

**TOWN OF Richmond, Vermont
2017 All-Hazards Mitigation Plan**

**Annex 11 to the
2017 Chittenden County Multi-Jurisdictional
All-Hazards Mitigation Plan**

**Prepared by:
The Chittenden County Regional Planning Commission
and the
Town of Richmond, Vermont**

*Adopted by the Town of Richmond Selectboard
on February 21, 2017*

Approved by FEMA on March 6, 2017

Executive Summary

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 purposes of this updated Local All-Hazards Mitigation Plan are to:

- Identify specific natural, technological and societal hazards that impact the Town of Richmond;
- Prioritize hazards for mitigation planning;
- Recommend town-level goals and strategies to reduce losses from those hazards; and
- Establish a coordinated process to implement the plan, taking advantage of a wide range of resources.

This plan is a local annex to the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan*. **In order to become eligible to receive various forms of Federal hazard mitigation grants, a Chittenden County municipality must formally adopt its Local All-Hazards Mitigation Plan along with the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan*, or develop and adopt an independent, stand-alone Local All-Hazards Mitigation Plan.**

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

Section 2: Hazard Identification expands on the hazard identification in the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan* with specific municipal-level details on selected hazards.

Section 3: Risk Assessment discusses identified hazard areas in the municipality and reviews previous federally-declared disasters as a means 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. The top three Hazards by type with the most risk in Richmond are:

<u>Natural Hazards:</u>	Fluvial Erosion, Flooding and Severe Winter Storm
<u>Technological Hazards</u>	Major Transportation Incident & Power Loss
<u>Societal Hazards</u>	Epidemic, Economic Recession & Crime

Section 4: Vulnerability Assessment discusses buildings, critical facilities and infrastructure in designated hazard areas, vulnerable populations and the issue of estimating potential losses.

Section 5: Mitigation Strategies is the heart of this All Hazards Mitigation Plan. This section begins with an overview of goals and policies in the *2012 Town of Richmond Town Plan* that support hazard mitigation. This is followed by an analysis of existing municipal actions that support hazard mitigation, such as planning and zoning and public works. This section presents the following municipal all-hazards mitigation goals:

- 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 and as identified generally in the Chittenden County Multi-Jurisdictional 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 stormwater management and the planning and development of various land uses.
- 5) Maintain existing municipal plans, programs, regulations, bylaws and ordinances that directly or indirectly support hazard mitigation.
- 6) Consider formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5), as well as incorporation of proposed new mitigation actions into the municipality's/town's bylaws, regulations and ordinances, including, but not limited to, zoning bylaws and subdivision regulations and building codes.
- 7) Consider formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans and infrastructure, utilities, highways and emergency services.

Category A: Complete fluvial geomorphology assessment and address identified vulnerable infrastructure to mitigate against Severe rainstorm, Flooding, Fluvial Erosion and Water Pollution

- Action A-1: Geomorphic assessment and corridor management plan for the Winooski
- Action A-2: Home Elevation Projects

Category B: Upgrade Existing Road and Stormwater Management Infrastructure to mitigate against Severe Rainstorms, Flooding, Fluvial Erosion and Water Pollution

- Action B-1: Culvert Upgrades
- Action B-2: Drainage Improvements
- Action B-2: Road Improvement

Category C: Implement Road Stormwater Management Plan consistent with Vermont Municipal Roads General Permit (MRGP) to mitigate against Severe Rainstorms, Fluvial Erosion and Water Pollution

- Action C-1: Obtain MRGP and develop Road Stormwater Management Plan
- Action C-2: Implement Road Stormwater Management Plan and file annual reports

Finally, this section includes an Implementation Matrix to aid the municipality in implementing the Mitigation Actions and annual monitoring and evaluation of this Plan.

