

Adopted on February 16th, 2021

Town of Derby, Village of Derby Line and the Village of Derby Center



Multi-Jurisdictional All-Hazards Mitigation Plan Update

**Town of Derby
124 Main St, Derby, VT 05829
(802) 766-4906**

**Public Assistance Applicant #: 019-17350-00: Town of Derby
019-17500-00: Village of Derby Line: 019-U5H52-00**

Prepared by:

Town of Derby, Vermont

Town of Derby, Vermont

CERTIFICATE OF LOCAL ADOPTION

Town of Derby, Village of Derby Line and the Village of Derby Center, Vermont

A Resolution Adopting the Multijurisdictional All-Hazards Mitigation Plan Update

WHEREAS, the Town of Derby, Village of Derby Line and the Village of Derby Center has worked with its residents and stakeholders to identify its hazards and vulnerabilities, analyze past and potential future losses due to natural and human-caused hazards, and identify strategies for mitigating future losses; and

WHEREAS, the Town of Derby, Village of Derby Line and the Village of Derby Center All-Hazards Mitigation Plan contains recommendations, potential actions and future projects to mitigate damage from disasters in Town of Derby, Village of Derby Line and the Village of Derby Center; and

WHEREAS, the Town of Derby, Village of Derby Line and the Village of Derby Center and the respective officials will pursue implementation of the strategy and follow the maintenance process described in this plan to assure that the plan stays up to date and compliant; and...

WHEREAS, a meeting was held by the Town of Derby, Village of Derby Line and the Village of Derby Center to formally approve and adopt the Multijurisdictional All Hazards Mitigation Plan.

NOW, THEREFORE BE IT RESOLVED that the Town of Town of Derby, Village of Derby Line, and the Village of Derby Center adopts this Multijurisdictional Hazard Mitigation Plan Update.

02/16/2021
Date

Selectman

Kat
Selectman

Mark P. Dodge
Selectman

Bryan Smith
Selectman

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Selectboard Chair

Village of Derby Center Designee

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Village of Derby Center Designee

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Village of Derby Center Designee

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Village of Derby Line Designee

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Village of Derby Line Designee

[Signature]
Village of Derby Line Designee

Yaye Marin
Attested to by Town Clerk

Multi-jurisdictional Hazard Mitigation Plan adopted _____ ii

Executive Summary

In 2020, the Town of Derby began to develop this Multi-jurisdictional All-Hazard Mitigation Plan update from the last approved plan, which was an annex to the 2005 multi-jurisdictional; NVDA Caledonia, Essex and Orleans Counties VT Regional All-Hazards Mitigation Plan. Mitigation planning requirements have changed considerably since 2005 and what once constituted an approved plan for the town holds little value in the current planning environment. While the 2005 plan was certainly reviewed in the update planning process, its value was considered low in moving the town forward with its future mitigation efforts and little, formal incorporation of the 2005 plan into other town planning or operations has occurred. The results of this work are contained herein and represent the collaborative efforts of the Hazard Mitigation Planning Team and associated residents, towns and agencies that contributed to the development of this plan. As hazard mitigation is a sustained effort to permanently reduce or eliminate long-term risks to people and property from the effects of reasonably predictable hazards, the town has communicated its efforts related to developing this plan to its residents and surrounding municipalities, providing a formal opportunity to provide input and review relevant sections of the plan. Along these lines, the town has documented the planning process so that future updates can follow an efficient pattern in addition to capturing this important component as means of establishing institutional memory. In realization that eligibility to receive federal hazard mitigation grants and optimize state-level reimbursement or “match” dollars during a federally declared disaster is dependent on a federally approved plan, the town remains committed to sustaining its mitigation efforts and by developing this plan, will have a guide for action that will foster enhanced emphasis on mitigation in the years to come. The town realizes the importance of mitigation inherent to its own resilience as well as means to establishing strong partnerships with regional support agencies and associations, state government and FEMA. Lastly, the pandemic-related events of 2020 have resulted in new considerations in the financial, health and safety arenas and the town feels it must formally engage in pandemic planning to mitigate risk. As the town moves towards formally adopting this All-Hazards Mitigation Plan update, the purpose of this plan is to:

- Identify specific hazards that impact the town
- Prioritize hazards for mitigation planning
- Recommend town-level goals and strategies to reduce losses from those hazards
- Establish a coordinated process to implement goals and their associated strategies by taking advantage of available resources and creating achievable action steps

This plan is organized into 5 Sections:

Section 1: Introduction and Purpose explains the purpose, benefits, implications and goals of this plan. This section also describes demographics and characteristics specific to the town and describes the planning process used to develop this plan.

Section 2: Hazard Identification expands on the hazard identification in the Town Plan with specific municipal-level details on selected hazards.

Section 3: Risk Assessment discusses identified hazard areas in the town and reviews previous federally-declared disasters to identify what risks are likely in the future. This section presents a hazard risk assessment for the municipality, identifying the most significant and most likely

hazards which merit mitigation activity. Building upon the identified hazards from 2005, the updated profiled hazards are introduced in the grid below:

Severe winter/Ice storm	Extreme Cold	Flooding/Erosion
Pandemic		

Section 4: Vulnerability Assessment discusses buildings, critical facilities and infrastructure in designated hazard areas and estimates potential losses.

Section 5: Mitigation Strategies begins with an overview of goals and policies in the most recent Town Plan that support hazard mitigation and then formulates a work plan around major infrastructure projects, community awareness and documentation. An analysis of existing municipal actions that support hazard mitigation, such as planning, emergency services and actions of the highway department are also included. The following all-hazards mitigation goals are summarized below:

- 1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- 2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
- 3) Maintain and increase awareness amongst the town’s residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
- 4) Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- 5) Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- 6) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission, Selectboard and NVDA and integrate the strategies into the existing town plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- 7) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Planning Commission will review the updated LHMP and use language/actions from it to inform the integration and future update processes. Town Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budget.

Section 5 also identifies and provides a detailed discussion on the following mitigation actions:

Action #1: Improve road infrastructure and municipal systems protection programs

Action #2: Improve resilience to severe winter storms

Action #3: Reduce impact of extreme cold durations

Action #4: Raise public awareness of hazards and hazard mitigation actions

Action #5: Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risk

Action 6: Reduce risk and impact of pandemic

In conclusion, Section 5 provides an Implementation Matrix to aid the municipality in implementing the outlined mitigation actions with an annual evaluation process to be coordinated and administered by the Planning Commission.

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SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

The purpose of this All-Hazards Mitigation Plan Update is to assist this municipality in identifying all hazards facing their community and in identifying strategies to begin to reduce the impacts of those hazards. The plan update also seeks to better integrate and consolidate efforts of the municipality with those outlined in the Town Plan as well as efforts of NVDA, Vermont State agencies, FEMA and the State Hazard Mitigation Plan. The town is aware that community planning can aid significantly in reducing the impact of expected, but unpredictable natural and human-caused events. Community planning can aid significantly in reducing the impact of expected, but unpredictable natural and human-caused events. The goal of this plan is to provide hazard mitigation strategies to aid in creating disaster resistant communities throughout Orleans County.

1.2 Hazard Mitigation

The 2018 Vermont State All-Hazards Mitigation Plan states:

“The impact of anticipated yet unpredictable natural events can be reduced through community planning and implementation of cost effective, preventive mitigation efforts. The State of Vermont understands that it is not only less costly to reduce vulnerability to disasters than to repeatedly repair damage, but that we can also take proactive steps to protect our economy, environment and most vulnerable citizens from inevitable natural hazard events. This Plan recognizes that communities have the opportunity to identify mitigation strategies during all phases of emergency management (preparedness, mitigation, response, and recovery) to more comprehensively address their vulnerability. Though hazards themselves cannot be eliminated, Vermonters can reduce our vulnerability to hazards by improving our understanding of both the natural hazards we face and their potential impacts. The 2018 Vermont State Hazard Mitigation Plan (SHMP) presents the hazard impacts most likely to affect Vermont and a mitigation strategy to reduce or eliminate our most significant vulnerabilities.”

Hazard mitigation strategies and measures can reduce or eliminate the frequency of a specific hazard, lessen the impact of a hazard, modify standards and structures to adapt to a hazard, or limit development in identified hazardous areas. This plan aligns and/or benefits from the State’s 2018 Hazard Mitigation Plan and as part of the Emergency Relief Assistance Funding (ERAF) requirements. With enhanced emphasis on community resiliency, many state agencies and local organizations have an increased awareness of the importance of mitigation planning and have produced plans and resources that towns can use to support their planning efforts. This plan will reference, when relevant, pertinent tools and resources that can be used to enhance mitigation strategies.

1.3 Hazard Mitigation Planning Required by the Disaster Mitigation Act of 2000

Hazard mitigation planning is the process that analyzes a community’s risk from natural hazards, coordinates available resources, and implements actions to reduce risks. Per *44 CFR Part 201: Hazard Mitigation Planning*, this planning process establishes criteria for State and local hazard mitigation planning authorized by Section 322 of the Stafford Act as amended by Section 104 of

the *Disaster Mitigation Act of 2000*. Effective November 1, 2003, local governments now must have an approved local mitigation plan prior to the approval of a local mitigation project funded through federal Pre-Disaster Mitigation funds. Furthermore, the State of Vermont is required to adopt a State Pre-Disaster Mitigation Plan for Pre-Disaster Mitigation funds or grants to be released for either a state or local mitigation project after November 1, 2004.

There are several implications if the plan is not adopted:

- After November 1, 2004, Flood Mitigation Assistance Grant Program (FMAGP) funds will be available only to communities that have adopted a local Plan
- For disasters declared after November 1, 2004, a community without a plan is not eligible for HMGP project grants but may apply for planning grants under the 7% of HMGP available for planning
- For the Pre-Disaster Mitigation (PDM) program, a community may apply for PDM funding but must have an approved plan to receive a PDM project grant
- For disasters declared after October 14th, 2014, a community without a plan will be required to meet a greater state match when public assistance is awarded under the ERAF requirements (Emergency Relief Assistance Funding)

1.4 Benefits

Adoption and maintenance of this Hazard Mitigation Plan will:

- Make certain funding sources available to complete the identified mitigation initiatives that would not otherwise be available if the plan was not in place
- Lessen the receipt of post-disaster state and federal funding because the list of mitigation initiatives is already identified
- Support effective pre-and post-disaster decision making efforts
- Lessen each local government's vulnerability to disasters by focusing limited financial resources to specifically identified initiatives whose importance have been ranked
- Connect hazard mitigation planning to community planning where possible

1.5 All-Hazards Mitigation Plan Goals

This All-Hazards Mitigation Plan establishes the following general goals for the town and both villages and their residents:

- 1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- 2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
- 3) Maintain and increase awareness amongst residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.

- 4) Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- 5) Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- 6) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the multi-jurisdictional municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Joint Planning Commission, Selectboard and NVDA and integrate the strategies into the existing town plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- 7) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into municipal operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Joint Planning Commission will review the plan and use language/actions from it to inform the integration and update process. Town Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budgets

1.6 Community History and Background

The Town of Derby shares a border with Canada to the north, and with the Towns of Holland, Morgan, Charleston, Brownington, Coventry and Newport on its other edges. It is an area of lakes, ponds and streams, some rolling hills and some large tracts of level plains. Within its borders, Derby contains all or parts of Lake Memphremagog, Clyde Pond, Derby Pond, Salem Lake, Cobb Pond, Brownington Pond, and numerous smaller ponds. Major tributaries include the Clyde River, Johns River, Tomifobia River, Cobb Brook, and many smaller streams. Such an abundance of water played an important part in the growth of the town and will continue to do so as bodies of water constitute prime recreational resources as well as being necessary for an abundant community water supply. Both Lakes Memphremagog and Salem have a large summer population. Lake Salem has some historical flooding around the lakeshore.

The main roads running north/south afford views of the Green Mountains to the west and the White Mountains to the east along with their adjacent foothills. The town is located on plateaus, which rise from an elevation of 695 feet at Lake Memphremagog, to 975 feet at Derby Center, and 1,345 feet at Darling Hill in the northwestern portion of the town. The gentle slope of much of the land and the ready availability of the water makes development practical, but only careful planning will ensure that the natural assets of the community are not destroyed in the process.

Settlement has been concentrated in the two villages of Derby Line and Derby Center, with smaller clusters of population in Beebe Plain and West Derby. The recent trend of vacation homes has resulted in densely settled lakeshore areas, thus forming additional residential areas. Throughout the remainder of the town, large dairy farms and smaller farms of varying types are found. Sections of swamps and wetlands along some streams have not been settled, and there is

much open land between the existing roads, some of it used for pasture, some for woodlots, and some not in use at the present time.

Long occupied by the Algonquin Indians, the area now known as Derby was first settled in the middle of the 18th century and chartered as a town in 1779. It grew rapidly since the land was conducive to farming and settlement, and in 1880 Salem was annexed to the town. Commerce and industry was concentrated in the villages, but lumbering, cattle farming, maple sugar manufacturing and crop farming were important livelihoods.

Derby Line occupies approximately 575 acres of the Town of Derby. According to historical records, it was first settled in 1798 and grew rapidly as a border village, where trade with England could be conducted through the Canadian province of Quebec. Its role as a trade center and port of entry has given the village an international character, a quality maintained up to the present time. Derby Line stands unique with the Haskell Library and Opera House, which straddles the border of both the United States and Canada. A number of nearby homes lie on the border as well, with portions of many of the residences divided between the two counties.

The Town of Derby has three international border crossings. The busiest is the Interstate 91 Derby Crossing. There is also the smaller Beebe Plain Crossing and Derby Line Crossing. The Canadian Town of Stanstead across the border is intertwined in the daily lives of Derby. There are many historic structures in Derby Village. Derby Center is located about five miles south of the border.

1.7 Summary of Planning Process

The work to update this plan was led by the planning team made up of municipal officials, school officials, local businesses, service agencies, and the regional planning organization (NVDA). The update project followed a work plan which provided the public and other stakeholders the opportunity for two-way communication. Existing documents were also researched and incorporated into the plan update.

Planning team members, for the most part, fulfill multiple roles in the community and represent a broad array of stakeholders. The following table presents the Planning Team members and their title:

2020 Derby Mitigation Planning Team Roster

1. Faye Morin, Town Clerk & Treasurer
2. Bob Kelley, Town Manager and Zoning Administrator
3. Steve Cross, 911 coordinator
4. Joe Profera, Dev. Review Board, Tree Warden, Planning Commission, Vol. Fire Dept.
5. Hazen Converse, Planning Commission
6. Barbara Sheltra, Planning Commission

7. Bob DeRoehn, Dev. Review Board
8. Steve Gendreau, Road Commissioner
9. Rod Lyon, Road Foreman
10. Elijah Capron, Health Officer
11. Joe Noble, Deputy Health Officer
12. Grant Spates, Town of Derby Selectboard
13. Brian Smith, Town of Derby Selectboard
14. Elizabeth Bumps, Clerk/Treasurer Village of Derby Center
15. David West, Public Works Manager, Village of Derby Center
16. Laurie Moss, Clerk/Treasurer, Village of Derby Line
17. Richard Creaser, Village of Derby Line Trustee
18. Brian Fletcher, Road Foreman Village of Derby Line
19. Rosaire Fortin, Village of Derby Center Trustee
20. Alison Low, Senior Planner, NVDA

The last approved plan for the town was in 2005. This approval came after formal adoption of an Annex of the NVDA-developed, 2005 Northeast Kingdom Multi-Jurisdictional Hazard Mitigation Plan. The 2005 plan was all-but forgotten and is considered too general and basic for current mitigation planning needs and requirements. While the town and its villages, by default of daily operations, experience with major disasters since 2005 and advancements in mitigation planning and guidance from state agencies, has enhanced its mitigation efforts since 2005, these enhancements were not a direct result of the 2005 plan. However, the two infrastructure-related mitigation actions defined in the 2005 plan were accomplished and remain successful at mitigating flood risk and associated financial impact.

There is a current understanding of the need to integrate the content of this update and its goals, actions and reporting into the daily operational structure and awareness of all town officials so that mitigation planning establishes itself as a consistent topic of concern and discussion. The planning team was developed, representing the community and regional partners as best as possible and planning updates were given consistently at warned, community meetings. July 13th, 2020 marked the kick-off meeting as part of a scheduled selectboard meeting. However planning team work was ongoing prior to this date but due to restrictions related to COVID-19, face-to-face interaction was not possible. A community survey was drafted asking for community input and made available through a formal mailing along with resident tax bills in early September, 2020. The survey introduced the importance and informational needs of a mitigation plan and asked for specific concerns the resident and/or business owner had. By October 15th, 2020 (when tax bills were due), 88 responses were returned. Issues raised included specific flood migration work, alerting public during a disaster, snow removal and concerns related to COVID-19. All results were assessed and summarized in the table included in the

appendix. All neighboring towns were sent notification via the town clerk of the plan's development and subsequent drafts and were given an opportunity to provide input through email and/or phone call to the town clerk. No responses were obtained from this solicitation. Following FEMA guidance in Local Mitigation Plan Review Tool Regulation Checklist, the plan was written using data sources that included:

- Surveys and warned, public meetings collecting public comment (issues raised were addressed in plan and the public meeting)
- 2018 Town Plan (provided current goals and regulations supporting mitigation, recent capital expenditures and infrastructure value helped to drive vulnerability assessment)
- 2013 Vermont State Hazard Mitigation Plan (provided key guidance language and definitions throughout the plan).
- Vermont Agency of Natural Resources (ANR) and Transportation (VTrans) (Provided key policy recommendations on environmental conservation, high accident locations, climate change and fluvial erosion data).
- Vermont Departments of Health (VDH) and Environmental Conservation (DEC) (provided information related with public health services that could be impacted during a disaster and state support functions designated to both VDH and DEC. DEC also provided river corridor data for mapping purposes.
- FEMA Open Source (data.gov) Data for Disaster History and PA funding (provided comprehensive declared disaster by year and type as well as project descriptions and cost per event).
- FEMA NFIP "Bureau.Net" database (provided detailed information on repetitive loss properties and associated flood insurance claims).
- EPA's Incident Action Checklist for cold weather resilience of water systems (provides a guidance tool for public works to cross-reference actions on the system).
- 2013 ACCD Mobile Home Resilience Plan (served as resource for future mitigation actions)

Based on the information obtained, input from town and state officials, the planning team, state and federal databases, local associations and NVDA, the plan was created. While many small communities in Vermont face similar circumstances (e.g. flooding, winter storms and remote residents), each one has unique considerations and opportunities. There was a point made to capture the subtle characteristics of the town and its distinct villages. From this, the specific risks, vulnerabilities and mitigation strategies were developed and applicable, broken down to the specific entity impacted. NVDA's role in assisting the entire region with all facets of planning provided crucial information and NVDA's Emergency Management Planning representative attended planning team meetings and provided guidance. While the LEPC provides the best platform to engage representatives from various towns and agencies, all bordering towns were contacted with planning objectives and asked to provide input through a formal email invitation. Vermont Emergency Management (VEM) also provided information during the development of the plan. VEM also has representation at the LEPC meetings and will

continue to provide input and guidance as the town moves forward with their mitigation strategies. The following summary represents the timeline for the planning process:

July 13th: Planning Team Kick-off meeting. Planning team was approved by selectboard and updated hazards to be profiled were discussed. Questions answered included possibility of HMGP funding for specific projects and interest of a community member to join planning team which was allowed.

