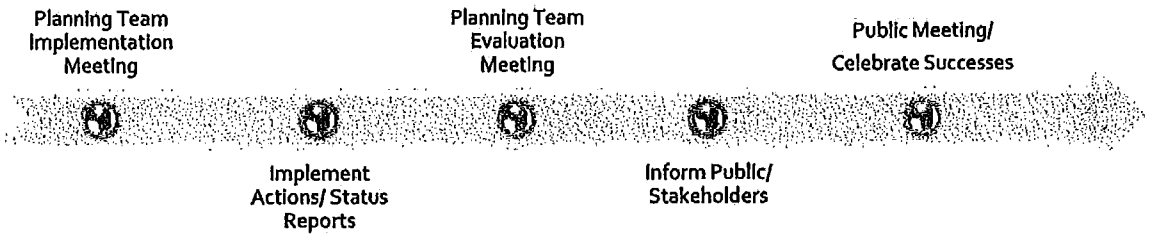
"I had a chance to review the Draft 2017 Hazard Mitigation Plan for the Town of Roxbury. I am a member of the Braintree Conservation Commission. I was very interested to see that certain invasive species which could affect tree health, in particular Emerald Ash Borer, are included in the plan."

Richard Bowen
Braintree Selectboard Chair
Thursday, March 23, 2017

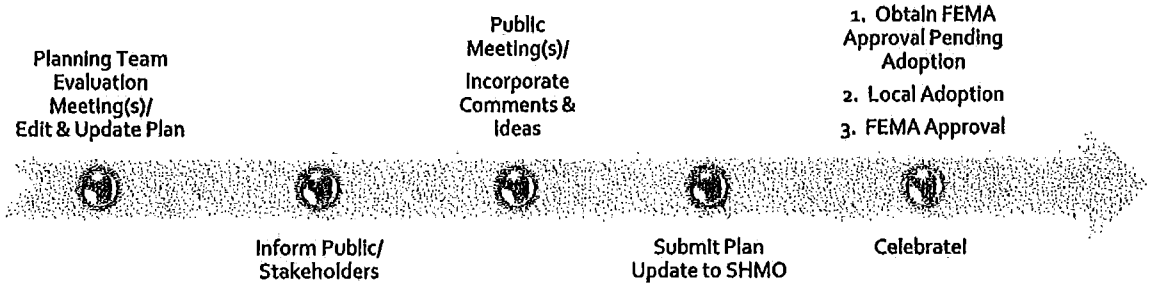
"I am currently the Chair of the Braintree Select Board. For your information, Braintree is in the process of selecting another Emergency Management Director and hopefully will appoint someone in two weeks. That being said, I have reviewed Roxbury's Hazard Mitigation Plan that you had forwarded to the Braintree Town Office. In reading this document, it seems intensive and complete. However as a novice reviewing it I have no other suggestions or comments... Thank you for providing the Town with a copy."

5-Year Plan Review/Maintenance

After Plan Adoption-Annually
Implement and Evaluate



Fifth Year, and After Major Disaster
Evaluate and Revise



Certificate of Adoption

The Town of Roxbury
Select Board
A Resolution Adopting the Local Hazard Mitigation Plan
May 7, 2018

WHEREAS, the Town of Roxbury has worked with the Central Vermont Regional Planning Commission to identify hazards, analyze past and potential future losses due to natural and manmade-caused disasters, and identify strategies for mitigating future losses; and

WHEREAS, the Roxbury Local Hazard Mitigation Plan contains several potential projects to mitigate damage from disasters that could occur in the Town of Roxbury; and

WHEREAS, a duly-noticed public meeting was held by the Town of Roxbury Select Board on May 7, 2018 to formally adopt the Roxbury Local Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that:

1. The Roxbury Select Board adopts the Roxbury Local Hazard Mitigation Plan.

2. The municipal officials identified in the Mitigation Projects Schedule (page 52) of this Plan are hereby directed to pursue implementation of the projects assigned to them.

Chair of Select Board

Member of Select Board

ATTEST

Roxbury Clerk