Executive Summary	i
List of Tables	iv
List of Figures.....	vi
SECTION 1: INTRODUCTION AND PURPOSE	1
1.1 Purpose and Scope of this Plan	1
1.2 Hazard Mitigation	1
1.3 Hazard Mitigation Planning Required by the Disaster Mitigation Act of 2000	1
1.5 All-Hazards Mitigation Plan Goals	2
1.6 Town of Richmond: Demographics and Development Characteristics	3
1.7 Summary of Planning Process	4
1.7.1 Development of the 2017 Richmond All Hazards Mitigation Plan	4
1.7.2 Opportunities for involvement in the planning process and formal public review and governing body approval	5
1.7.3 Submission of drafts to VDEMHS and FEMA for Review and final adoption process	7
1.7.4. Monitoring, Evaluation and Updating of the Plan	7
SECTION 2: HAZARD IDENTIFICATION	9
2.1.1 Profiled Hazards.....	9
SECTION 3: RISK ASSESSMENT	14
3.1 Mapped Hazard Areas	14
3.1.1 Flood Hazard Areas	14
3.1.2 Fluvial Erosion Hazard and River Corridor Areas	14
3.1.3 Repetitive Loss Properties and National Flood Insurance Program	15
3.2 Other Information	15
3.2.1 1998 Ice Storm Damage.....	15
3.2.2 Severe rainstorms.....	15
3.2.3 High Crash Locations	16
3.2.4 Road Infrastructure Failure	16
3.2.5 Hazardous Substances.....	17
3.3 Previous FEMA-Declared Natural Disasters and Snow Emergencies	18
3.3.1 Public Assistance	18
3.3.2 Individual Assistance funds	19
3.4 Future Events	20
3.4.1 Natural Hazards	21
3.4.2 Technological Hazards.....	23
3.4.3 Societal Hazards.....	25
3.4.4 Hazard Summary	27

SECTION 4: VULNERABILITY ASSESSMENT	28
4.1 Critical Facilities	31
4.2 Infrastructure	32
4.2.1 Town Highways	32
4.2.2 Bridges, Culverts, and Dams	33
4.2.3 Water, Wastewater and Natural Gas Service Areas.....	34
4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines	34
4.3 Estimating Potential Losses in Designated Hazard Areas.	34
4.4 Vulnerable Populations	35
4.5 Land Use and Development Trends Related to Mitigation	36
4.5.1 Conserved or Undevelopable Parcels	36
4.5.2 Recent and Future Development.....	37
SECTION 5: MITIGATION STRATEGY	38
5.1 Existing 2012 Town of Richmond Town Plan Objectives and Implementation Tasks That Support Hazard Mitigation	38
5.2 Existing Town of Richmond Actions That Support Hazard Mitigation	39
5.3 Town of Richmond All-Hazards Mitigation Goals	41
5.4 Mitigation Actions	42
5.4.1 Current Capabilities and Need for Mitigation Actions	44
5.4.2 Specific Mitigation Actions	47
5.4.3 Prioritization of Mitigation Strategies	50
5.5 Implementation and Monitoring of Mitigation Strategies	52
5.6 Implementation of Preparedness, Response and Recovery Strategies	54

List of Tables

Table 1-1 Town of Richmond, selected population characteristics, 2010	3
Table 1- 2 Town of Richmond, selected housing unit data, 2010 Census	4
Table 3-1 Town of Richmond, high accident road sections, based on 2010-2014 data	16
Table 3-2 Town of Richmond, fuel storage sites in excess of 10,000 lbs.	17
Table 3-3 Town of Richmond, Extremely Hazardous Substances storage sites	18
Table 3-4 Town of Richmond, FEMA-declared disasters and snow emergencies, 1990-2016	18