July 13th: Individual meetings with Derby Line Public Works Director and Town Road Foreman. These meetings resulted in important infrastructure vulnerability information and a preliminary 5-year work plan for mitigation work on town roads and bridges. This information was presented to the planning team that evening.

August 10th: Selectboard meeting resulted in approval of updated profile hazards with review and approval of both best available repetitive loss and NFIP information specific to the town. Amendments to the community survey were also made to include pandemic concern and opportunity for public to address concerns.

August 18th: Teleconference with Town Road Foreman, Town Administrator and Village of Line Clerk to discuss the \$50k public works repair resulting from 2014 Severe Winter Storm Disaster.

August 26, 2020: The planning team received draft sections I and II of the proposed update to review and provide comment on.

September 15th, 2020: Community Input Surveys mailed with tax bills to residents of Town and both Villages.

October 15th, 2020: Community Input Surveys collected and assessed by NVDA

October 24th, 2020: Planning team received qualitative risk assessment for profiled hazards for review and comment

October 26th, 2020: Planning team received draft sections III-V for review and comment

November 16th, 2020: Community meeting to review hazards and mitigation actions: Request to add assessment of Beebe Water System to develop an upgrade plan to the mitigation action items was made and added to plan

The draft plan was then revised based on input from planning team (e.g. minor corrections to names and titles of planning team members with an additional infrastructure project added). The revised draft was made available for review at the town office and residents were informed via meeting minutes and the town bulletin board of the ability to review the draft and additional opportunity for formal comment and suggestions. Minor edits were made to the plan following state recommendations and the final draft was resubmitted to VEM and then to FEMA for formal review and approval pending municipal adoption. A resolution of adoption will occur following FEMA review and “approval pending adoption” status.

SECTION 2: HAZARD IDENTIFICATION

The 2005 Plan profiled the following hazards (bold indicates continued inclusion in this update):

- **Flooding**
- Hazardous Materials Incident
- Radiologic Incident
- Fire
- School Safety/Terrorism

For this update, the planning team considered the continued inclusion or deletion of the 2005 hazards profiled by developing and researching the natural hazard categories outlined in the state mitigation plan and for each, considered prior history, current trends and available data to estimate risk. As highlighted above, some profiled hazards remain a risk for the town. However, other hazards, due to lack of occurrence frequency, risk and/or vulnerability have been removed in this update. The additions to this update's profiled hazard category are; *extreme cold, severe winter/ice storm and pandemic*. The definitions of each hazard, along with historical occurrence and impact, are described below.

Natural Hazards: weather / climate hazards (drought, hurricane/tornado, high winds, severe winter storm, extreme temperatures, climate change, lightning, hail), flooding, geological hazards (landslide / erosion, earthquake, naturally-occurring radiation), and fire hazards.

2020 Updated Profiled Natural Hazards: Severe Winter Storm/Ice, Flooding/fluvial erosion, Extreme Cold Temperature. Additional profiled hazard: Pandemic.

2.1 Natural Hazards Overview

There have been 19 disasters and 3 emergencies declared in Orleans County from 1973 through 2020 (it is noted that "Hurricane Irene" was listed as an Emergency, and then "Tropical Storm Irene" was listed as a Disaster a few days later). It should be noted that 16 of these disasters have occurred since 1998. Incident types in Orleans County since 1998 have been Severe Storm and flooding (12 incidents), Severe Ice (1), Severe winter storm (2) and Pandemic (1).

The following discussion on natural hazards is based upon information from several sources. Often, extent data specific to Derby is not available but when appropriate and available, nearby Newport City data can be used to capture the extent of natural hazard events for the town and villages. General descriptions are based upon the *2018 Vermont State Hazard Mitigation Plan*. According to NOAA Storm data, there were over 460 severe weather events from 1995-2020 in Orleans County. Events specific to the town, in addition to declared disasters include:

- 9/6/98, 6/26/02 thunderstorms
- 5/29/12 hail/tornado

- 7/29/13 flash flood
- 5/19/2015 hail

The highest risk hazards (severe winter/ice storm, flooding, extreme cold and pandemic) have been profiled to provide the basis of future mitigation strategies. However, lower risk natural hazards (drought, tornado, tornado, high winds, extreme heat, hail, landslide, earthquake, naturally-occurring radiation, hurricanes and fire hazards) are omitted from full profiling because they do not pose enough risk to substantiate mitigation efforts at this time. And while the risk of a hazardous materials incident as outlined in the 2005 plan remain moderates due to border crossings and the associated vulnerabilities that result, the town will focus on natural hazards and pandemic response for this update. Additionally, impacts from hurricanes are addressed under flooding hazard.

Table 2-1: Summary of Vermont Emergency Declarations

Number	Year	Type
3437	2020	Pandemic (COVID-19) national 3/13/20
3338	2011	Hurricane Irene
3167*	2001	Snowstorm
3053	1977	Drought

Source: FEMA

Table 2-2: Summary of Vermont Major Disaster Declarations since 1998 (Orleans County: Bold and “” denotes Town PA received)*

Number	Year	Type
4532	2020	Pandemic: COVID 19 (4/6/20)
4474*	2019	Severe Storms and Flooding
4380	2018	Severe Storms and Flooding
4356	2018	Severe Storms and Flooding
4330	2017	Severe Storms and Flooding
4207	2015	Severe Winter Storm
4232	2015	Severe Storms and Flooding
4178	2014	Severe Storms and Flooding
4163*	2014	Severe Winter Storm
4140	2013	Severe Storms and Flooding
4120	2013	Severe Storms and Flooding
4066	2012	Severe Storms, Tornado and Flooding
4043	2011	Severe Storms and Flooding
4022*	2011	Tropical Storm Irene
4001	2011	Severe Storms and Flooding
1995*	2011	Severe Storms and Flooding
1951	2010	Severe Storm
1816	2009	Severe Winter Storm
1790	2008	Severe Storms and Flooding
1784	2008	Severe Storms, Tornado and Flooding

1778	2008	Severe Storms and Flooding
1715	2007	Severe Storm, Tornado and Flooding
1698	2007	Severe Storms and Flooding
1559*	2004	Severe Storms and Flooding
1488	2003	Severe Storms and Flooding
1428*	2002	Severe Storms and Flooding
1358	2001	Severe Winter Storm
1336	2000	Severe Storms and Flooding
1307	1999	Tropical Storm Floyd
1228	1999	Severe Storms and Flooding
1201	1998	Ice Storm

2.1.1.1. Profiled Hazards

An Introduction to Climate Change:

Over the past several decades, there has been a marked increase in the frequency and severity of weather-related disasters, both globally and nationally. Most notably, the Earth has experienced a 1°F rise in temperature, which has far-reaching impacts on weather patterns and ecosystems. This statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer), is known as climate change. The Intergovernmental Panel on Climate Change (IPCC) forecasts a temperature rise of 2.5°F to 10°F over the next century, which will affect different regions in various ways over time. Impacts will also directly relate to the ability of different societal and environmental systems to mitigate or adapt to change⁶. Increasing temperatures are forecasted to have significant impacts on weather-related disasters, which will also increase risk to life, economy and quality of life, critical infrastructure and natural ecosystems. The IPCC notes that the range of published evidence indicates that the costs associated with net damages of climate change are likely to be significant and will increase over time. It is therefore imperative that recognition of a changing climate be incorporated into all planning processes when preparing for and responding to weather-related emergencies and disasters. Most of the natural hazards identified in this plan are likely to be exacerbated by changes in climate, either directly or indirectly. The National Aeronautics & Space Administration (NASA) reports that global climate change has already had observable effects on the environment: glaciers are shrinking, sea ice is disappearing, sea level rise is accelerating, heat waves are occurring more frequently and intensely, river and lake ice is breaking up earlier, plant and animal ranges have shifted, and trees are flowering sooner. Though climate change is expected to have global reach, the impacts differ by region. While the southwestern United States is expected to experience increased heat, wildfire, drought and insect outbreaks, the northeastern region is predicted to experience increases in heat waves, downpours and flooding. Accordingly, consideration of climate change was identified as a key guiding principle of the 2018 SHMP, addressed in each of the pertinent hazard profiles and incorporated into all relevant mitigation actions

-2018 Vermont State Hazard Mitigation Plan

From 1962 to 2006, each five-year period resulted in 0-6 Major Disaster Declarations in Vermont. From 2007-2020, there were 23. It is commonly accepted that weather extremes are becoming more commonplace in Vermont. Since 2011, record setting snow, rain and cold have been experienced in the state. In recent years, it has become evident that human activities, mostly associated with the combustion of fuel, have added to the natural concentration of greenhouse gases in the atmosphere and are contributing to rapid climate change on a global scale. While projections of the effects of climate change vary, it is generally predicted that Vermont will have warmer temperatures year-round, with wetter winters and drier summers. An increase in the size and frequency of storms is also predicted. Thus, climate change in the next century will likely increase the chance of weather-related hazards occurring. An increase in precipitation may also result in increased flooding and fluvial erosion. Drier summers may increase the chance of drought and wildfire. A warmer climate may also result in the influx of diseases and pests that cold winters previously prevented. The severity of climate change is also difficult to predict, though the effects may be mitigated somewhat if greenhouse gas emissions are reduced soon. In 2011, Governor Shumlin formed the *Vermont Climate Cabinet*. The Cabinet, chaired by the Secretary of Natural Resources, is a multidisciplinary approach to enhance collaboration between various state Agencies. Its primary objectives include providing the Governor with advisory information and facilitating climate change policy adoption and implementation. In 2013, the Vermont Agency of Natural Resources (ANR) released the Climate Change Adaptation Framework which addresses climate change exposures, vulnerability-specific elements within each of the natural resource sectors, and ongoing and proposed actions that can be or have been taken to prepare for the expected changes. In line and in conjunction with the ANR report, the primary goal of a VTrans climate change adaptation policy is to minimize long-term societal and economic costs stemming from climate change impacts on transportation infrastructure.

Severe Winter Storm

Winter storms impact the entire planning area and can include snowstorm, cold, blizzard and ice. According to the *2018 Vermont State All-Hazards Mitigation Plan*:

“Severe winter storms bring the threat of heavy accumulations of snow, cold/wind chills, strong winds, and power outages that result in high rates of damage and even higher rates of expenditures. A heavy accumulation of snow, especially when accompanied by high winds, causes drifting snow and very low visibility. Sidewalks, streets, and highways can become extremely hazardous to pedestrians and motorists. Severe winter storms develop through the combination of multiple meteorological factors. In Vermont and the northeastern United States, these factors include the moisture content of the air, direction of airflow, collision of warm air masses coming up from the Gulf Coast, and cold air moving southward from the Arctic. Significant accumulations of ice can cause hazardous conditions for travel, weigh down trees and power lines, and cause power outages. Freezing rain can also be combined with snowfall, hiding ice accumulation and further hindering travel, or with mixed precipitation and potentially ice jams or flooding.”

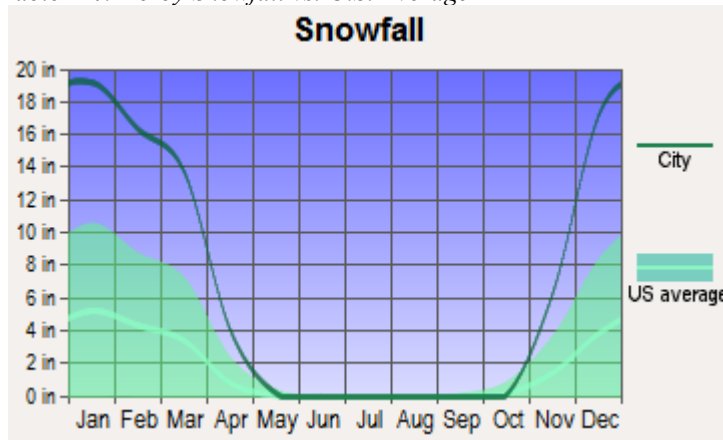
Winter storm frequency and distribution varies from year to year depending on the climatological patterns but snowfall in the town is significantly higher than the national average.

County-wide, the winter of 2010-2011 was the third snowiest on record with a total of 124.3 inches. The record of 145.4 inches was set in 1970-1971. The potential for a major snowstorm that exceeds the capabilities of town exists every year but with the recent increase in snowfall totals and cold temperature duration, the town realizes that further consideration is required. NOAA's National Centers for Environmental Information is now producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. NCEI has analyzed and assigned RSI values to over 500 storms going as far back as 1900. As such, RSI puts the regional impacts of snowstorms into a century-scale historical perspective. The index is useful for the media, emergency managers, the public and others who wish to compare regional impacts between different snowstorms. The RSI and Societal Impacts Section allows one to see the regional RSI values for storms as well as the area and population of snowfall for those storms. The area and population are cumulative values above regional specific thresholds. For example, the thresholds for the Southeast are 2", 5", 10", and 15" of snowfall while the thresholds for the Northeast are 4", 10", 20", and 30" of snowfall. 2010, 2012 and 2015 have some of the highest rankings for notable storms in Derby. These rankings are based, in part on the severity of the storm using the following system. Since 2000, there has only been one event that reached a category 4 in the Northeast, five reached Category 3, eight were "significant" and all others were notable.

Table 2-3: NOAA's Regional Snowfall Index (RSI)

CATEGORY	RSI VALUE	DESCRIPTION
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18.0+	Extreme

Table 2-4: Derby Snowfall vs. U.S. Average



The Town has seen damage from declared snow disasters in the past, primarily dealing with debris removal from downed trees. In any Vermont community, this potential exists every winter. While there is no consistent record of snowfall for Derby, nearby Newport City had the following events which serve to reflect the extent with which snow can impact the area. In January of 2015 received 28” of snow compared to only 11.3” in 2014. However, the snowstorm disaster of 2014 resulted in nearly \$50,000 of damage to the village’s public utilities in addition to some other, smaller projects.

Historic January snowfall totals fell in 1987 (47.5”), 1978 and 1979 (46.5”, 45.8”). Total average snowfall in December is 26.2”, January is 22.6”, February averages are slightly less at 16.9” and March is 18.3”. February 14th-15th, 2007 saw the greatest 24-hour max snowfall total at 23.5”. The snowfall totals are annual averages based on weather data collected from 1981 to 2018 for the NOAA National Climatic Data Center. From 2011 to the first half of 2020, there were four recorded “extreme” weather events in Orleans County: February 4th and 15th: Heavy Snow. January 7th and February 1, 2015: Extreme Cold/Wind Chill.

On February 5, 2001, a winter storm event with accumulations of 10 to 14 inches across Orleans County had reported damage in several towns, including Derby: “A storm system developed off the coast of Virginia early Monday, February 5, 2001 and moved northeast . It moved across extreme southeast coastal New England late Monday night and into the Gulf of Maine early Tuesday, February 6th. Steady snow spread across the area by the afternoon of Monday, February 5th and continued overnight and was heavy at times. The snow tapered off to flurries Tuesday morning, February 6th. Some minor automobile accidents were reported. Barn roofs collapsed in the Towns of Craftsbury and Holland (Orleans County), apparently due to the weight of the snow after the storm ended. Across the counties, generally 10 to 14 inches of snow fell, with Sutton (Caledonia county) reporting 14.4 inches, Chelsea (Orange county) with 12 inches, and Greensboro (Orleans county) with 10.” On March 5-7, 2001, there was a snow emergency event for which the Town of Derby received Public assistance funds (EM 3167). The NOAA database reports that between 12 and 30 inches of snow fell, and \$75,000 in regional property damage resulted. The following description is provided:

“Snow overspread Vermont Monday morning (March 5th) and became steady and heavier by afternoon and continued through the night before tapering off late Tuesday, March 6th. The snow was heavy at times. Some impacts included: Many schools were closed and many towns postponed town meeting day. A number of accidents were reported including some on IT89. Generally, between 12 and 30 inches of snow fell, with the least in the extreme north and in the shadow effect area of eastern Orleans county. A few snowfall reports included: In Franklin county, Enosburg Falls reported 16 inches while in Orleans county, Newport reported 19 inches.” On February 14, 2007 a “heavy snow” event in Orleans resulted in 200 K in property damage county-wide and deposited 24 inches of snow in Derby.

There are no standard loss estimation models or methodologies for the winter storm hazards. Potential losses from winter storms are, in most cases, indirect and therefore difficult to quantify. According to the 2014 National Climate Assessment, there is an observable increase in severity of winter storm frequency and intensity since 1950. While the frequency of heavy snowstorms has increased over the past century, there has been an observed decline since 2000 and an overall decline in total seasonal snowfall (2018 SHMP).