Table 3-5 Town of Richmond, location of individual assistance claims, Spring 2011 flood & Tropical Storm Irene, September 2011.....	19
Table 3-6 Natural hazards risk estimation matrix, Richmond.....	22
Table 3-7 Technological hazards risk estimation matrix, Richmond	24
Table 3-8 Societal hazards risk estimation matrix, Richmond.....	26
Table 4-1 Town of Richmond: Natural Hazards and typical vulnerabilities	28
Table 4-2 Town of Richmond: Technological Hazards and typical vulnerabilities.....	29
Table 4-3 Town of Richmond: Societal Hazards and typical vulnerabilities	30
Table 4-4 Critical facilities in the Town of Richmond	31
Table 4-5 Town highway mileage by class, Town of Richmond.....	32
Table 4-6 Town highway mileage by surface type, Town of Richmond	33
Table 4-7 Culverts with geomorphic compatibility rating of “Mostly Incompatible” or “Incompatible”	33
Table 4-8 Dams under the jurisdiction of VT Department of Environmental Conservation	34
Table 4-9 National Dam Inventory Data	34
Table 4-10 Vulnerable populations, Richmond	35
Table 4-11 Structures compared to zoning, Town of Richmond.....	36
Table 4-12 Conserved Land, Town of Richmond	36
Table 5-1 Existing municipal capabilities addressing hazard mitigation, Town of Richmond	39
Table 5-2 Existing municipal emergency services & plans, Town of Richmond	40
Table 5-3 Progress on the actions of the 2011 Richmond All-Hazards Mitigation Plan.....	42
Table 5-4 Town of Richmond: Capabilities to address vulnerabilities from natural hazards	44
Table 5-5 Town of Richmond: Capabilities to address vulnerabilities from technological hazards.....	45

Table 5-6 Town of Richmond: Capabilities to address vulnerabilities from societal hazards	46
Table 5-7 Town of Richmond mitigation action evaluation and prioritization matrix	51
Table 5-8 Town of Richmond Mitigation Actions: Implementation Monitoring Worksheet	52
Table 5-9 Town of Richmond: Progress on Preparedness, Response and Recovery Strategies since 2011	54
Table 5-10 Town of Richmond: Preparedness, Response and Recovery Strategies: 2017-2021	56

[Note: See appendices of Chittenden County Multi-Jurisdictional AHMP for weblinks to the various data sources used to generate many of the tables noted above.]

List of Figures

Figure 1.1	Geography, Town of Richmond.....	Appendix
Figure 1.2	Housing and Employment, Town of Richmond.....	Appendix
Figure 1.3	Future Land Use, Town of Richmond.....	Appendix
Figure 1.4	Critical Facilities, Town of Richmond	Appendix
Figure 2.1	River Corridors and Floodplains, Town of Richmond.....	Appendix
Figure 3.1	FEMA Public Assistance Projects, Town of Richmond.....	Appendix
Figure 3.1.1	FEMA Individual Assistance locations, Town of Richmond.....	Appendix
Figure 3.2	Stormwater Management, Town of Richmond	Appendix
Figure 4.1	Vulnerable Populations, Town of Richmond.....	Appendix
Figure 4.2	Land Development Trends, Town of Richmond	Appendix

SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

The purpose of this Local All-Hazards Mitigation Plan is to assist this municipality in identifying all hazards facing their community and in identifying strategies to reduce the impacts of those hazards. The plan also seeks to coordinate the mitigation efforts of this municipality with those outlined in the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan* as well as efforts of quasi-governmental organizations such as Local Emergency Planning Committee, District #1 and the Chittenden County Regional Planning Commission.

This annex, when used with the appropriate sections of the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan, constitutes an All-Hazards Mitigation Plan for the Town of Richmond. Community planning can aid in significantly reducing the impact of expected, but unpredictable natural and human-caused events. The goal of this plan is provide hazard mitigation strategies to aid in creating disaster resistant communities throughout Chittenden County.

1.2 Hazard Mitigation

The *2013 Vermont State All-Hazards Mitigation Plan* defines hazard mitigation as

Any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. The Federal Emergency Management Agency (FEMA) and state agencies recognize that it is less expensive to prevent disaster or mitigate its effects than to repeatedly repair damage after a disaster has struck. This plan recognizes that communities have opportunities to identify mitigation strategies and measures during all of the other phases of Emergency Management—Preparedness, Mitigation Response and Recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where they are most severe and to identify actions that can be taken to reduce the severity of the hazard.