Ice Storm

Major Ice Storms occurred in January 1998 and again in January 2014. While Derby was not affected by the ice storm of 1998, one of the problems with weather related storms is the loss of power. Power outages are frequent during storms with high winds causing the trees to fall on power lines. The North American Ice Storm of 1998 was produced by a series of surface low pressure systems between January 5 and January 10, 1998. For more than 80 hours, steady freezing rain and drizzle fell over an area of several thousand square miles of the Northeast, causing ice accumulation upwards of 2” in some areas. Derby received less than .5” of ice. On December 13th, 2013, another ice storm hit portions of Orleans County, resulting in the greatest disruption of electric service since 1998 at 96 hours for some customers regionally but the greatest impact for residents in Derby and was 16 hours on February 16th, 2013. While there is evidence that supports an increase in weather and precipitation severity, the incidence of ice storms remains fairly spaced out. The town expects to have another ice storm but unlike rain and snow events, the occurrence of a major ice storm is not expected every year (www.wrh.noaa.gov/map/?wfo=sto).

Extreme Cold

Extreme cold temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure (e.g. burst pipes from ice expansion and power failure). What constitutes “extreme cold” can vary across different areas of the country based on what the population is accustomed to in their respective climates. Exposure to cold temperatures can cause frostbite or hypothermia and even lead to heart attacks during physically demanding outdoor activities like snow shoveling or winter hiking. When temperatures dip below freezing, incidents of icy conditions increase, which can lead to dangerous driving conditions and pedestrian-related slipping hazards.

A large area of low pressure and cold air surrounding the poles, known as a polar vortex, is strengthened in the winter. When these polar vortex winds are distorted, due to cyclical strengthening and weakening or interaction with high-amplitude jet stream patterns, they have the potential to split into two or more patterns, allowing arctic air to flow southward along a jet stream. As this arctic air is able to access more southerly regions, extreme cold conditions can be observed in Vermont, which also have the potential to remain over the region for extended periods.

-2018 SHMP

While there is no historical evidence to support a concern over the consequences of extremely hot temperatures on human health and safety, high temperatures can help to create severe storms as the one evidenced on September 11th, 2013, where record heat helped to produce damaging hail and winds in parts of the NEK and other areas of Vermont and NY. Recent extremes in cold temperatures is a concern and impact the entire planning area and region. 2015 tied the coldest winter (January to March) on record (1923) for Vermont according to the NOAA's National Climatic Data Center whose dataset dates to 1895. The National Weather Service has the following, recent, temperature records for nearby Newport City:

- Highest: 95 degrees, August 2001
- Lowest: -38 degrees, February 1933

Cold temperatures are expected in the Northeast, but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. The winter of 2015 was the coldest anyone could remember with a mean temperature of 7.8 degrees Fahrenheit. However, the January of 1994 had a mean temperature of 2.7 degrees Fahrenheit which is the coldest mean temperature since 1930 and January is the statistically coldest month in all of Vermont. Since 1930, January produced temperatures in the negative 20's and 30's consistently for Orleans County with record cold temperatures occurring in 1957 and 1933 (-38). While the temperatures for the town remain within averages seen in the last 85 years, dangerously cold temperatures are expected every winter.

The NOAA Wind Chill Chart identifies those temperatures and associated wind speeds that may cause frostbite if skin is exposed to the air over a certain period of time:

Table 2-5: NOAA Wind Chill Chart

		Temperature (°F)																	
Calm		40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Wind Speed (mph)	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98	

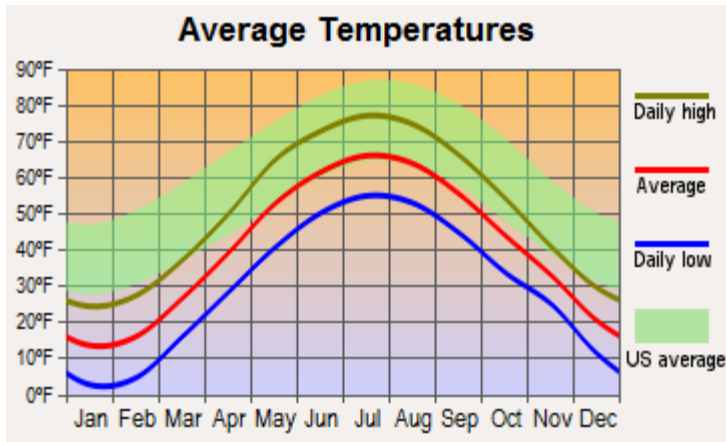
30 minutes
10 minutes
5 minutes

Wind Chill (°F) = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})
 Where, T = Air Temperature (°F) and V = Wind Speed (mph)

In anticipation of extreme cold temperatures, the National Weather Service may issue the following watches, warnings or advisories, which are aimed at informing the general public as well as the agricultural industry:

- Wind Chill Warning: Dangerously cold wind chill values are expected or occurring
- Wind Chill Watch: Dangerously cold wind chill values are possible
- Wind Chill Advisory: Seasonably cold wind chill values but not extremely cold values are expected or occurring
- Hard Freeze Warning: Temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants
- Freeze Warning: Temperatures are forecasted to go below 32°F for a long period of time, killing some types of commercial crops and residential plants
- Freeze Watch: Potential for significant, widespread freezing temperatures within the next 24-36 hours

Table 2-6: Derby Temperature Ranges vs. National Average



Flooding

“Flooding is the most common recurring hazard event in Vermont. In recent years, flood intensity and severity appear to be increasing. Flood damages are associated with inundation flooding and fluvial erosion. Data indicate that greater than 75% of flood damages in Vermont, measured in dollars, are associated with fluvial erosion, not inundation. These events may result in widespread damage in major rivers’ floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of both inundation flooding and fluvial erosion can be exacerbated by ice or debris dams, the failure of infrastructure (often as a result of undersized culverts), the failure of dams, continued encroachments in floodplains and river corridors, and the stream channelization required to protect those encroachments.”

-2018 SHMP

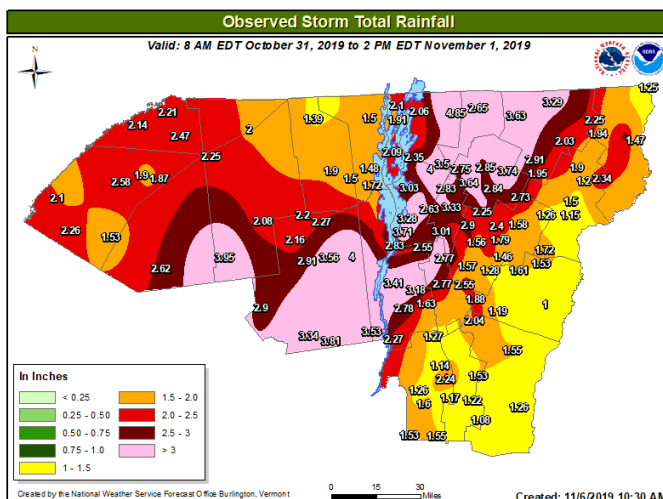
The Town of Derby is within Vermont Tactical Basin 17, and the majority of the town is in the Lake Memphremagog and Clyde River watersheds. The northeast corner of Derby is in the Riviere Tomifobia watershed with the eastern portion in the Headwaters Tomifobia River sub-watershed. The southern section of Derby is in the Barton River watershed with the very southern tip in the Willoughby River sub-watershed. Although the basin is known for its clear waters, deep lakes and exceptional fisheries, the State of Vermont 2016 Stressed Waters List includes Lake Memphremagog (elevated levels of mercury in walleye), Clyde Pond (elevated levels of mercury in walleye), and a portion of Johns River (farms, granite process & lagoons, wetlands are adjacent land uses). Surface waters in Derby that are large enough to be regulated by the State Agency of Natural Resources under the Shoreland Protection Act, which establishes a protected area consisting of the first 250 feet from the mean water level of lakes and ponds greater than 10 acres in size, include Lake Memphremagog, Lake Salem, Little Salem, Derby Pond, Brownington Pond, and Cobb Pond. Named rivers and streams in Derby include Clyde River, Johns River, Cobb Brook, Coche Brook, Crystal Brook, Day Brook, Greens Brook, and Orcutt Brook

The Federal Emergency Management Agency (FEMA) produced Flood Insurance Rate Maps (FIRM) in 1985. These maps are extremely poor with a scale of 1 inch = 1,000 feet making it

difficult to determine the boundaries of the flood hazard zones. FEMA is working on updating the FIRMs with an estimated completion date of 2022.

While Derby, as much of the NEK, suffered minimally from Tropical Storm Irene which proved to be the most damaging and widespread flood event Vermont has seen in many decades, the “Halloween” storm of 2019 proved to be the most damaging flood event for Derby in recent memory. This powerful storm system tracked across the eastern Great Lakes late on October 31st 2019 and produced an axis of 3 to 5 inches of rain, which caused significant flooding across our region. Record rainfall occurred at Burlington, Vermont with 3.30 inches on October 31st, along with a record high temperature of 71 degrees. In addition, very gusty southwest winds developed behind this potent storm, which generated scattered to widespread power outages. Surface wind gusts measured up to 65 mph across northern New York and parts of Vermont, with gusts over 100 mph at the summits. The heavy rainfall washed out numerous roads and culverts from Essex County, New York into parts of central and northern Vermont, while 10 rivers reached flood stage with 8 reaching moderate to major levels. A new record high level of 14.72 feet was attained at North Troy on the Missisquoi River. Extensive flooding was observed in the following river basins: Missisquoi, Lamoille, Winooski, and Ausable, while flash flooding with very sharp rises of smaller streams and rivers occurred across the higher terrain of the eastern Adirondacks into central and northern Green Mountains of Vermont, including the Champlain Valley. A few observed storm total rainfall were 5.26 inches in East Berkshire, 4.85 inches in Enosburg Falls, 4.80 in Fletcher, 4.32 Westford, and 4.0 inches in Elizabethtown, New York. Table 2-7 below shows the storm total precipitation from 31 October at 8 AM to 1 November 2019 at 2 PM. Derby and its Villages are included in the light purple sections of the map, indicating over 3” of rainfall during the event.

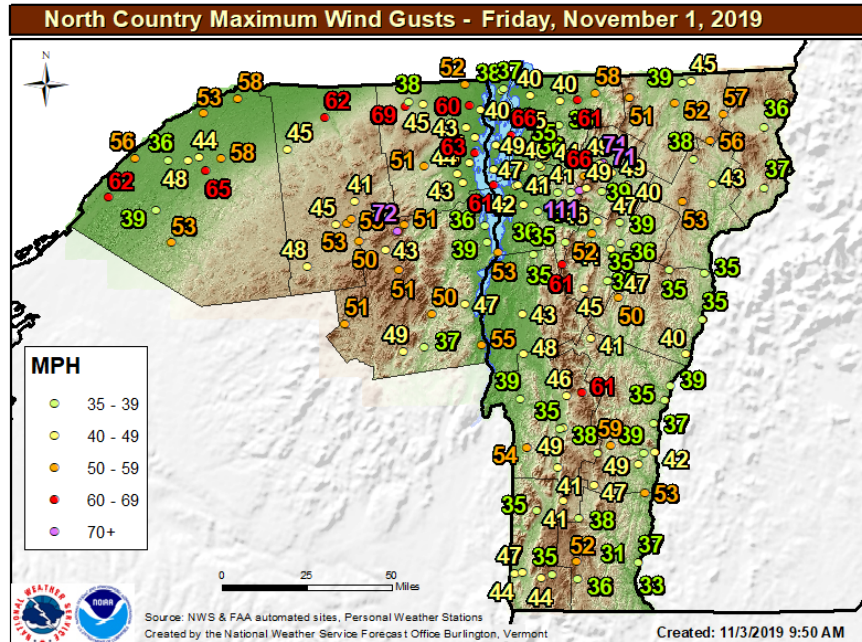
Table 2-7: Observed storm total rainfall from 8 AM EDT on 31 October to 2 PM EDT on 1 November 2019.



The second significant impact from this powerful storm was the high winds, which caused scattered to widespread power outages across northern New York into Vermont. The core of the strongest winds occurred early morning on November 1st across New York and spread into

Vermont during the daytime hours. At the peak, over 120,000 customers were without power across the region. Given how saturated the soils were from the recent heavy rainfall, shallow rooted trees were easily uprooted, exacerbating power outages. A few peak wind gusts included 69 mph at Ellenburg, 65 mph in Potsdam and 62 mph in Malone, New York, while a gust to 71 mph was measured in Johnson, 66 mph at Burton Island and 111 mph at Mount Mansfield in Vermont. Figure 2 below shows a map of observed peak wind gusts across the North County on 1 November 2019. Derby did sustain wind damage that was addressed by electric and telephone service providers.

Table 2-8: Maximum Wind Gust Map for 11/1/2020



Flooding is the most common recurring hazard event in the state of Vermont. June 2015 broke records across the state for the wettest on record. The area received 7 to 8 inches of rain in June but flooding did not result. Recent history, including the flooding events of 2011 and 2019 and the records set in 2015 suggest that increases in total rain fall and severity are to be expected along the lines seen with the records set across the state recently. In addition to the disaster events listed in this update, there have been 11 events on Orleans County since 2011: 6 Flash Floods; 5 Floods. However, Derby was not affected by these events (Source NOAA).

Flood Vulnerability

All of the planning area has the potential to be affected by flooding. Although, comparatively, the town has remained insulated from the catastrophic flood damage that the state has seen in the last ten years, the community continues to have concerns about impacts of future flooding. Data obtained from the SHELDUS Spatial Hazards Events & Losses Database maintained by the University of South Carolina catalogs flooding events over approximately the past 10 years and reports 21 events in the county. Financially, damage to town bridges poses the greatest threat.

There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash flooding and urban flooding. Flooding has also been known to occur as a result of ice jams in rivers adjoining developed towns and cities. These events may result in widespread damage in major river floodplains or localized flash flooding caused by unusually large rainstorms over a small area.

The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private and/or beaver dams. Rain storms are the cause of most flooding in town. Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding, especially when coupled with high rain levels. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation and erosion damage to property and infrastructure. The *2018 Vermont State All-Hazards Mitigation Plan* discusses flooding extensively. While that plan is concerned with all of Vermont, the information on flooding is relevant in that:

“Recent studies have shown that most flooding in Vermont occurs in upland streams and road drainage systems that fail to handle the amount of water they receive. Due to steep gradients, flooding may inundate these areas severely, but only briefly. Flooding in these areas generally has enough force to cause erosion capable of destroying roads and collapsing buildings. These areas are often not mapped as being flood prone and property owners in these areas typically do not have flood insurance (DHCA, 1998). Furthermore, precipitation trend analysis suggests that intense local storms are occurring more frequently. Additionally, irresponsible land use and development will exacerbate the preexisting vulnerability. Urban flooding usually occurs when drainage systems are overwhelmed and damages homes and businesses. This flooding happens in all urban areas, but specifically in Burlington where the area is located at the bottom of a gradient, which adds to the intensity of this localized flooding...

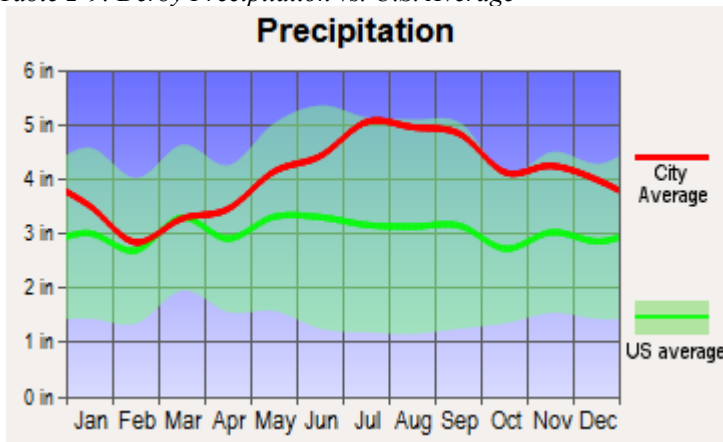
...Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Heavy rains with previous ground saturation, which causes runoff, are a significant part of the flooding formula in Vermont. Steep topography and narrow, inhabited, stream and river valleys further increase the dangerous nature of this hazard. Furthermore, precipitation trend analysis suggests that intense, localized storms that can cause flash flooding are occurring with greater frequency. While flooding will continue, planning and other mitigation measures can help minimize damages.

All of Vermont’s major rivers have inhabited flood plains. While residents in mountain valleys are at risk, they may not be aware of the danger or may choose to ignore it. There are many reasons property owners are reluctant to relocate to less flood prone ground, not the least of which is the lack of personal experience of flooding. In addition, many communities originated beside rivers and streams, some of the most attractive property is located in vulnerable areas. Lakeshore property in Vermont is vulnerable to flooding from high water levels, either by surface water erosion or flooding. Occasionally, water-saturated ground and high-water tables cause flooding to basements and other low-lying areas. Lakeshore property is highly desirable

and valuable, making the development of lakeshore areas very likely, even with the high potential for flooding. Restrictions on lakeshore property development have significant negative economic and tax revenue impacts that must be carefully weighed against the gains in personal safety and protection of property.”

Vermont experienced major floods long before Federal disaster assistance became available. The most destructive recorded event was in November of 1927. In the month before the flood, rains in excess of 150% of normal precipitation fell after the ground had frozen. The flood itself was precipitated by 10 inches of rain falling over the course of a few days. The flood inundated parts of many towns and damaged or destroyed numerous bridges in the county. As the history of the flooding cited above bears out, the geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Numerous floods have resulted in Presidentially declared disasters and an influx of Federal disaster assistance. Of these disasters, 1973 flood inflicted widespread damage across the state and the residual rains of Hurricane Belle in 1976 resulted in substantial federal disaster assistance in Vermont. The greatest 24-hour rainfall record for nearby Newport City occurred in late August 2011 at 4.01”. The greatest level of precipitation in any month occurred in August 2011 at 11.12”. Previous experiences have proven to the town that flooding is the greatest risk and another flood event is probable by the time this plan requires an update. With this conviction, the need to complete viable mitigation actions to town infrastructure becomes incredibly important and the town remains aware of this. The estimated Capacity-Disruption Levels Given a Measured Rainfall Event can be interpreted as the conditional probability that a particular roadway capacity disruption occurs, given that a rainfall event occurs. For Orleans County, the probability that the intensity of a rain event will result in approximately a 2%, 7.5%, or 13.5% roadway capacity reduction are 7.35%, 23.96%, or 1.3%, respectively (Source: *A Risk-Based Flood-Planning Strategy for Vermont’s Roadway Network, 2015*).