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.

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. According to 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 have to 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 in order 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.

- Flood Mitigation Assistance Grant Program (FMAGP) funds will be available only to communities that have adopted a local Plan
- 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 in order to receive a PDM project grant.
- Under Vermont's Emergency Relief Assistance Fund rules, contributions from the State to cover the non-Federal share of a municipality's FEMA Public Assistance project costs varies depending on whether a community has a plan. A community without a plan would have to cover 17.5% of the overall project cost, but a community with a plan would have to cover only 7.5% to 12.5% of the cost.

1.4 Benefits

Adoption and maintenance of this 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.
- Ease 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 has been ranked.
- Connect hazard mitigation planning to community planning where possible, such as in emergency operations plans, comprehensive plans (aka "town plans"), capital improvement plans and budgeting, open space plans, and stormwater master plans.

1.5 All-Hazards Mitigation Plan Goals

The Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan establishes the following general goals for the county as a whole and its municipalities:

- 1) Hazard mitigation planning should take into account the multiple risks and vulnerabilities of the significant hazards in the County due to its mixed urban-suburban-rural nature, its economic importance to the State and its significant presence of public and private infrastructure.

- 2) Promote awareness amongst municipalities, residents and business in the county of 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 stormwater management and the planning and development of various land uses.
- 3) Ensure that regionally-initiated mitigation measures are consistent with municipal plans and the capacity of municipalities to implement them.
- 4) Encourage municipalities to formally incorporate their individual Local All-Hazards Mitigation Plan into their municipal plan as described in 24 VSA, Section 4403(5), as well as incorporate their proposed mitigation actions into their various bylaws, regulations and ordinances, including, but not limited to, zoning bylaws and subdivision regulations and building codes.
- 5) Encourage municipalities to formally incorporate elements of their Local All-Hazards Mitigation Plan, particularly their recommended mitigation strategies, into their municipal operating and capital plans and programs, especially, but not limited to, as they relate to public facilities and infrastructure, utilities, highways and emergency services.
- 6) Educate regional entities on the damage to public infrastructure resulting from all hazards and work to further incorporate hazard mitigation planning into the regional land use and transportation planning program conducted by the Chittenden County Regional Planning Commission.
- 7) Maintain existing mechanisms, develop additional processes, or explore funding mechanisms and sources to foster regional cooperation in hazard mitigation, specifically and emergency management planning, generally.

1.6 Town of Richmond: Demographics and Development Characteristics

The Town of Richmond (*cf. Figure-1.1*) is located in the southeastern portion of Chittenden County and is surrounded by the following towns: Huntington, Hinesburg, Williston, Jericho and Bolton. Richmond encompasses 32.75 square miles.

Based on U.S. Census data, the University of Vermont’s Center for Rural Studies reports a municipal population of 4,081 people in 2010. Selected population characteristics are as follows:

Table 1-1 Town of Richmond, selected population characteristics, 2010

Category	Number	%
Total Population	4,081	--
Median Age	41.7 years	--
Population age 65 years and over	389	9.5
Population (and %) under 10 years old	524	12.8
Population (and %) in group quarters	13	0.3

U.S. Census Bureau, 2010 Census of Population and Housing, Population and Housing Unit Counts

The following shows the types of housing within Richmond:

Table 1-2 Town of Richmond, selected housing unit data, 2010 Census

Category	Number	%
Total Housing Units	1,653	--
Occupied housing units	1,586	95.9
Vacant housing units	67	4.1
Vacant housing units used for seasonal, recreational or occasional use	22	1.3
Detached 1-unit housing units	1,079	70.6
Housing units with 5 or more units in structure	88	5.7
Mobile homes	180	11.8
Housing structures built in 1939 or earlier	331	21.7

U.S. Census Bureau, 2010 Census of Population and Housing, Population and Housing Unit Counts

The population of Richmond is distributed relatively evenly throughout the town (*cf. Figure 1.2*), with denser concentrations in the Village area along Route 2. The predominant land uses in Richmond are large-lot residential and agriculture.