Table 2-9: Derby Precipitation vs. U.S. Average



Inundation and Floodplains

Portions of the 4H Road, Hayward Road, and Birch Drive are within flood zone A and are susceptible to flooding during spring runoff. It is difficult to estimate the total number of

structures in the 100-year limit of the Flood Insurance Rate Maps identified floodplain, as those maps do not accurately match up to the E-911 maps. It is estimated that approximately 50 structures are within the flood hazard area. FEMA is currently working on updating the flood maps for all of Orleans County. The state has further identified and classified roads at risk of erosion. Regarding flood inundation issues, the *2018 Vermont State All-Hazards Mitigation Plan* states:

Inundation flooding is the rise of riverine or lake water levels, while fluvial erosion is streambed and streambank erosion associated with physical adjustment of stream channel dimensions (width and depth). Both inundation flooding and fluvial erosion occur naturally in stable, meandering rivers and typically occur as a result of any of the following, alone or in conjunction:

- *Rainfall: Significant precipitation from rainstorm, thunderstorm, or hurricane/tropical storm. Flash flooding can occur when a large amount of precipitation occurs over a short period of time.*
- *Snowmelt: Melted runoff due to rapidly warming temperatures, often exacerbated by heavy rainfall. The quantity of water in the snowpack is based on snow depth and density.*
- *Ice Jams: A riverine back-up when flow is blocked by ice accumulation. Often due to warming temperatures and heavy rain, causing snow to melt rapidly and frozen rivers to swell.*

Inundation and fluvial erosion may both increase in rate and intensity as a result of human alterations to a river, floodplain, or watershed. For instance, when a dam fails there may be significant, rapid inundation which can occur without warning. Public and private structures and infrastructure become vulnerable when they are located on lands susceptible to inundation and fluvial erosion.

Riverine Inundation Flooding:

The land area where inundation flooding occurs is known as the floodplain. During high water events, water flows out of the river bank and spreads out across its floodplain. FEMA defines the portion of the floodplain inundated by the 1% annual chance flood as the Special Flood Hazard Area (SFHA); the area where the National Flood Insurance Program (NFIP) floodplain management regulations must be enforced and where the mandatory purchase of flood insurance applies for federally-secured loans.

Inundation flooding on larger rivers and streams typically occurs slowly, over an extended period of time but can spread out over a large area of land. Due to the slower onset of inundation flooding on larger rivers, there is time for emergency management planning (e.g. evacuations, electricity shut-off considerations, etc.) to take place. Though the inundation floodwaters are slower to hit, they often take time to recede as well, and exposure to water for an extended period of time can result in significant property damage. U.S. Geological Survey's (USGS) National Water Information System monitors real-time streamflow gaging stations in Vermont.

Fluvial Erosion

Erosion occurs on a consistent, but small-scale, basis within the riparian corridor of the town's streams and rivers. This is a part of normal natural processes and as such is necessary for the proper functioning of the ecosystem of these waterways. However, fluvial erosion on a large scale can damage stream banks and undercut infrastructure such as roads, bridges and culverts as well as agricultural land and structures, causing severe damage. Fluvial erosion on a large scale can cause stream bank collapses, which are generally classified as landslides. Most flood damage is associated with fluvial erosion rather than inundation. The *2018 Vermont State All-Hazards Mitigation Plan* contains the following discussion of fluvial erosion:

In Vermont, most flood-related damage is due to fluvial erosion. Erosion occur when the power of the flood (i.e. the depth and slope of the flow) exceeds the natural resistance of the river's bed and banks. Rivers that have been overly straightened or deepened may become highly erosive during floods, especially when the banks lack woody vegetation, or when the coarser river bed sediments have been removed. In areas where rivers are confined due to human activity and development, they have become steeper, straighter, and disconnected from their floodplains. The more trapped the river is, the greater power it will gain, which eventually results in a greater degree of damage to critical public infrastructure such as roads and stream crossings, as well as homes, businesses, community buildings and other man-made structures built near rivers. Fluvial erosion is also increased downstream when all the eroded materials (i.e. sediment and debris) come to rest in a lower gradient reach, clog the channel, and cause the river to flow outside its banks. When severe enough, fluvial erosion can also be the cause of Landslides (see: Landslides). The land area that a river accesses to meander and overtop its banks to release flood energy without excessive erosion is known as the River Corridor. A river corridor includes the meander belt of a stream or river and a buffer of 50'. The River Corridor, as defined in Vermont statute, is: 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 section 1422 of this title, and for minimization of fluvial erosion hazards, as delineated by the Agency of Natural Resources in accordance with river corridor protection procedures.

Vermont's River Corridor maps delineate river corridors for larger streams and rivers, and standard setbacks for smaller, upland streams. The setbacks were determined by factoring in the same stable stream slope requirements used when delineating a river corridor using a meander centerline setback. These maps are located on the Vermont FloodReady3 and Vermont Natural Resources Atlas websites.

The Vermont Agency of Transportation (VTrans) applies the term “scour critical” to stream crossing structures especially vulnerable to streambed scour—the undermining of bridge supports by water action and erosion. A spreadsheet database is maintained by VTrans and continually updated by the Bridge Inspection Program. Structures inspected are only those of 20 ft. or longer owned by a municipality or the state. The scour critical rating is based on the structure itself, and does not consider debris jams, outflanking, channel change, or other issues

commonly associated with fluvial erosion. Water supply source and distribution systems are also endangered by fluvial erosion. Many water distribution systems involve buried pipes that cross streams, which are vulnerable to fluvial erosion. In December 2014, the Vermont Department of Environmental Conservation (DEC) released the “Flood Hazard Area and River Corridor Protection Procedures” guide, outlining specific actions and considerations. Erosion of stream banks was a concern but is less-so now. A FEMA study has shown very little increase in velocities resulting from over-bank events which are infrequent and have subsequently not caused channel migration.

The State of Vermont Agency of Natural Resources (ANR) has mapped “River Corridors” throughout the State. The river Corridors, as defined by ANR, “encompass the area of land surrounding a river that provides for the meandering, floodplain, and the riparian functions necessary to restore and maintain the naturally stable or least erosive form of a river minimizing erosion hazards over time.” Since lands within and immediately abutting a river corridor are at higher risk to fluvial erosion, the State recommends that 2020 Town Plan – Adopted March 3, 2020 46 development within mapped River Corridors be avoided, and that a 50 foot setback be maintained for smaller streams. As an incentive to encourage Towns to restrict new development within River Corridors, the State provides an increased State match under ERAF for Towns that adopt local flood regulations incorporating regulation of State River Corridors. River Corridors have been mapped by the State for all or portions of Clyde River, Johns River, Cobb Brook, Coche Brook, Day Brook, Greens Brook, Orcutt Brook and an unnamed stream that empties into the south east portion of Little Salem.

Ice Jams

Ice jams, which can cause rapid and catastrophic flooding, are considered increasingly hazardous in parts of Vermont. In addition to the inundation damage they cause, ice jams can block infrastructure such as roads and culverts. Ice jams are not as much of a concern in Newport as elsewhere in Vermont. A list of historic ice jams, including municipalities and streams, is maintained by the Vermont Division of Emergency Management and the Vermont Agency of Natural Resources. There has been some damage and minor flooding as a consequence of ice jams in the past. Ice jams are not as much of a concern in town as elsewhere in Vermont. A list of historic ice jams, including municipalities and streams, is maintained by VEM and the Vermont Agency of Natural Resources (ANR). The US Army Corps of Engineers Cold Regions Research and Engineering Laboratory maintains a more specific database of ice jams, which includes over 903 events in Vermont with the latest occurring in 2013. The Clyde River has had two recorded ice jams but not in the region of the town or villages of Derby. Other NEK areas have high rankings. Passumpsic had 19 (10th highest in the state) and St. Johnsbury had 38 (5th highest in the state) with the Connecticut River being number one in the state with 84 recorded ice jams. On a positive note, the total number of events has been decreasing since 2004. (Source: http://rsgisias.crrel.usace.army.mil/apex/f?p=524:39:10954063060296::NO::P39_STATE:VT)

Dams

According to the 2013 Vermont State All-Hazards Mitigation Plan, “The VT Agency of Natural Resources (ANR) Dam Safety Program maintains an inventory of 1205 dams (including 85 ANR owned dams) with impoundments greater than 500,000 cubic feet”. Failure of any of these dams could result in significant downstream flooding. A dam breach is remains the biggest threat to

the municipal sewer system. There have been no recent or historically relevant flooding events associated with the failure of any dam in *Vermont*. However, as stated in FEMA Guide P-956 “Living with Dams: Know Your Risks” (2013): “*Although dam failures are infrequent, the impacts can be catastrophic, often far exceeding typical stream or river flood events.*” Derby has no dams and is not at risk from dam failures in the region.

Pandemic

Pandemic planning in Vermont appears to ebb and flow. Following the H1N1 Virus Outbreak in 2009-2010, increased emphasis on pandemic planning was seen across the state. From 2010 to 2019 however, without another U.S. event, emphasis on pandemic planning diminished. While Vermont, due to its rural nature, has some level of protection from national infection rates during a pandemic, the financial implications experienced during the COVID-19 pandemic in 2020 hit the state extremely hard.

COVID-19 is a new disease, caused by a virus not previously seen in humans. COVID-19 is highly contagious and people with COVID-19 who don't have any symptoms can spread the virus to other people. On March 13, 2020, President Trump declared a nationwide emergency pursuant to Sec. 501(b) of Stafford Act to avoid governors needing to request individual emergency declarations. All 50 states, the District of Columbia, and 4 territories have been approved for major disaster declarations to assist with additional needs identified under the nationwide emergency declaration for COVID-19. Additionally, 32 tribes are working directly with FEMA under the emergency declaration. FEMA announced that federal emergency aid has been made available for the state of Vermont to supplement the state and local recovery efforts in the areas affected by the Coronavirus Disease 2019 (COVID-19) pandemic beginning on January 20, 2020 and continuing. Public Assistance federal funding was made available to the state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency protective measures (Category B), including direct federal assistance under Public Assistance, for all areas in the state of Vermont affected by COVID-19 at a federal cost share of 75 percent.

In early 2020, there was a quick return to the tenets of effective pandemic planning. Preparing for hospital surge, high death rates and the medical equipment necessary for both patients and health care workers are examples of the state’s early focus. Public information and guidance on safety, isolation, travel and quarantine also became extremely important while mitigating the pervasive economic consequences of reducing work forces, sending students home and closing businesses. Additionally, Vermont had to consider the implication of, and work to control, the immigration of people from other states. Both infection risk and taxing of local resources were the main concerns associated with this real consequence of the pandemic.

While the Northeast Kingdom remained insulated from infection rates (and subsequent deaths) seen elsewhere in the state (e.g. Burlington), issues of border closure, implementing safety protocol and procedures and economic resilience were experienced in Derby. The town will be applying for Federal Disaster Funding and helping to facilitate grant and emergency loans for residents and business owners. Specifics related to amount and funding source were not available during the writing of this update. As of August 18, 2020, there have been 1527 cases, 58 deaths and 1343 recovered in the state. According the current data, Derby has had 1-5 cases (<https://www.healthvermont.gov/response/coronavirus-covid-19/current-activity-vermont#town>).

SECTION 3: RISK ASSESSMENT

3.1 Designated Hazard Areas

3.1.1. Flood Hazard Areas

All of the Barton River watershed is located in Orleans County, a drainage area of approximately 164 square miles. The Town of Derby is within Vermont Tactical Basin 17, and the majority of the town is in the Lake Memphremagog and Clyde River watersheds.

The northeast corner of Derby is in the Riviere Tomifobia watershed with the eastern portion in the Headwaters Tomifobia River sub-watershed. The southern section of Derby is in the Barton River watershed with the very southern tip in the Willoughby River sub-watershed. Although the basin is known for its clear waters, deep lakes and exceptional fisheries, the State of Vermont 2016 Stressed Waters List includes Lake Memphremagog (elevated levels of mercury in walleye), Clyde Pond (elevated levels of mercury in walleye), and a portion of Johns River (farms, granite process & lagoons, wetlands are adjacent land uses).

Surface waters in Derby that are large enough to be regulated by the State Agency of Natural Resources under the Shoreland Protection Act, which establishes a protected area consisting of the first 250 feet from the mean water level of lakes and ponds greater than 10 acres in size, include Lake Memphremagog, Lake Salem, Little Salem, Derby Pond, Brownington Pond, and Cobb Pond. Named rivers and streams in Derby include Clyde River, Johns River, Cobb Brook, Coche Brook, Crystal Brook, Day Brook, Greens Brook, and Orcutt Brook.

Despite NFIP data reporting eight properties in the A-zone, there are more than this and the town will work to specify these properties in the upcoming planning cycle. Also reported are 25 policies with a total coverage of \$4,297,800. There has been one claim since 1978 for \$133,944. *Source: NFIP Insurance Report/Town Maps.* The tables below give information on the 1; National Flood Insurance Program, 2; Repetitive Loss Property Information, 3; Non-mitigated Repetitive Losses

1. National Flood Insurance Program Information:

Total Premium	V-Zone	A-Zone	Policies	Total Coverage	Claims since 1978	Total Paid since 1978
\$14,708	0	8	25	\$4,297,800	26	\$335,316

2. Repetitive Flood Loss Property Information: (all residential buildings)

Area/Type	Repetitive Losses	BCX Claims	Polices	LOMCS	FIRM

Derby Center	0	0	0	0	3/28/1975
Derby Town	6	2	25	5	9/27/1985

Resource: FEMA Repetitive Loss/BCX Claims. NOTE: BCX claims are ones located out of the SFHA.

3.1.2. Fluvial Erosion Hazard Areas

About two-thirds of Vermont’s flood-related losses occur outside of mapped floodplains, and this reveals the fundamental limitations of the FEMA FIRMs. A mapped floodplain makes the dangerous assumption that the river channel is static, that the river bends will never shift up or down valley, that the river channel will never move laterally, or that riverbeds will never scour down or build up. River channels are constantly undergoing some physical adjustment process. This might be gradual, resulting in gradual stream bank erosion or sediment deposit – or it might be sudden and dramatic, resulting a stream bank collapse. The losses experienced during the May 2011 storms and Tropical Storm Irene were most often related to the latter. In fact, this type of flood-related damage occurs frequently in Vermont, due in part to the state’s mountainous terrain. Land near stream banks are particularly vulnerable to erosion damage by flash flooding, bank collapse, and stream channel dynamics. The Vermont Department of Environmental Conservation, Agency of Natural Resources, has identified river corridors, which consist of the minimum 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. In other words, the river corridor provides “wobble room” for a stream as its channel changes over time. Keeping development out of the river corridors therefore reduces vulnerability to erosion.

3.2 Non-designated Hazard Areas

3.2.1. Ice Storm Damage

On December 13th, 2013, another ice storm hit portions of Orleans County, resulting in the greatest disruption of electric service since 1998. While there is evidence that supports an increase in weather and precipitation severity, the incidence of ice storms remains fairly spaced out. The town expects to have another ice storm but unlike rain and snow events, the occurrence of a major ice storm is not expected every year. (1998 data: <https://www.fema.gov/disaster/1201>)

3.2.2. High Winds and Lightning

Ridgeline and hilltop homes as well as homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. High tension lines are maintained very well by the electric service providers and the Vermont Agency of Transportation works to keep limbs trimmed on state highways. As with many Vermont communities characterized by natural terrain, the issue of downed trees creating power loss and property damage is more common compared to urban areas. Historically, these instances are short in duration and have not posed a serious risk for the town or its residents.

3.3 Previous FEMA-Declared Natural Disasters and Non-Declared Disasters

While Derby has had a history of flooding, losses to public infrastructure have intensified in recent years. DR 4474 (2019) resulted in the greatest financial impact to infrastructure for the town. The town has been fortunate that its buildings and residential property has remained unaffected by recent disasters. Derby and its Villages have received public assistance funding from FEMA for the following natural disasters:

Table 3-1: KEY:

DR	Date	Type
1307	11/10/1999	TS Floyd
1428	07/12/2002	Severe Storm(s)
1559	9/23/2004	Severe Storms, and Flooding
1995	06/15/2011	Severe Storm(s)
3167	04/10/2001	Snow
4022	09/01/2011	Hurricane
4140	08/02/2013	Severe Storm(s)
4066	06/22/2012	Severe Storms, Tornado and Flooding
4163	01/29/2014	Severe Winter Storm
4178	06/11/2014	Severe Storm/Flooding
4207	02/03/2015	Severe Winter Storm
4380	06/30/2018	Severe Storm/Flooding
4356	01/02/2018	Severe Storm/Flooding
4474	10/31/2019	Severe Storm/Flooding

Table 1-2: Public Assistance by Disaster and Project: 2005-Current:

Disaster Number	PW Number	Application Title	Applicant ID	Damage Category Code	Project Size	Project Amount	Federal Share Obligated	Total Obligated
1559	189	DITCH AND ROAD REPAIR	019-17350-00	C - Roads & Bridges	Small	\$3,928.76	\$2,946.57	\$3,095.07
1559	190		019-17350-00	C - Roads & Bridges	Small	\$1,743.36	\$1,307.52	\$1,373.42
1559	191	SLOPE REPAIR	019-17350-00	C - Roads & Bridges	Small	\$2,205.00	\$1,653.75	\$1,737.10

1559	192	ROAD SURFACE REPAIR	019-17350-00	C - Roads & Bridges	Small	\$1,645.00	\$1,233.75	\$1,295.93
1559	193	ROAD BASE AND HEADWALL REPAIR	019-17350-00	C - Roads & Bridges	Small	\$23,514.00	\$17,635.50	\$18,524.33
1559	194	SHOULDER REPAIR	019-17350-00	C - Roads & Bridges	Small	\$3,516.00	\$2,637.00	\$2,769.90
1559	195	ROAD DAMAGE	019-17350-00	C - Roads & Bridges	Small	\$3,346.48	\$2,509.86	\$2,636.37
1559	196	ROAD SURFACE AND HEADWALL REPAIR	019-17350-00	C - Roads & Bridges	Small	\$4,156.32	\$3,117.24	\$3,274.35
1559	197	ROAD SURFACE REPAIR	019-17350-00	C - Roads & Bridges	Small	\$1,208.66	\$906.50	\$952.18
1559	198	ROAD SURFACE AND DITCH REPAIR	019-17350-00	C - Roads & Bridges	Small	\$8,507.44	\$6,380.58	\$6,702.16
1559	199	ROAD AND SHOULDER REPAIR	019-17350-00	C - Roads & Bridges	Small	\$3,207.14	\$2,405.36	\$2,526.59
1559	208	EMERGENCY ASSISTANCE	019-17350-00	B - Protective Measures	Small	\$2,135.00	\$1,601.25	\$1,681.95
1995	388	NCORLDER bushyhill	019-17350-00	C - Roads & Bridges	Small	\$15,870.88	\$11,903.16	\$11,903.16
1995	395	NCORLDER hayward	019-17350-00	C - Roads & Bridges	Small	\$22,670.79	\$17,003.09	\$17,003.09
1995	401	NCORLDER shattuck hill	019-17350-00	C - Roads & Bridges	Small	\$4,526.19	\$3,394.64	\$3,394.64
1995	421	NCORLDER west	019-17350-00	C - Roads & Bridges	Small	\$5,988.99	\$4,491.74	\$4,491.74
1995	492	NCORLDER west 2	019-17350-00	C - Roads & Bridges	Small	\$6,163.30	\$4,622.48	\$4,622.48

Sources: FEMA Opensource

Table 3-4: DR 4474 Disaster Summary by Project

Name of damage/facility	Describe Damage	Approx. Cost	% Work Complete	Labor Type	PA History	Applicant priority
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Dumas Rd C9:Q27	Road washed out approx .15 mile from Rte 111. 15 ft deep 50 ft long. Road will be closed for a while.	\$200,000	5%	FA/C	U	Urgent
Ann Wilson Rd	Total washout 600+ ft road. Road and stream bank need to be rebuilt. Road open but needs a lot of work.	\$30,000	100%	FA/C	U	Urgent
Bushey Hill Rd	1) 18" Culvert washed out bottom of Libbly Hill. 2) Driveway culvert washed out approx .2 mile from Rte 105. 3) Cross culvert plugged East of Salem Derby Rd with associated ditch erosion. 4) Minor ditch erosion other areas.	\$10,000	100%	FA/C	U	Urgent
Elm St	Erosion around Johns River culvert undermined half way across road. One lane was closed until repairs were completed. Still need to pave damaged area.	\$5,000	100%	FA/C	U	Urgent
Glover Rd	1) Cross culvert failed and only one lane is passable. 2) Class 4 section of road washed	\$5,000	100%	FA/C	U	High

	out.					
Hinman Settler Rd	1) Major washout on hill just off Rte 105. One lane was closed until repairs on Saturday. 2) North of Cobb Creek moderate ditch erosion.	\$15,000	100%	FA/C	U	Urgent
Salem View Heights	Road and ditch erosion at the intersection with Terrace Dr	\$1,000	100%	FA/C	U	Medium
Shattuck Hill Rd	Ditch erosion all the way down the right side depositing a lot of gravel at the base of the hill.	\$5,000	100%	FA/C	U	High
4-H Rd	1) Beach House parking lot next to building has minor washout. 2) Culvert at the end of the road has some erosion on upstream side than needs to be filled. 3) Bus turn around area eroded may need gravel or just grading.	\$1,000	100%	FA	U	Medium
All other roads	Practically all roads have some minor erosion issues.	\$5,000	100%	FA	U	Low
Bates Hill Rd	Moderate/Minor ditch erosion varioius locations	\$1,000	100%	FA	U	Low
Beebe Rd	Minor erosion across Beebe Water Dept drive on the	\$200	100%	FA	U	Low

	flats near Lawson Rd.					
Bridge St	Moderate to severe ditch erosion along south side of road and one cross culvert may be plugged.	\$2,000	100%	FA	U	High
Christman Rd	Culvert on south side of road washed out and needs to be reset.	\$1,000	100%	FA	U	Low
Cross Rd	1) Moderate ditch erosion along middle section of road. 2) Minor ditch erosion other areas.	\$1,000	100%	FA	U	Medium
Fontaine Rd	Ditch erosion in various areas.	\$1,000	100%	FA	U	Medium
Fortin Rd	Moderate and minor erosion in multiple areas.	\$1,000	100%	FA	U	High
Hayward Rd	Road washed out 300+ ft. Road and ditch need to be rebuilt. Stream jumped bank near first set of twin culverts near Dumas/Fontaine intersection.	\$20,000	100%	FA/C	U	Urgent
Herrick Rd	Driveway culvert at Bob Eldrich property washed out and road undermined by ditch erosion. Erosion on top of culvert above Eldrich house.	\$2,000	100%	FA	U	High
Lawson Rd	High water and road erosion.	\$2,000	100%	FA	U	High

	Residents needed to be evacuated.					
Lindsay Rd	2 sections of road between Lakewood Dr and bike path washed out to middle of the road 2-3 ft deep.	\$5,000	100%	FA	U	High
Nelson Hill Rd	Moderate to minor ditch erosion various locations.	\$1,000	100%	FA	U	Medium
Pine Hill Rd	Moderate to minor ditch erosion various locations.	\$1,000	100%	FA	U	Medium
Wallace Rd	Ditch erosion right side just past pavement and left side near end	\$1,000	100%	FA	U	Medium

Source: Town Project Worksheet. Note: financial indicators and completion percentages are considered estimates

Table 3-4: Town of Derby Declared Disaster Summary

Disaster Number	Declaration Date	Incident Type	Applicant Name	Number of Projects	Federal Share Obligated
1559	09/23/2004	Severe Storm(s)	DERBY (TOWN OF)	12	\$44,334.88
1995	06/15/2011	Severe Storm(s)	DERBY (TOWN OF)	5	\$41,415.11
3167	04/10/2001	Snow	DERBY LINE	1	\$1,408.67
3167	04/10/2001	Snow	DERBY (TOWN OF)	1	\$6,244.80
4474	10/31/2019	Severe Storms	DERBY (TOWN OF)	24	\$316,200

Non-declared disasters (e.g. snow and rainstorms) have not resulted in damage above and beyond normal maintenance. Extreme, long-lasting cold temperatures during winter months do pose a concern for the town as in many communities where the price of heating fuel often

exceeds resident's ability to pay. Coupled with high unemployment, there is an increased risk for the town's residents to not meet the financial requirements for adequate heat, especially during long periods of extremely cold temperatures. Without adequate provisions, 48 hours of extremely cold temperatures could create a serious health hazard.

3.3 Hazard Assessment and Risk Analysis

Although estimating the risk of future events is far from an exact science, the Planning Team used best available data and best professional judgment to conduct an updated Hazards Risk Estimate analysis. This analysis assigns numerical values to a hazard's affected area, expected consequences, and probability and supports the inclusion of all profiled hazards in this plan. This quantification allows direct comparison of different kinds of hazards and their effect on the town and serves as a method of identifying which hazards hold the greatest risk based on prior experience and best available data. While there are some differences in risk associated with each jurisdiction, there is a single estimation matrix and when appropriate, subsequent narratives will describe the differences in risk. The following scoring system was used in this assessment:

Area Impacted: scored from 0-4, rates how much of the municipality's developed area would be impacted.

Consequences: consists of the sum of estimated damages or severity for four items, each of which are scored on a scale of 0-3:

- Health and Safety Consequences
- Property Damage
- Environmental Damage
- Economic Disruption

Probability of Occurrence: (scored 1-5) estimates an anticipated frequency of occurrence based on prior experience and current information.

To arrive at the Overall Risk Value, the sum of the Area and Consequence ratings was multiplied by the Probability rating. The highest possible risk score is 80.

3.3.1. Natural Hazards

According to the updated Hazard and Risk Estimation for Derby, the following natural hazards received the highest risk ratings out of a possible high score of 80:

- Severe Winter/Ice Storm (listed as "Winter Storm" in table) (32)
- Flooding (36)
- Extreme Cold (32)
- Pandemic (18)

Flood-related disasters have had the greatest financial impact on the town. While no deaths or injuries have been recorded for declared or non-declared disasters, the potential for health and safety risk during a severe winter storm and extreme cold events are considered higher than that posed by a flooding event.

Table 3-2 Natural hazards risk estimation matrix

Derby Natural Hazard & Risk Analysis: NATURAL HAZARDS		Drought	Flooding	High Winds	Fluvial Erosion	Landslide	Lightning	Multi-Structure Urban Fire	Pandemic	Winter Storm	Extreme Cold
		Area Impacted									
Key: 0 = No developed area impacted											
1 = Less than 25% of developed area impacted											
2 = Less than 50% of developed area impacted											
3 = Less than 75% of developed area impacted											
4 = Over 75% of developed area impacted		1	3	2	1	0	1	1	0	4	4
Consequences											
<i>Health & Safety Consequences</i>											
Key: 0 = No health and safety impact											
1 = Few injuries or illnesses											
2 = Few fatalities or illnesses											
3 = Numerous fatalities		0	1	0	0	0	1	1	3	1	1
<i>Property Damage</i>											
Key: 0 = No property damage											
1 = Few properties destroyed or damaged											
2 = Few destroyed but many damaged											
3 = Few damaged but many destroyed											
4 = Many properties destroyed and damaged		0	1	1	1	0	1	2	0	1	1
<i>Environmental Damage</i>											
Key: 0 = Little or no environmental damage											
1 = Resources damaged with short-term recovery											
2 = Resources damaged with long-term recovery											
3 = Resource damaged beyond recovery		2	2	1	1	2	0	1	0	0	0
<i>Economic Disruption</i>											
Key: 0 = No economic impact											
1 = Low direct and/or indirect costs											
2 = High direct and low indirect costs											
2 = Low direct and high indirect costs											
3 = High direct and high indirect costs		2	2	1	2	1	1	1	3	2	2
Sum of Area & Consequence Scores		5	9	5	5	3	4	6	6	8	8
Probability of Occurrence											
Key: 1 = Unknown but rare occurrence											
2 = Unknown but anticipate an occurrence											
3 = 100 years or less occurrence											
4 = 25 years or less occurrence											
5 = Once a year or more occurrence		1	4	3	3	1	2	2	3	4	4
TOTAL RISK RATING											
Total Risk Rating =		5	36	15	15	3	8	12	18	32	32
Sum of Area & Consequence Scores											
x Probability of Occurrence											

3.4 Hazard Summary

According to the risk estimation analysis, the highest rated hazards for Derby are:

1. Flooding
2. Severe Winter Storm/Ice
3. Extreme Cold
4. Pandemic

Flooding is the highest rated hazard for Derby due to previous damage events and subsequent costs to repair. Within each of the highest rated hazards, there exists the potential for the secondary, but no less important, consequence of increased financial demand on residents because of an event. While winters in Vermont are characterized by cold weather, recent increases in extreme weather events, including extremely cold temperatures increases the costs of heating energy and this is a challenge that the state and local communities are being forced to address. Along these lines, the cases of COVID-19 were minimal in the planning area but the financial impact of protective measures implemented on a state-level impacted the planning area as it did many of the surrounding communities. Recovery from the pandemic will be a long road for some and the consequences for residents and the town and the villages have the potential of being severe. The next planning cycle will give the planning team an opportunity to assess and work to mitigate these consequences.

SECTION 4: VULNERABILITY ASSESSMENT AND LAND USE

Vulnerability refers to the potential impact of a specific loss related to an identified risk. While the loss of any one facility would cause a disruption in town services and operations, the overall vulnerability is low. There are roads, bridges and culverts vulnerable to flooding and those are identified below. Loss of equipment function for the highway department is a vulnerability for the town but the risk is not due or predicted to be a result of a disaster, merely, the required maintenance expected of highway-related machinery. For this section of the plan, the planning team looked at prior history and worst-case scenarios. All three jurisdictions have, essentially, the same vulnerability with two main exceptions: 1; The Villages are more vulnerable to hazardous materials incident due to location of the facility/chemical storage and 2; Derby Town is more vulnerable to road erosion and wash-outs because of its higher percentage of dirt roads (the Villages are nearly 100% paved). These differences will be further addressed in this section and Section 5. Despite any minor variance in vulnerabilities in the three jurisdictions, the primary vulnerability for the three jurisdictions is transportation-related infrastructure damage due to flooding.

Of the profiled hazards, the following vulnerability rating (high, moderate, low) is given below. This vulnerability rating is based on the disaster case history for the town and when the greatest financial impact was seen due to the disaster. The specific vulnerability to the population as a

whole or any specific sub-population (e.g. elderly) is subjective because there is no historical data to rank vulnerability to health and safety of residents, workers or travelers.

Severe winter/ice storm: Moderate

Summary: While all structures are vulnerable to major snow loads, there is little evidence to support concern over structure failure due to snow loads on roofs, ice on gutters, etc. Town snow removal equipment is vulnerable to damage with greater use, especially during emergency situations as well as road damage from plowing. Populations caught outdoors, commuting or working outside during a severe winter storm are more vulnerable to cold-related injury and/or snow related accidents but winter comes every year and residents and the town are accustomed to making intelligent decisions regarding safety and protection of infrastructure. Special populations (e.g. aging, disabled, etc.) are more vulnerable in terms of mitigating structure loads, hazardous travel and relocating to safety.

Extreme Cold: Moderate

Summary: Recent evidence shows that greater extremes in temperature and overall weather fluctuation are occurring with increased frequency. A long-duration cold snap can cause significant damage to structures due to bursting pipes and the residential health and safety considerations include factors related to financial resources, fuel supply, sheltering, provisions and employment.

Flooding: High

Summary: The town is flooding and this is specific to transportation routes and infrastructure more-so than buildings and people in Derby. However slight in terms of probability, a dam failure would have catastrophic implications on homes, buildings, people and equipment. The magnitude of financial resources devoted to flood-related damage in the town equates to high vulnerability. Flooding impacts the planning area by inundation damage to structures, which are considered well-below the FEMA flood hazard elevation and roadway drainage structures. Most of the damage is to road surfaces, drainage structures (culverts, ditching) and driveways. Roadways are also an issue for municipal road crews in each jurisdiction when they become inundated and cut off traffic.

Pandemic: High

Summary: Not only is the COVID-19 current during the drafting of this plan but it will likely remain active, at very least, over the 2020-2021 flu season. While Vermont has remained relatively insulated from the worst-case scenarios already seen in other states in regard to infection rates, there have been significant financial impacts for the region and state. There are several important considerations for the town and villages to take on. Issues such as tax revenue reductions from failure to pay on a large scale to how a major storm event could compromise pandemic response (e.g. sheltering operations and resource allocation).

Table 4-1: Vulnerability Summary Table

Hazard	Vulnerability	Extent (Storm Data from most severe event)	Impact (economic/health and safety consequence)	Probability
Flood	<p>Culverts, bridges, road infrastructure.</p> <p>0 critical or public infrastructure in SFHA/.2% FHA</p>	<p>The greatest 24-hour rainfall record for immediate region occurred in late October 31st, 2019 at 3". The greatest level of precipitation in any month occurred in August 2011 at 11". No detailed data was available for fluvial erosion damage in town in terms of numbers of acres lost during each event.</p>	<p>DR 4474 (10/19) resulted in greatest financial impact and damage to roads and bridges with over \$316,000 in total project costs. No extent data as available for this event</p>	High
Extreme Cold/ Snow/Ice Storm	<p>The entire planning area is vulnerable, including road infrastructure, town and privately-owned buildings, utility infrastructure</p>	<p>Snowfall has varied, from a few inches to over a foot or more. Heavy snow and wind may down trees and power lines. Snow/ice contributes to hazardous driving conditions.</p>	<p>For roof collapse: monetary damages will depend on each structure but, collapse of barn roof is often a total loss. This does not include the loss of livestock. Collapse of a house roof may be at a 50% loss. For car crashes due to poor driving conditions: minimal damage to vehicle to totaled vehicle and operator injury. Health impacts could vary significantly. Loss of energy or communication capabilities may occur and impede recovery.</p>	High

Pandemic	The entire planning area is vulnerable in both health and financial stability	COVID-19 has far-exceeded severity of 2009-2010 HINI Pandemic	2020 COVID-19 has resulted in the greatest infectious disease-related financial consequence for the planning area in history	High
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4.1 Water, Wastewater and Electric Power Service

There are two providers of public sewer service within the Town of Derby; the Village of Derby Center and the Village of Derby Line. However, neither Village has any treatment facilities of its own. The Village of Derby Center owns and maintains the lines and pump stations within the Village and Town and has an allocation in the wastewater treatment plant in Newport City, Vermont. The Village of Derby Line owns and maintains lines and pump stations in Derby Line and pumps its wastewater to be treated at the wastewater treatment plant in neighboring Stanstead, Quebec. Village of Derby Center Sewer Operations and Maintenance The Village of Derby Center owns and maintains lines and pump stations in Derby and has an allocation it has purchased of 150,000 gallons per day in the wastewater treatment plant in Newport City, Vermont.

The sewer lines are almost entirely within the Village of Derby Center and between it and Newport City. The sewer lines are mapped. An inter-local agreement between Derby Village and the Town was completed in 1993. This agreement allows service to people outside the Village. A water/sewer ordinance is in effect. Newport City Wastewater Treatment Plant Newport and Derby Center’s wastewater is processed at the treatment plant, located on T.P Lane off of Western Avenue. The Newport City Wastewater treatment plant completed upgrades in 2008 and now has a 1.3 million-gallon per day capacity. Currently it is treating an average of about 600,000 gallons per day. Village of Derby Line The Village of Derby Line and Stanstead Quebec have an Interlocal agreement for wastewater treatment. Derby Line’s wastewater is treated at the wastewater treatment plant in Stanstead, and Derby Line pays half the cost of the operations of this plant. The plant in Stanstead was built in 1965 to handle Stanstead’s wastewater.