Table 1-3 Town of Richmond, Historic Population Trends

Year	Population
1960	
1970	
1980	3,159
1990	3,729
2000	4,090
2010	4,081
2014	4,129

April 1 census counts for 1960, 1970, 1980, 1990, 2000 and 2010; July 1 estimates for 2014

1.7 Summary of Planning Process

As noted above, the update of this municipal All Hazard Mitigation Plan (AHMP) was part of the planned update of the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan and the municipal AHMPs that are annexes to the Multi-Jurisdictional Plan. The CCRPC, with funding provided by the State of Vermont via a FEMA Hazard Mitigation Grant, began this update process in the spring of 2015.

1.7.1 Development of the 2017 Richmond All Hazards Mitigation Plan

CCRPC staff met several times with various Town staff and officials during the course of the development of this plan. Initial Meetings focused on the following issues:

1. Reviewing the matrix used in 2011 to identify and prioritize hazards facing Richmond, and determining whether the overall scoring still makes sense
2. Discussing any newly significant hazards in Richmond and identifying any new actions that could be taken to address them.
3. Discussing any progress that has been made on the strategies and tasks from the 2011 plan.

In August 2015, CCRPC Staff met with the Town Manager (Geoff Urbanik), Town Planner (Clare Rock), Town Clerk (Linda Parent), the late Fire Chief (Tom Levesque), and Police Chief (Alan Buck).

In November 2015, CCRPC Staff met with the Road Foreman (Peter Gosselin) to discuss the work of the road crew in terms of hazard mitigation.

Based on these meetings, CCRPC Staff developed memos for Richmond's Selectboard and Planning Commission outlining proposed changes to the 2011 materials and summarizing the reported progress. The memos also clearly stated how CCRPC staff could be reached for comment.

In addition, the following materials were reviewed:

1. The 2012 Town of Richmond Town Plan
2. River corridor plan for the Huntington River
3. Information on previous disasters
4. Information from Vermont Agency of Natural Resources on fluvial erosion hazards and flood hazards
5. Information from the Vermont Agency of Transportation on town roads, bridges, culverts and high crash locations.
6. Information from the Vermont Department of Emergency Management and Homeland Security on prior disaster and hazardous materials reporting.

Demographic information for this Plan was updated by a CCRPC interns in 2015. New information, relative to the 2011 AHMP, from review of the Land Development regulations and the Comprehensive Plan was incorporated into Section 5. Information on prior disasters, fluvial erosion hazards and flood hazards and various transportation data was incorporated into Sections 2, 3 and 4. Throughout the plan development process CCRPC staff sent rough drafts of the plan to numerous town staff to review for accuracy and conferred with these same staff regularly via phone and email. CCRPC staff produced new versions of the 2011 maps and also produced new maps desired in this 2017 update.

1.7.2 Opportunities for involvement in the planning process and formal public review and governing body approval

Emergency management planners are obligated to provide opportunities for the general public, neighboring communities, local, regional and state agencies, development regulation agencies and other interests to be involved in the review and development of Hazard Mitigation Plans.

Additionally, the CCRPC, as a public agency is obligated to provide public notice and opportunities for input into its programming and processes. With regard for public involvement in the develop of the first drafts of this Municipal AHMP *prior to release of public drafts*, there was no formal solicitation process to recruit or invite the public to come to staff level meetings wherein the first process of updating data in the old 2011 Plan. That being said, however, the public has been free to review the 2011 Plans on the CCRPC website since they were first posted in 2011. Additionally as noted in Section 1.10.2.4 of the Multi-Jurisdictional AHMP, in the period before the first municipal draft AHMPs were publicly released in August 2016 (see below) there were twelve public meetings held by the CCRPC Board and the Plan Update Committee wherein the overall Hazard Mitigation planning process was discussed including the content and purpose of the local, Municipal AHMPs as well as the planned timeline for their development starting in 2015 and extending well into 2016. [Note that opportunities for public review and development of the Multi-Jurisdictional AHMP are described in Section 1.10.2 of the that document.]

Commencing with an August 5, 2016 press release and with a comment deadline of August 19, 2016, the CCRPC issued a press release and also posted to all of the electronic bulletin boards of Front Porch Forum in every municipality in the County to solicit and receive comments on the first drafts of this Town of Richmond All-Hazards Mitigation Plan as well as the AHMPs of the other 18 municipalities in the County. On August 5, 2016, emails to the same state agency staff and executive directors of neighboring Regional Planning Commissions as noted above, were also sent to encourage their review and comment. The public, agency staff and RPC staff were directed to provide comments to Dan Albrecht, Senior Planner at the CCRPC.

With regard to opportunities for public involvement and input from neighboring communities in development of individual Local All-Hazards Mitigation Plans including this Plan for the **Town of Richmond**, opportunities were as follows:

- a) On August 5, 2016, the CCRPC posted all the first drafts of the 18 local AHMPs on the CCRPC website and via various means (press release, electronic newsletter, etc) made the public aware of the opportunity to comment. The public was advised to send comments directly to Dan Albrecht, CCRPC Senior Planner by August 19, 2016.
- b) On August 5, 2016 the CCRPC staff sent direct emails to the Agency staff noted above notifying them as well of the opportunity to review the 18 local AHMPs posted on the CCRPC website and encouraging them to send any comments directly to Dan Albrecht, CCRPC Senior Planner by August 19, 2016.
- c) On August 5, 2016 direct emails were also sent to the municipal Mayors/ Managers/ Administrators and/or Clerks of the abutting 12 communities outside of Chittenden County (South Hero, Georgia, Fairfax, Cambridge, Stowe, Waterbury, Duxbury, Fayston, Lincoln, Starksboro, Monkton and Ferrisburgh) that about the County, notifying them of the opportunity to review the 18 local AHMPs posted on the CCRPC website and encouraging them to send any comments directly to Dan Albrecht, CCRPC Senior Planner by August 19, 2016.

No comments were received on the draft Town of Richmond AHMP prior to the August 19th deadline. Additionally, no inquiries were received concerning this AHMP after August 19th through December 31, 2016 while the Plan was posted on the CCRPC website.

1.7.3 Submission of drafts to VDEMHS and FEMA for Review and final adoption process

On July 31, 2016 the first draft of this local Town of Richmond AHMP was sent to the Vermont Department of Emergency Management and Homeland Security (VDEMHS) for review. Comment and required revisions were received from VDEMHS on August 8, 2016. RPC staff, working in concert with municipal staff, then made revisions to the Plan to address the required revisions and formal submissions to VDEMHS and FEMA then progressed as follows:

The revised final draft annex was submitted to VDEMHS for review and forwarding to FEMA for formal review and approval pending municipal adoption on December 20, 2016.

On February 3, 2017 FEMA Region One issued a notice that the Town of Richmond AHMP was approved pending adoption by the relevant municipal governing body.

CCRPC staff provided the final versions of the Multi-Jurisdictional Plan and this Municipal Annex to the Town manager for distribution to the Town of Richmond Selectboard members on February 14, 2017. CCRPC also provided draft language for a resolution of adoption to be discussed at a regularly scheduled and properly warned Town of Richmond Selectboard meeting on February 21, 2017

The revised annex was adopted by the Selectboard on February 21, 2017 and a copy of the resolution, the final adopted Plan and association was sent by CCRPC staff to VDEMHS on February 27, 2017 for forwarding to FEMA.

On March 20, 2017 FEMA Region I issued a letter that the Town of Richmond's All-Hazards Mitigation Plan was approved effective March 6, 2017.