The plant was upgraded and expanded in 1981 when Derby Line signed on and was officially opened on May 25, 1982. The plant provides primary and secondary treatment. Operation costs are shared between Stanstead and Derby Line. There is adequate capacity for the future. A major upgrade is planned for 2020, and a new Interlocal agreement is in the works.

Municipal Water

There are two Public Water Systems that provide some citizens in Derby with water: the Derby Center Water Company and the International Water Company. Residents who do not have access to municipal water utilize private wells. The Derby Center Water Company serves the Village of

Derby Center but also has some hookups in the Town outside of the Village. The International Water Company serves the Village of Derby Line, the Town of Derby, as well as the Canadian Towns. 2020 Town Plan – Adopted March 3, 2020 44 Derby Center Water Company (DCWC) The Village of Derby Center owns and operates the Derby Center Water Company which serves many residents within the Village limits, as well as residential and commercial entities outside the Village boundaries. As of January 1, 1997, the primary water service for the DCWC is Derby Pond. The secondary source is a drilled well which has a 500 gallon per minute capacity approved for 350 gallons per minute with a 350 gallons per minute pump. Both water services are chlorinated. Water is pumped into two reservoirs, each with over 300,000-gallon capacity and fed to users via a gravity system. Average daily demand is 160,000 gallons with a peak capacity of 750,000 gallons. There are 75 fire hydrants on the system. Roughly 1/3 of hook ups are outside the Village and account for 50 percent of the water used. An inter-local agreement for water was approved by the Town and Village in 1992 and remains in effect. A water/sewer ordinance is in effect. The Village has an interlocal agreement with Newport City to provide up to 10,000 gallons per day to the City Center Industrial Park, with back up capabilities for the Newport Water System. The DCWC is supplying high quality water and has ample capacity for the foreseeable future. International Water Company (IWC) The International Water Company (IWC) serves the Town of Stanstead, Quebec, and the Village of Derby Line. A Board of Trustees with seven members from Stanstead and four from Derby Line administers it. The primary water source for IWC is two drilled wells in Stanstead, one producing 330 gallons per minute capacity and one producing 222 gallons per minute capacity. Holland Pond, located in the Town of Holland, is now a back-up source for use only in an emergency. Water is pumped from the wells (and/or Holland Pond) into a 950,000 gallons reservoir in Derby Line. Water is treated with chlorine at its source. Average usage of IWC water is between 14 million and 16 million gallons per month, which is well below the system’s capacity. This system also services Beebe, Quebec, and several residences in the former Village of Beebe in the Town of Derby. The water source is six wells, four located in the Town of Derby, and two in Beebe, Quebec. The water is treated with liquid chlorine. Distribution lines are gravity fed. The only capital improvement currently being considered is a new chlorination building.

The Town is exploring options to improve water service in the Beebe sector. Recent improvements by DCWC and IWC assure the residents in their service area of reliable source of quality water. The present capacities should easily handle increases in demand for the foreseeable future.

4.2 Estimating Potential Losses in Designated Hazard Areas

Portions of the 4H Road, Hayward Road, and Birch Drive are within flood zone A and are susceptible to flooding during spring runoff. It is difficult to estimate the total number of structures in the 100-year limit of the Flood Insurance Rate Maps identified floodplain, as those maps do not accurately match up to the E-911 maps. It is estimated that approximately 50 structures are within the flood hazard area. FEMA is currently working on updating the flood maps for all of Orleans County. The town and villages do not believe that even during a flooding event similar to the worst experienced in the last 20 years that there would be substantial damage to buildings or residential housing that exceeded 1%. Given the magnitude of damage to town bridges, the potential for costs exceeding \$300,000 dollars to repair exists because it has happened in the last 5 years. However, the repairs and upgraded resilience of these locations associated with these prior expenses greatly reduces the potential for a recurrence and the

disaster funding history supports the fact that, aside from 2019, the town and villages have not had to spend nearly as much on repairs following a declared disaster compared to many other towns in the state.

4.3 Proposed Land Use and Development Trends Related to Mitigation

Derby, in its planning activities, must consider planning activities of neighboring communities and the State of Vermont. Growth in one part of the state affects growth in all parts of the state, and growth in one segment cannot be considered without looking at growth in other areas. In looking at growth, Derby will consider economic development, housing, transportation, government and education.

The commercial corridor along Route 5 between Derby and Newport has the highest potential for future growth because of its access and the availability of municipal water and sewer. Because public water and sewer are not available to the I-91 Access Road area, future development of this area will have the additional hurdle of having to either design onsite systems or extending municipal systems to service this area (2020 Derby Town Plan).

The effective flood maps are used by the town to support flood hazard area regulations and are assessed for necessary changes as part of the NFIP continued compliance. Bob Kelley, Zoning Administrator and Town Manager serves as Compliance Officer for the town's participation in the NFIP. Since the last approved mitigation plan in 2005, the total number of residential dwellings increased from 375 to 428. This represents a smaller increase in the previous 13 years (from 267 to 375). Mobile homes account for a slightly higher percentage of single-family homes in 2017 as they did in 1980 (27.8% in 2017 compared to 26.9% in 1980). The increase in residential structures is not coupled with an increase in residential flood damage or flood vulnerability based on claims data and town awareness. NFIP compliance is met, in part by the following regulations:

- *“All development including fill, excavation, grading, erection or placement of structures, substantial improvement of existing structures and storage of equipment and material prescribed by the Town of Derby are permitted within an area of special flood hazard only upon the granting of a conditional use permit by the Board of Adjustment”*
- *“All development and structures shall be:
1. Designed to minimize flood damage to the proposed development and to public facilities and utilities
2. Designed to provide adequate drainage to reduce exposure to flood hazards.”*
- *“No development shall occur within 50 feet of the seasonal high water-mark of any stream or river shown on the official zoning maps. If such stream or river is within a designated flood plain area.”*

4.3.1. Land Use Goals

As stated in the 2020 Town Plan, it is the goal of the town to:

- Locate environmentally friendly industry and business in Derby. Diversify the tax base and enhance Town payrolls
- To create a district to: control lakeshore densities, protect shorelines, maintain public access to public waters, protect water quality, insure stabilized riverbanks and courses, and protect watershed. The area of this district is to include lands within 500 to 1000 feet of any body of water exceeding 20 acres and a buffer along all appropriate rivers and streams
- Preserve the integrity of the environment balanced with the protection of the property and stakeholder rights of all present and future citizens
- Plan and execute infrastructure projects in a thoughtful and timely fashion in order to absorb expected industrial and commercial development and to meet the needs of a growing population
- Meet the housing needs of an expanding workforce, regardless of wage levels, in quality housing that does not erode the property tax base
- Conserve the appearance and preserve the traditional scale of our historic village centers

4.3.2. *Village-specific Land Use Goals*

- Work with the Village of Derby Center and Derby Line to delineate and draft regulations for a design control district
- The Development Review Board shall use site plan review criteria to closely enforce the 10,000 square foot limit on commercial uses
- Work with the Village of Derby Center and Derby Line to formulate a master plan for the Village
- The Development Review Board shall use site plan review criteria to closely apply the 5,000 square foot limit on commercial uses and the prohibition on street level residential uses

4.3.4 *Future Development and Housing*

The town will plan to locate large-scale retail, commercial and high-density residential development within sewer and water service districts on class one lots whenever feasible. The Town shall work with these municipal services to plan and control growth. The goal of the Town of Derby residential districts is to provide a variety of housing options to the residents of Derby at densities appropriate to the character of the neighborhood and the capacity of the land to support those densities. Due to state housing provisions requiring the equal treatment of one- and two-family dwellings densities are specified for both structures and dwelling units. Our specific district zones and target densities are:

RESIDENTIAL HIGH DENSITY

- This district is designated for the most intense residential uses including semi-detached one family dwellings and apartment houses. Dwelling unit densities shall not exceed twenty per acre.

RESIDENTIAL MEDIUM DENSITY

- This district is designated for moderately intense residential uses in areas with proximity to village and commercial growth centers. Dwelling unit densities shall not exceed ten per acre.

RESIDENTIAL ONE ACRE

- This district is designated for predominantly residential uses in rural settings, which are served by all-season roads. Since public water and sewer services usually will not be available, the lots should be of sufficient size and soil quality to facilitate on site provision of water and sewage disposal. Dwelling unit densities shall not exceed two per acre or one dwelling structure per acre.

RESIDENTIAL TWO ACRE

- This district is land designated for predominantly residential, seasonal dwelling, agricultural and forestry uses in areas of currently low densities and levels of town service, but that have high potential for future residential development. Since public water and sewer services are not available, the lots should be of sufficient size and soil quality to facilitate on site provision of water and sewage disposal. Dwelling unit densities shall not exceed one per acre or one dwelling structure per two acres.

TOWN OF DERBY RURAL DISTRICTS

- The goals of Town of Derby rural districts are to preserve the working landscape and protect areas with fragile ecosystems and low carrying capacity. Our objectives are to allow the lowest densities and require the largest possible parcel sizes to maintain the economic viability of agricultural and forestry uses. PUDs are encouraged in this district. The PUD provisions in the bylaw should be amended to allow for houses on smaller lots (cluster development) while preserving large contiguous blocks of forestland or farmland.

RURAL RESIDENTIAL

- This district is designated for predominately agricultural, forestry and the least intense residential and seasonal uses. Since public water and sewer services are not available, lots shall be of sufficient size and soil quality to provide for onsite provision of water and sewage disposal. This district shall provide for major areas of agricultural and forestry uses and dwelling unit densities shall not exceed one per two and one half acres or one dwelling structure per five acres.

SECTION 5: MITIGATION STRATEGIES

The greatest advancement in mitigation planning the town has achieved since 2005 has come from the direct experiences in responding to, and recovering from, the major disasters that have impacted the town and villages in the last decade. These disasters, have, to a large extent, redefined how the entire state views and approaches mitigation. The work of state agencies, including those devoted to transportation, planning and emergency management have also changed the way towns go about their day-to-day operations and planning, both in emergency situations and out. It is because of this that the town views this update as the new standard in their mitigation planning efforts. This plan allows for the systematic documentation of efforts in the next planning cycle. There has not been a formula for ongoing, documented, mitigation

efforts prior to this update. While the town has learned a great deal and put much of the knowledge to practice in its highway department and planning efforts, these have not come as a result of the 2005 plan. We feel that the implementation matrix captures specific progress in certain areas but more importantly, gives the town a guide from which all future action and updates can be based on.

5.1 Town Goals and Policies that support Hazard Mitigation

5.1.1. *Community Goals*

- a. Continue municipal service supply systems
- b. Establish and maintain specific districts to protect the natural environment and limit flood damage
- c. Protect the quality of ground water
- d. Encourage the elimination of existing and potential pollution sources. This is important for all lakes and ponds and is of critical importance for bodies of water which serve as municipal water supply sources
- e. Promote and provide for the public health, safety and welfare
- f. Protect and enhance the quality of life for all of Derby's resident

5.1.2. *Capital Improvement Goals*

- a. The Town shall actively pursue tax/revenue bonding and federal and state grants to support construction of infrastructure to make the proposed industrial zones viable
- b. Utilize the TIF district mechanisms, which allow certain tax revenues to be set aside to offset the infrastructure cost of new developments
- c. Support the development of an industrial park to serve as an enticement to economic development
- d. Focus on developing new businesses or expanding existing businesses that are environmentally friendly and that complement existing and planned infrastructure.

5.1.3. *Public Participation Goals*

- a. Continue to solicit input regarding planning issues from town residents and from other entities which can help to offer solutions and insight into the problems the Town faces both now and in the future via formal meetings and advertised opportunities for input
- b. Utilize the LEPC and NVDA to increase awareness, enhance planning and engage in exercises that address needs in the community

5.1.4. *Regulatory Devices Goals*

- a. State permitting and Vermont's Act 250
- b. Develop and maintain specific districts as required
- c. Develop and maintain a "No Adverse Impact" (NAI) approach to flood hazard management by institutionalizing the best practices set forth by the ASFPM.

d. Utilize best practices in flood-plain management for farm-related development in town

5.1.5. Land Use

a. Work to develop a Flood Hazard Area Overlay District to include all designated flood hazard areas. The purpose of the Flood Hazard Area Overlay District is to (1) protect public health, safety, and welfare by preventing or minimizing hazards to life and property due to flooding, and (2) to ensure that private property owners within designated flood hazard areas are eligible for flood insurance under the National Flood Insurance Program (NFIP).

b. All other Land Use goals are stated in the 2020 Town Plan

5.1.6 Natural Resources

a. Ensure that the existing health ordinance is enforced to maintain protection of both surface and groundwater supplies

b. The town should work with the NVDA and ACCD to continue the process of identifying the Town's land conservation priorities, and to the degree possible, link them to broader regional conservation work

c. In line with the VTrans mission statement regarding climate change, the town remains committed to:

- Ensure that there are viable alternative routes around vulnerable infrastructure such as bridges and roadways
- Make safety a critical component in the development, implementation, operation and maintenance of the transportation system
- Develop contingency plans for a wide-variety of climate impacts to be implemented as data/information becomes available
- Utilize information technology to inform stakeholders during times of emergency
- Educate of the public and other stakeholders on the threats posed by climate change and fluvial erosion hazards
- Increase inspection of infrastructure if warranted by climate change indicators
- Apply a decision-making framework to incorporate cost-benefit analyses into adaptive plans and policy
- Work to protect essential ecosystem functions that mitigate the risks associated with climate change
- Educate individuals within the agency to use best-practices during recovery periods to avoid ecological damage that may further exacerbate risk
- Recognize the interconnected nature of our built environment with ecological processes
- Protect the state's investment in its transportation system and adapting transportation infrastructure to the future impacts of climate change

e. In line with DEC's best practices regarding fluvial erosion, the town will work to:

- Slowing, Spreading, and Infiltrating Runoff (The State Surface Water Management Strategy is found at <http://www.watershedmanagement.vt.gov/swms.html> and <http://www.watershedmanagement.vt.gov/stormwater.htm>)
- Avoiding and Removing Encroachments. http://www.watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm
http://www.watershedmanagement.vt.gov/rivers/docs/rv_RiverCorridorEasementGuide.pdf
- River and Riparian Management: DEC has prepared a compendium of *Standard River Management Principles and Practices* to support more effective flood recovery implementation; improve the practice of river management; and codify best river management practices in Vermont. The document compiles the most current river management practices based on the best available science and engineering methods to create consistent practice and language for risk reduction while maintaining river and floodplain function. Best practices are established to address common flood damages, including:
 - Erosion of banks adjacent to houses and infrastructure
 - Erosion of road embankments
 - Channel movement across the river corridor
 - River bed down-cutting that destabilizes banks, undermines structure foundations, exposes utility crossings, and vertically disconnects rivers from adjacent floodplains
 - Bridge and culvert failure

Source: http://www.watershedmanagement.vt.gov/permits/htm/pm_streamcrossing.htm

5.1.7. Policies

- a. Through both town and state-level management, the town and villages will work to:
 - Encourage and maintain naturally vegetated shorelines, buffers and setbacks for all rivers, ponds and streams
 - Reduce flood hazard and repetitive road and driveway washout through continued updates and adherence to priorities in road, bridge and culvert improvement projects
 - Identify and manage pollution, flooding and fluvial erosion hazards along rivers and streams as they arise

5.1.8. Transportation Plan

In adjunct to town-specific planning, the town is committed to continually subscribing to all current state standards related to:

- a. Maintaining safe operating conditions on the present system of town roads through design and modification to keep traffic at appropriate speeds and to assure the safest possible driving conditions, including consideration of additional paving (though only on portions of roads prone to damage) should state funding become available
- b. Protection of existing town roads from flood damage and uncontrolled storm water runoff

- c. Preserving the capacity of town roads and maintain adequate traffic flows and safety
- d. Support the road maintenance crew through Town-provided training sessions. This includes ICS training along with the Road Commission (Selectboard)
- e. Support policies and procedures that ensure longevity of essential town-equipment and develop and maintain MOU's with neighboring towns related to equipment use during emergencies
- f. Continue long term access opportunities to gravel and sand deposits for future road maintenance use
- g. Consider developing a standard operating procedure (SOP) based on ICS principles for highway department response events where coordination, communication and support are at a heightened level

5.1.9. Utilities and Facilities Goals

- a. Develop policies and procedure that ensures equipment longevity to the greatest extent possible.
- b. Ensure adequate provision of water sources for fire suppression by requiring dry hydrants, fire ponds, water storage, or other measures where appropriate.
- c. Continue to maintain municipal water and sewer systems

5.1.9.1. Educational Goals

- a. Create an environment for learning in our schools and community, where staff, parents, teachers and students work together to achieve excellence for all. Every learner can and will succeed in ways that reflect his or her own unique aptitudes and interests
- b. Support and encourage collaboration with other educational entities
- c. Enhance the ability of Derby residents to have access to various technologies
- d. Maximize the availability of community facilities for an increased array of learning and teaching opportunities and natural areas
- e. Recognize the need to increase outreach to parents and families in order to build relationships of trust and support that are so crucial to each student's success. This outreach needs to begin at the earliest possible age and continue throughout the learner's educational experience
- f. Recognize the need for greater outreach to the community in order to increase and strengthen parent and community involvement in schools

5.2 Existing Town of Derby Actions that Support Hazard Mitigation

The town has done an excellent job at monitoring and addressing transportation issues, engaging in a documented and systematic approach to mitigation actions. The Selectboard has successfully pursued funding to address needs through FEMA-based Public Assistance, Better Back Roads and Structures Grants. Through these funding sources, the town and villages have been able to

enhance resilience and overall preparedness. The town has addressed its current and future needs and by and large, road improvement projects remain the primary focus and the areas identified during the planning process were selected based on institutional awareness in-line with recent state-led Road Erosion Site Inventory data and primarily focused on runoff issues particularly as the incidence of heavy storms has increased. In many cases, culverts properly sized for normal rain events are overwhelmed by severe storms. The town will seek local, state and federal funds to address the sites identified as priorities. The town has also adopted municipal road and bridge standards that meet or exceed the most recent standards and has an approved and annually adopted Local Emergency Operations Plan and a Town Plan.

Table 5: Existing Town Actions that Support Hazard Mitigation:

Type of Existing Protection	Description /Details/Comments	Narrative, Issues or Concerns
Emergency Response		
Police Services	Vermont State Police/ County Sheriff	Currently, the Town of Derby leases patrol services from the Orleans County Sheriff Department. The State Police and Border Patrol barracks are located in Derby which provides a high law enforcement visibility with the Town. The need for a town police department will increase as commercial development and population continue to grow
Fire Services	Derby	Fire Chief has raised several concerns about water supply availability for firefighting in many areas of Town. The need is imminent and will begin affecting community fire insurance ratings with an increase in homeowner insurance rates. Further, the Fire Chief states that some pieces of equipment are reaching the end of their 25- year life cycle. The Fire Chief also has raised concerns about available manpower for the volunteer department. Preferred staffing is 30 firefighters and the department is currently staffed with 27 volunteers
Fire Department Mutual Aid Agreements	Northeast International Mutual Aid (19 participants)	None at this time
EMS Services	Newport City	The Town of Derby is contracted with Newport Ambulance Service for ambulance coverage for the Town and the Villages.

		Our goal is to ensure the community has high quality medical emergency services.
Other Municipal Services		
Highway Services	Town Highway Department	The effective operation of the road system is dependent on the adequacy of road equipment and supporting facilities. The general condition of Road Department equipment and facilities is good, and the 5-year Capital Improvement Program outlines anticipated needs. The Road Commissioner and Select Board should incorporate vehicle replacement cycles to assist in anticipating future capital needs.
Highway personnel	1 FTE/2-3 PT field personnel	None at this time
Water Department	Village Water (Managed by Fire District)	The Town is exploring options to improve water service in the Beebe sector. The water system needs to be assessed to develop a plan to upgrade the system. Recent improvements by DCWC and IWC assure the residents in their service area of reliable source of quality water. The present capacities should easily handle increases in demand for the foreseeable future.
Planning and Zoning personnel	Town positions filled	None at this time
Residential Building Code / Inspection	No	None at this time
Emergency Plans		
Local Emergency Operations Plan (LEOP)	4/20/20	Assure sheltering plans and contact information is up to date and vulnerable populations are addressed.
School Emergency/Evacuation Plan(s)	2005	Increased collaboration (with town staff, school, LEPC, NVDA), knowledge of roles and drills
Municipal HAZMAT Plan	None	Fire chief is proactive in this
Shelter, Primary	Derby School	Working with ARC's Shelter Initiative and have obtained certification, training and supplies. Include volunteer staff in planning communication and schedule drills to test efficacy.
Replacement Power, backup generator	none	Stay proactive with state and FEMA regarding town interests.

Municipal Plans		
Town / Municipal Comprehensive Plan	2020	Update done
Town of Derby Road Erosion Site Inventory	2020	Created with assistance from ANR
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	Utilize most current state regulations.	Consider using current best practices to guide actions for achieving a “No Adverse Impact” policy as well as assuring future farm development occurs with defined best practices
Participation in National Flood Insurance Program (NFIP) and Floodplain/Flood Hazard Area Ordinance	Active Participation and in good standing with NFIP.	9/27/85 current eff. map date
Certificate of Compliance with Road and Bridge Standards	7/29/19	https://vtculverts.org/map https://vtculverts.org/bridges#list Strive to coordinate lists and keep up to date

5.2.1. Flood Resilience Goals:

- Mitigate flood hazards in the most cost-effective manner while maintaining water quality
- Minimize the risk exposure and associated expense to Derby tax payers
- Ensure the Town and its facilities are prepared to meet the demands of the next flood
- Ensure the Town can receive the maximum outside assistance in the event of the next Federally declared disaster

5.2.2. Flood Resilience Strategies:

- Identify and protect natural flood protection assets, including floodplains, river corridors, other lands adjacent to streams, wetlands, and upland forested cover
- Adopt flood hazard regulations that at a minimum, protect property from known risks
- Review and evaluate statewide river corridor information, when it becomes available
- Consider adopting regulations that will protect erosion prone areas for additional Development and encroachment
- Maintain and regularly update the Local Emergency Operations Plan.
- Continue to meet the VTrans Road and Bridge standards. Participate in regional Road Foreman trainings and Transportation Advisory Committee meetings to stay abreast of flood resilience measures for the Town’s roads and bridges
- Continue to update the Town’s transportation infrastructure information in the Vermont Online Bridge and Culvert Inventory Tool
- Upgrade undersized and failing culverts
- Keep Hazard Mitigation Plan updated every 5 years
- Assure all emergency shelters are adequate and equipped with a generator

5.3 All-Hazards Mitigation Goals

The following goals were developed by the planning team, vetted during a warned community meeting and approved during the development of this plan:

- Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
- Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
- Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the multi-jurisdictional municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Joint Planning Commission, Selectboard and NVDA and integrate the strategies into the existing town plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Joint Planning Commission will review the plan and use language/actions from it to inform the integration and update process. Town Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budgets.

5.4 Mitigation Actions

In following FEMA guidance, the following mitigation action categories form the basis of the town's future mitigation actions. The planning team, after considering the basic and generalized format of the 2005 plan, decided to adopt this approach for this update and all future mitigation work. For each mitigation action to follow, an indication of group will be given with the abbreviations listed below:

Mitigation Action Groups:

(P) Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

(PP) Property Protection: Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter-resistant glass.

(PEA) Public Education & Awareness: Actions to inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

(NRP) Natural Resource Protection: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

(SP) Structural Projects: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms

5.4.1. Current Capabilities, Progress since 2005 and Need for Mitigation Actions

The Town Plan's goals and policies that support hazard mitigation and the existing mitigation actions demonstrate the variety of policies and actions forming the foundation of this All Hazards Mitigation Plan Update. As with most towns in the state, mitigating flood-prone areas is a continuous effort that sees increased attention following a major event. The town remains aware and diligent in keeping up with mitigation actions for all municipal systems. There exists a collaborative spirit that not only is valued but serves to enhance efficiency of action what needs to be done. The Town regards its current hazard mitigation efforts carried out by the road departments as adequate to address winter storm impacts to local roads, however temporary road closure due to winter storms may isolate parts of town. Winter storms are often the cause of the power loss and telecommunications failure. Tree trimming and vegetation management coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation. However, the town can incorporate the use of public information to support community resilience during a power outage. As part of the strategies defined in this plan, the town will develop a plan for mass communication and, if telecommunication lines are down, a method for alerting residents of the alternate means of information dissemination and/or protocol (e.g.

shelter logistics). Major infrastructure that has seen repeated damage due to flooding is a concern for the town and they are active in identifying priorities, working with State Transportation and Natural Resource Agencies as means to increasing infrastructure resilience.

Progress in Mitigation Efforts

The 2005 plan listed the following mitigation actions, both have been completed but Wilson Road needs further attention.

Excerpt from the 2005 Mitigation Plan

Project/Priority	Mitigation Action	Who is Responsible	Approximate Timeframe and Potential Funding Sources	Initial Implementation Steps
Salem Derby Culvert Project HIGH	This project involves a washed out undersized culver that needs replacement. Guardrails and gravel are also needed.	Jim Buchanan, Road Foreman (802) 766-2405	Cost: Approximately \$19,000 Potential funding: HMGP, FMA, PDM-C	This project is ready to go.
Wilson Road Repairs Medium/High	Need hydraulics study for a new metal or cement structure	Jim Buchanan, Road Foreman (802) 766-2405	Cost: Undetermined Need study through FEMA funds	Needs engineering study first for best cost alternatives.

5.4.2. Specific Mitigation Actions

The following actions define the mitigation measures to be taken by the town in the next five years:

<p>Action #1: Improve road infrastructure and municipal systems protection programs Action #2: Improve resilience to severe winter storms Action #3: Reduce impact of extreme cold durations Action #4: Raise public awareness of hazards and hazard mitigation actions Action #5: Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified Action 6: Reduce risk and impact of a pandemic event</p>

Below, each of the seven actions listed above are explained below regarding progress, project leads and partner agencies and specific action steps:

Action #1: Improve road infrastructure and municipal systems protection programs
Group: SP, NRP, PP

Lead Responsible Entity: Town and Villages of Derby and associated municipal systems managers

Potential Partner Entities: Vermont Agency of Natural Resources; Vermont Agency of Transportation; NVDA, VEM, FEMA and the Agency of Commerce and Community Development

Timeframe: 2021-2026

Funding Requirements and Sources: FEMA or other hazard mitigation grants; FHWA grants; VAOT grants; Municipal Operating and Capital budgets.

Progress: The Road Foreman continually monitors road and storm water management capabilities. In 2015, the University of Vermont released Scour research and opportunities for scour sensors. Maintenance and improvement of municipal water, sewer and electric power supply systems is established and ongoing.

Specific Identified Tasks:

- 1) Infrastructure Assessment for Storm Water Vulnerability – Funding and staff resources permitting, assess the vulnerability and operational capability of municipal-owned roads, culverts and other storm water management infrastructure to predicted storm water and snowmelt in areas with a documented history of recurring problems. Infrastructure will be evaluated regularly prior to replacement or upgrades.
- 2) Assessment for Fluvial Erosion/Landslide Vulnerability – Identify streambanks that have high risk of fluvial erosion that could benefit from riparian plantings or Better Roads grant. Riparian buffers prevent erosion, restore river floodplain, and help reduce the intensity of flood events; therefore, protecting town infrastructure and human health.
- 3) Culvert Upgrades – Using recent state-level analysis data, develop a schedule and program to replace undersized culverts. Appropriately sized culverts effectively handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding damage.
- 4) Continued Monitoring of Vulnerable Infrastructure - Inventory bridges to document future damage from flooding. A constantly updated inventory will allow Derby to keep track of frequently damaged infrastructure and will guide planning to avoid future infrastructure damage.
- 5) Road Improvements - Within political and financial restraints, consider re-engineering certain sections of roads to lower overall maintenance costs, improving snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Utilize the Vermont Stream Alteration Permit process when replacing or installing new culverts and bridges as required by State Statute.

Specific projects include:

1. Utilize Village pump station needs assessment to develop plan-by-priority projects pending on available funding
2. Develop increased awareness on potential risk to water system operations with new connections being made to water system by third parties and consider development of ordinance to mitigate evidence-based risk

3. Bushy Hill Rd: Third Culvert at bottom of Libby Hill needs upgrade to 12'. Water is unable to drain into Brownington Pond fast enough and washes road out during high rain events
4. Dumas Rd: 10/19 storm created a problem at this site for the first time, resulting in a 2-week road closure. 5' culvert becomes blocked. Upgrade required.
5. Ann Wilson Rd: Completed
6. North Derby Rd (near Beebe Plain): This paved section needs to be wider for safety reasons and needs larger culvert to reduce standing water during high rain events. Hydraulic study required. Lower priority but require attention.
7. Lawson Rd: Road is too low and needs to be raised. When the river rises, 1' of standing water can result
8. 4H Rd: Culvert is undersized and too narrow, needs upgrade. Evacuation involving 30 dwellings on road has resulted.
9. Hayward Road (Coche Brook Crossing): Poor alignment and absence of wingwall have contributed to road washout. Actions: Remove debris, stabilize structure, obtain hydraulic study and seek funding to address needs. Authorization to conduct next flood measures obtained from DEC
10. Assess Beebe Water System to develop an upgrade plan

- 6) Increase Awareness of Funding Opportunities - Increase understanding of FEMA's HMGP program so that this potential funding source can be utilized.
- 7) ICS Training and Emergency Operations (SOP) Plan Development – Enhance knowledge of the principles of ICS and develop a Standard Operating Procedures that details the relationship, roles and responsibilities of the Highway Department and Road Commission during major events.
- 8) Documenting – Maintain Project Log methodology to track all grant-funded infrastructure projects.

Rationale / Cost-Benefit Review: Conducting vulnerability assessments facilitates a targeted and effective approach to road and storm water management infrastructure. This will prove useful in the development and implementation of municipal capital and operating plans as well as the development and implementation of grant-funded mitigation projects. Some areas suffer low-level but consistent damage during heavy rains and snowmelt. Mitigating against these problems would reduce short and long-term maintenance costs and improve the flow of traffic for personal and commercial purposes during flooding events. Tracking road work and understanding the HMGP program can open funding streams into the town and can make the application process much easier when required information is already available. A basis understanding of ICS will serve the town and at little or no cost. As a requirement for an approved LEOP, municipal ICS-awareness is seen as necessary state-wide. During an emergency event when the Highway Department personnel are required to work beyond normal capacity, increased communication and collaboration between the Highway Department and local entities can be enhanced with a basic SOP. An SOP can also serve to increase institutional memory when there are staff changes at every level as well as provide a template from which tabletops and drills can be based on.

Action #2: Maintain and improve resilience to severe winter storms

Group: SP, PP, PEA

Primary Responsible Entities: Town and Villages of Derby, Selectboard, Planning Commission and Emergency Management director;

Potential Partner Entities: LEPC, Derby Fire Chief, ARC's Sheltering Initiative Program

Timeframe: 2021-2026

Funding Requirements and Sources: VEM or FEMA hazard mitigation funding; existing programs, contingent on available resources and funding.

Progress: Roads are monitored and altered, when necessary so that plowing can occur without damage to trucks and/or road. All designated shelters have a back-up power. Snow clearing equipment is regularly serviced, and the town maintains an adequate supply of salt.

Specific Identified Tasks:

- 1) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the town and intends to move forward on planning and public involvement. More formalized training is required and the ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.
- 2) Reduce risk of power failure due to ice storms: Enhance collaboration between town and private electric company as means of increasing efficiency of mitigation efforts and restoration when systems are down. Maintain function of generators.
- 3) Notification: Develop a notification/communication plan that conveys essential sheltering information using school phone system and back-up methodology (email, text, etc.)
- 4) Residential Programs: Provide guidance and communication to residents on the structural and mechanical actions that can occur to reduce risk to severe winter storms (e.g. weatherproofing, anchoring, alternative heating sources, tree trimming, financial programs, etc.). Develop awareness on enhanced vulnerability of mobile home parks to storm events related to percentage of grand list value.
- 5) Monitor roads for safe and effective plowing: Efficient snow removal is the foundation to winter storm (snow) events, assuring roads are plowable before winter remains an important facet of highway department functions. Increase communication with rail as deemed necessary to assure safe train travel during heavy snow/ice events.
- 6) Increase awareness of ICS structure and recommended practices: The town can mitigate the effects of a severe winter by understanding how a large-scale storm is managed when the State EOC is operational. Additional awareness of local-level roles and responsibilities during statewide event is a mitigation action.

Rationale / Cost-Benefit Review:

This mitigation action serves to reduce the economic impact and risk to both human and animal (livestock and pet) health and safety during severe winter storm events by reducing risk and enhancing the mechanisms of winter storm mitigation in the long term. More formalized policy formation in both staffing and notification procedures, especially pertaining to vulnerable populations where transportation and special needs are a concern could potentially significantly reduce the physical, psychological and social impacts of a disaster.

Action #3: Reduce impact of extreme cold durations

Group: PEA, PP, SP

Risk or Hazard Addressed: Risk to infrastructure, livestock and residents

Primary Responsible Entities: Town and Villages of Derby, NVDA, Derby School, local/regional assistance organizations.

Potential Partner Entities: VEM, LEPC

Timeframe: 2021-2026

Funding Requirements and Sources: Financial factors may produce barriers to change. Strategic planning and understanding of the total scope of needs and potential for change is logical first-step.

Specific Identified Tasks:

- 1) Economic Resilience: Establish program for assistance in paying heating bills during crisis situations, if not already required by state law. Develop and sustain a program that serves to connect resource organizations with residents in need of support services.
- 2) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the city and intends to move forward on planning and public involvement. More formalized training is required and the ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.
- 3) Assess Vulnerable Population— Develop an awareness of the most at-risk community members during an evacuation and/or sheltering event. Focusing on those that lack resources or capability to reach facilities when in need and create plans, including outreach protocol on how to address this potential hurdle.
- 4) Notification and Education – Investigate and develop a notification/communication plan that conveys essential sheltering information. Educating citizens regarding the dangers of extreme cold and the steps they can take to protect themselves when extreme temperatures occur by sustaining a process that serves to disseminate educational resources for homeowners and builders on how to protect pipes, including locating water pipes on the inside of building insulation or keeping them out of attics, crawl spaces, and vulnerable outside walls. Inform homeowners that letting a faucet drip during extreme cold weather can prevent the buildup of excessive pressure in the pipeline and avoid bursting through a yearly public service campaign.

Rationale / Cost-Benefit Review:

With an increase in extreme weather, including cold, there is a need to protect property and the population. Given the magnitude of population dependence on social services, indicating economic and other social vulnerabilities, effective outreach, education and collaboration with resources supports this mitigation action category.

Action #4: Raise public awareness of hazards and hazard mitigation actions

Group: PEA

Risk or Hazard Addressed: Risk to property, residents

Lead Responsible Entities: Town and Villages of Derby, Fire Chief, LEPC, NVDA

Potential Partner Entities: Vermont state agencies and regional organizations

Timeframe: 2021-2026

Funding Requirements and Sources: Majority of information is available and both state agencies and organizations can provide materials for outreach

Progress: As mitigation planning continues to integrate into normal, day-to-day operations, the town has an opportunity to engage its residents with information that will serve to mitigate several risks. The LEPC meets regularly and covers a host of topics related to emergency preparedness and raises awareness in the community about what organizations are doing around emergency response planning and chemical safety. Town meeting day can serve as an annual update and outreach opportunity as well.

Specific Identified Tasks:

- 1) Hazard Resilience for Property Owners- Develop and maintain education materials to inform property owners on how to protect their homes and businesses through accepted hazard resilience actions (e.g. securing their structures from high winds, elevating their electrical equipment/furnaces in basements, protecting from lightning strikes by grounding electrical outlets, etc.).
- 2) HMGP Awareness: Attend informational sessions on the HMGP funding opportunities for acquisition, elevation and flood-proofing projects. Work with NVDA to develop an information brochure for residents.
- 3) School Programs: Assure the school is structurally ready to handle natural hazard risks to the greatest extent possible. Continue school programs to raise student awareness of hazards, safety, preparedness and prevention. Explore establishing the school emergency notification system as the primary methodology for all emergency notification procedures and build in the contact information accordingly.
- 4) Family Programs – Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.
- 5) Fire Prevention Programs – Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.
- 6) Other hazard awareness programs – Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate as directed by the state department of health and its jurisdictional offices of local health

Rationale / Cost-Benefit Review: Improved public awareness could potentially significantly reduce the loss of life and property damage through ongoing, formal, ongoing, public information campaigns that address property protection actions (flood proofing, elevation, anchoring mobile homes/propane tanks, electric and water system elevation, electric grounding, etc.) Improved awareness would also build understanding and public support for municipal mitigation actions to reduce potential infrastructure and liability costs.

Action #5: Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risks

Group: P, NRP, PEA, PP

Risk or Hazard Addressed: Risk to infrastructure, residents

Primary Responsible Entities: Department of Environmental Conservation, NVDA, Agency of

Natural Resources (VT ANR), Town and Villages of Derby.

Potential Partner Entities: Nonprofits, other Town of Derby officials, and other appropriate entities.

Funding Requirements and Sources: NVDA can assist in enhanced mapping of the floodplain (if and when these are developed) within the town and has provided the town with updated River Corridor Maps.

Specific Identified Tasks

- 1) Fluvial Geomorphic Assessments – The town will work with DEC through coordinated meetings, workshops and communication to increase understanding of current findings and develop an applicable framework to help guide decisions related to priority infrastructure work and vulnerability.
- 2) Fluvial Erosion Hazard Mapping – Develop a fluvial erosion hazard map for the waterways, using the GIS extension known as SGAT (or Stream Geomorphic Assessment Tool) for assessed stream reaches. As assessments are completed, a map of all assessed waterways in the town will be created.
- 3) River Corridor Management Plans – Using the River Corridor Maps, the town will develop an outreach strategy to residents/structures in or near the defined corridor. This communication should focus on flood resilience measures and opportunities. With the lack of repetitive loss properties in the town, the likelihood of viable HMGP acquisition projects is low but increasing awareness of this program can serve the town well.
- 4) Fluvial Erosion Hazard Mitigation Implementation - The town will draft strategies to avoid or mitigate losses from the identified fluvial erosion hazards. These strategies may include the adoption and implementation of programs, mechanisms or regulations to prevent endangerment of persons and property in riparian corridor areas from fluvial adjustment processes. Efforts could range from a relatively simple, public information campaign about the map to the adoption of a municipal ordinance or by-law that restricts development in such hazard areas.

Rationale / Cost-Benefit Review:

Continuing this project will require a sustained succession of grants, state appropriations and other funding to complete assessments in Derby. Successful completion will provide municipal and regional benefits. The municipality's fluvial erosion areas would be adequately and electronically mapped. This will enable the municipality to make residents and businesses aware of fluvial erosion hazards and potentially lead to municipally-directed programs, mechanisms and regulations that further mitigate against this hazard, protecting existing structures and infrastructure. Identifying fluvial erosion hazard areas could also help the municipality restrict future development in hazardous areas, if that should be an advantage to the town in the future. More accurate knowledge of fluvial geomorphology will enable the community to have a better understanding of hazard areas and what mitigation measures might most effectively address those concerns. Flooding is the most common and most significant hazard that can trigger a Federal disaster declaration in Derby. Along with the creation of flood hazard area maps, identifying the fluvial erosion hazard areas provides improved opportunities for the community to mitigate potential losses and gauge future development initiatives.

Action 6: Reduce risk and impact of a pandemic event

Group: PEA, PP, SP

Risk or Hazard Addressed: Risk to infrastructure, environment and residents

Primary Responsible Entities: Town and Villages of Derby, ACCD, VDH, NVDA

Potential Partner Entities: VEM, FEMA

Funding Requirements and Sources: Pandemic planning funding is secondary to financial stability funding in response to potential economic consequences not known to be a serious consequence of infection mitigation efforts. State and Federal funding are primary sources with limited but important local opportunities.

Specific Identified Tasks:

- 1) Work with facility leads on understanding risk factors and what can be done to mitigate and enhance training and skills for response
- 2) Enhance awareness and planning for COVID-19-related mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability
- 3) Maintain process for funding acquisition related to COVID-19 for Town, Villages and residents
- 4) Develop and maintain continuity of operations plans for critical positions

5.4.3. Prioritization of Mitigation Strategies

Because of the difficulties in quantifying benefits and costs, it was necessary to utilize a simple “*Action Evaluation and Prioritization Matrix*” to affect a simple prioritization of the mitigation actions identified by the town. This method is in line with FEMA’s STAPLEE method. The following list identifies the questions (criteria) considered in the matrix so as to establish an order of priority. Each of the following criteria was rated according to a numeric score of “1” (indicating poor), “2” (indicating below average or unknown), “3” (indicating good), “4” (indicating above average), or “5” (excellent).

- Does the action respond to a significant (i.e. likely or high risk) hazard?
- What is the likelihood of securing funding for the action?
- Does the action protect threatened infrastructure?
- Can the action be implemented quickly?
- Is the action socially and politically acceptable?
- Is the action technically feasible?
- Is the action administratively realistic given capabilities of responsible parties?
- Does the action offer reasonable benefit compared to its cost of implementation?
- Is the action environmentally sound and/or improve ecological functions?

Table 5-2: Derby Action Evaluation and Prioritization Matrix

The ranking of these criteria is largely based on best available information and best judgment of project leads. For example, all road improvement projects were initially identified by Road Foreman and approved for inclusion in this plan by the road commission. It is anticipated that, as

Rank	Mitigation Action	Responds to high hazard	Funding potential	Protection value	Time to implement	Social and Political acceptance ¹	Technical feasibility	Admin feasibility	Benefit to Cost	Environmental advantage	TOTAL
2	Improve road infrastructure and municipal systems protection programs	5	4	5	2	5	4	4	5	4	38
3	Improve resilience to severe winter storms	2	5	5	4	5	5	4	5	2	37
4	Reduce impact of extreme cold durations	3	2	4	2	3	2	2	3	3	24
5	Reduce risk and impact of a pandemic event	5	4	5	4	5	3	3	5	1	35
1	Raise public awareness of hazards, hazard mitigation and disaster preparedness	4	5	5	5	5	5	5	5	3	43
6	Continue fluvial geomorphology (in coordination with state recommendations and protocol) assessments and develop strategies in response to any identified risk	3	2	4	2	2	2	2	3	3	23

the town begins to implement the goals and actions of their Mitigation Strategies, they will undertake their own analysis in order to determine whether or not the benefits justify the cost of the project. Also, most proposed FEMA HMGP mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

¹ All mitigation actions outlined in this plan are, and will continue to be, consistently assessed for feasibility related to the social, political, and financial factors that are inherent to town operations.

5.5 Implementation and Monitoring of Mitigation Strategies

5.5.1. Public Involvement Following Plan Approval

After formal adoption, which will occur at warned, documented meetings for each respective jurisdiction, the town and villages will continue to maintain web-presence of the mitigation plan with an opportunity for community input available on its website. Additionally, the town will hold an annual public meeting after performing the annual progress report for the mitigation plan to discuss achievements and the following year's implementation plan. At town meeting, the town will present mitigation information and provide the public an opportunity to increase understanding and involvement with planning efforts. The LEPC will also host an annual mitigation plan presentation where response/state agencies, neighboring communities and other stakeholders can provide input. The town will also notify its neighboring municipalities of the availability of information for review and any significant risks and/or mitigation actions that have an impact on surrounding towns.

5.5.2. Project Lead and Monitoring Process

The town's selectboard and Village Trustees are the project leads and will work in conjunction with the required staff and NVDA to complete the yearly progress report included in the plan. The town will create a mitigation action collection system that will be used as the source of future updates following the annual evaluation that will occur in conjunction with the progress report using the Plan Implementation Matrix provided below. While mitigation actions are, by default, often addressed at monthly Selectboard and Trustee meetings, the town will schedule one meeting annually to formally assess the plan and adopt updates following the annual progress report and community meeting regarding the LHMP. Once the plan is approved by FEMA, the calendar will begin for annual review. The town will take the following implementation matrix and add actions to it each year, modifying tasks and/or needs as required so that the next LHMP update will be populated with the specific actions related to each mitigation strategy by year.

5.5.3 Plan Evaluation and Update Process

The town's Selectboard chair and each Village Trustee designee will lead the plan evaluation process as part of the annual progress report. Prior to town meeting and in preparation for the annual town report, a mitigation section will be included that provides an executive summary for the public that addresses the following topics:

- Status of recommended mitigation actions for the five-year planning period
- Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk
- Identification of a lead person to take ownership of, and champion the plan if different from Selectboard/Trustee
- An approach to evaluating future conditions (i.e. socio-economic, environmental,

- demographic, change in built environment etc.)
- Discussion of how changing conditions and opportunities could impact community resilience in the long term
- Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience

By engaging in the annual evaluation, the town will have a viable method for capturing the facets of efficacy and areas needing revision and improvement in its mitigation plan. The town is committed to “institutionalizing” mitigation into its normal operating procedures and with approval of this plan, embarks on the formal incorporation of mitigation actions and discussion, maintaining an awareness that involves not only the Selectboard, Village Trustees, respective Clerks and staff but also the community at large, including the organizations represented by the current planning team. Along these lines, the town will maintain a contact list of the current planning team and make revisions as required, including the team on the evaluation process each year. Through this consistent attention resulting from the evaluation process, progress reports and communication in the annual town report, the town will achieve the consistency required to enhance resilience through planning, assessment and actions devoted to mitigation.

5.5.4. Plan Update Process

The Plan update will be led by the Selectboard Chair and Village Trustees. Depending on funding availability, the town may elect to acquire the assistance of NVDA and/or a consultant to update the plan following a declared disaster and/or the next five-year planning cycle. To assure that the Plan does not expire, the town will begin the update process within no less than six months of the current Plan’s expiration date. Following a disaster and during the recovery phase, the town will use the experience to assess the current Plan’s ability to address the impact of the most recent disaster and edit the plan accordingly. Using the annual progress reports and evaluation narratives as a guide, along with perceived changes in risk or vulnerabilities supported by data and/or observation, strategies will be captured in accordance with FEMA guidelines, which includes reconvening the planning team during the update process. The town will establish a “Mitigation File” that documents all evaluations and progress reports, along with actions, especially related to infrastructure improvement projects. While the progress reports are designed to capture the specific actions, the town has accomplished related to implementation, keeping a narrative list with dates on all actions relatable to mitigation (e.g. school drills, LEOP updates, Fire Safety Awareness, meetings, etc.), will provide the town the bulk of information required in the update process.

5.5.5. Implementation Matrix for Annual Review of Progress

The following table is intended to aid municipal officials in implementing the mitigation actions for Derby Town and to facilitate the annual monitoring and progress reporting. Progress has been included as a guide to future updates. Each year, the town will reserve a Joint Planning Commission meeting to review and update the Implementation Matrix as means to establishing an accurate evaluation of the plan’s efficacy and the information required for the succeeding update to the plan. Each Jurisdiction will fill in the implementation matrix specific to work

accomplished relevant to the actions outlined, especially as it pertains to outreach, municipal system actions and road improvement projects.

Table 5-3 Implementation Matrix for Annual Review

Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Improve road infrastructure and municipal systems protection programs	Town and Village Road Foreman and associated municipal systems managers	Spring 2021- Fall 2026	Infrastructure Assessment for Storm Water Vulnerability	
	Town and Village Road Foreman	Spring 2021- Fall 2026	Assessment for Fluvial Erosion, Landslide Vulnerability	
	Town and Village Road Foreman	Spring 2021- Fall 2026	Culvert Upgrades	
	Town and Village Road Foreman and associated municipal systems managers	Spring 2021- Fall 2026	Continued Monitoring of Vulnerable Infrastructure	
	Town and Village Road Foreman	Spring 2021- Fall 2026	Road Improvements 1.Utilize Village pump station needs assessment to develop plan-by-priority projects pending on available funding 2.Develop increased awareness on potential risk to water system operations	Ann Wilson Rd: Completed

			<p>with new connections being made to water system by third parties and consider development of ordinance to mitigate evidence-based risk</p> <p>3. Bushy Hill Rd: Third Culvert at bottom of Libby Hill needs upgrade to 12'. Water is unable to drain into Brownington Pond fast enough and washes road out during high rain events</p> <p>4. Dumas Rd: 10/19 storm created a problem at this site for the first time, resulting in a 2-week road closure. 5' culvert becomes blocked. Upgrade required.</p> <p>6. North Derby Rd (near Beebe Plain): This paved section needs to be wider for safety reasons and needs larger culvert</p>	
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			<p>to reduce standing water during high rain events. Hydraulic study required. Lower priority but require attention.</p> <p>7.Lawson Rd: Road is too low and needs to be raised. When the river rises, 1' of standing water can result</p> <p>8.4H Rd: Culvert is undersized and too narrow, needs upgrade. Evacuation involving 30 dwellings on road has resulted.</p> <p>9. Hayward Road (Coche Brook Crossing): Poor alignment and absence of wingwall have contributed to road washout. Actions: Remove debris, stabilize structure, obtain hydraulic study and seek funding to address needs.</p>	
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			10. Assess Beebe Water System to develop an upgrade plan	
	Town Manager and Village Trustees	Spring 2021- Fall 2026	Increase Awareness of Funding Opportunities	
	Town Manager and Village Trustees	Spring 2021- Fall 2026	ICS Training and Emergency Operations (SOP) Plan Development	
	Town Manager and Village Trustees with assistance from Clerks/Road Foreman/crew	Spring 2021- Fall 2026	Documenting	
Action	Responsible Entity	Time Line	Specific Identified Tasks	Annual Progress
Maintain and improve resilience to severe winter storms	Town EMD, Town Manager	Spring 2021- Fall 2026	Maintain Existing Shelter Capability	
	Town EMD, Town Manager	Spring 2021- Fall 2026	Reduce risk of power failure due to ice storms	
	Town EMD, Town Manager	Spring 2021- Fall 2026	Notification	
	Town EMD, Town Manager, Fire Chief	Spring 2021- Fall 2026	Residential Programs	
	Town and Village Road Foreman	Spring 2021- Fall 2026	Monitor roads for safe and effective plowing	

	Town EMD, Manager and Village Trustees	Spring 2021- Fall 2026	Increase awareness of ICS structure and recommended practices	
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Reduce impact of extreme cold durations	Town and Villages of Derby, NVDA, Derby School, local/regional assistance organizations.	Fall 2021- Fall 2026	Economic Resilience	
	Town EMD and Manager	Fall 2021- Fall 2026	Maintain Existing Shelter Capability	
	Town Manager and Village Trustees, NVDA, Derby School, local/regional assistance organizations.	Fall 2021- Fall 2026	Notification and Education	
	Fire Chief, Planning Commission, Town EMD/THO	Fall 2021- Fall 2026	Assess Vulnerable Population	
Action	Responsible Entity	Time Line	Specific Identified Tasks	Annual Progress
Raise public awareness of hazards and hazard mitigation actions	Town EMD, Fire Chief, LEPC, NVDA	Spring 2021- Fall 2026	Hazard Resilience for Property Owners	

	Town Manager, Selectboard and Village Trustees	Spring 2021- Fall 2026	HMGP Awareness	
	Schools and Town Manager	Spring 2021- Fall 2026	School Programs	
	Planning Commission, Clerks	Spring 2021- Fall 2026	Family Programs	
	Fire Chief, LEPC	Spring 2021- Fall 2026	Fire Prevention Programs	
	Fire Chief, LEPC, NVDA	Spring 2021- Fall 2026	Other Hazard Awareness Programs	
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risks	Department of Environmental Conservation, NVDA, Agency of Natural Resources (VT ANR), Town Manager	Spring 2021- Fall 2026	Fluvial Geomorphic Assessments	
	Department of Environmental Conservation, NVDA, Agency of Natural Resources (VT ANR), NVDA	Spring 2021- Fall 2026	Fluvial Erosion Hazard Mapping	
	Department of Environmental Conservation, NVDA, Agency of	Spring 2021- Fall 2026	River Corridor Management Plans	

	Natural Resources (VT ANR)			
	Department of Environmental Conservation, NVDA, Agency of Natural Resources (VT ANR)	Spring 2021- Fall 2026	Fluvial Erosion Hazard Mitigation Implementation	
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Reduce risk and impact of a pandemic event	Town Manager, Planning Commission ACCD, VDH, NVDA	Spring 2021- Fall 2026	Work with facility leads on understanding risk factors and what can be done to mitigate and enhance training and skills for response	
	Town Manager, Planning Commission ACCD, VDH, NVDA	Spring 2021- Fall 2026	Enhance awareness and planning for COVID-19-related mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability	
	Town Manager, Planning Commission ACCD,	Spring 2021- Fall 2026	Enhance awareness and planning for COVID-19-related	

	VDH, NVDA		mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability	
	Town Manager, Planning Commission ACCD, VDH, NVDA	Spring 2021- Fall 2026	Develop and maintain continuity of operations plans for critical positions	

APPENDICES

NOTE: Appendices A-D not included with State submission or for FEMA review)

Appendix A: Community Reports: Derby (Flood Ready Vermont)

Appendix B: Culvert Locator: (VTrans)

Appendix C: No Adverse Impact Floodplain Management Fact Sheet (ASFPM)

Appendix D: Farm Structures in Designated Flood Hazard Area Planning Checklist (VAAFV)

Appendix E: Community Outreach Summary (PDF)