1.7.4. Monitoring, Evaluation and Updating of the Plan

Section 6 of the Multi-Jurisdictional AHMP document provides extensive details on the role each municipality and the Chittenden County RPC will play to be certain that progress on the implementation of this local AHMP is monitored and evaluated and that the AHMP is updated as needed and no later than its anticipated expiration in early 2022. In short, the Town of Richmond will:

- in the fall of 2017 and each fall thereafter, the municipal departments as noted in Section 5.5 as the conclusion of this document shall respond to CCRPC's questionnaire seeking information on the status (progress, problems if any, etc.) of each identified mitigation strategy detailed in Section 5;
- in the fall of 2018 and the fall of 2020, provide information to aid CCRPC in its more comprehensive review of the Multi-Jurisdictional AHMP and this local AHMP which will address issues such as goals, risks, resources, implementation problems, and

partners; in partnership with the municipalities, the CCRPC will make the public aware of the availability of these review documents (via press releases, posting on the CCRPC website, electronic newsletters, one formal announcement in a paper of general circulation in the County, and other mechanisms) and provide detailed instructions on how to provide comment on these reviews;

- provide at least one representative of the municipality to participate as a member of the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan Update and Review Committee which, after the current Plan update process is completed, to resume meeting in 2018; and
- participate in the Plan update process (assumed to commence in 2020 and conclude by early 2022).

Finally, it should be reemphasized that the Town of Richmond may review and update its own programs, initiatives and projects more often by working directly with the State Hazard Mitigation Officer (SHMO) based on changing local needs and priorities. Formal changes to individual municipal annexes may be made at any time by each municipality's governing body in order to reflect changing conditions, priorities, and opportunities during the five-year life cycle of their single jurisdiction plan.

SECTION 2: HAZARD IDENTIFICATION

Detailed descriptions of the natural, technological, and societal hazards affecting the municipalities of Chittenden County are contained Section 2 of the *Multi-Jurisdictional All-Hazards Mitigation Plan*. Designated and non-designated hazard areas are described in Section 3 of this annex. Vulnerability of structures and infrastructure to hazards is also described in Section 4 and depicted in *Figure 4.1*.

2.1.1 Profiled Hazards

This Plan profiles six Natural Hazards: Severe Winter Storm, Flooding, Fluvial Erosion, Severe Rainstorm, Extreme Temperatures and Wildfire. Prior to this discussion of Hazards and the subsequent analysis of Risk and Vulnerability, it will be first helpful to summarize the general state of knowledge regarding Location, Extent and Impact in the Town of Richmond for these hazards

Hazard (section of MJAHP where discussed)	Are Location data available?	Are Extent data available?	Are Impact data available?
Severe Winter Storm (2.1.1.1)	No, occurs across the municipality and not mapped	No, only long-term data is at single point of National Weather Service station in South Burlington	Yes, if FEMA declares disaster. See 3.3 below.
Flooding (2.1.1.3)	Yes, 100 & 500 year flood areas delineated in the municipality. <i>See Figure 2.1</i>	*Yes but only at a few discrete locations with gauge data such as USGS gauge on Winooski River <u>downstream</u> of the Town. OR With regards to applicability to Milton, consistent and long-term data on Lake Champlain water levels are maintained at Burlington. See Figure 2.2 below (repeat for all Lakeshore towns)	Yes, if FEMA declares disaster but co-mingled with fluvial erosion and severe rainstorm hazards events. See 3.3 below.
Fluvial Erosion (2.1.1.4)	Yes, fluvial erosion hazards areas (now termed river corridor	Though fluvial erosion is considered a significant hazard	Yes, if FEMA declares disaster but data co-mingled with

	protection areas) are mapped in the municipality. See <i>Figure 2.1</i> .	in the municipality, the number of feet-acres of soil lost in any one event has not been recorded nor is there a record with such data.	flood and severe rainstorm events. See 3.3 below.
Severe Rainstorm (2.1.1.2)	No, occurs across the municipality and not mapped. Damage locations are mapped but damages can just as easily be a function of poorly designed road and/or driveway drainage as it is a function of heavy rain exceeding infrastructure capacity.	*Yes but only long-term data is at single point of National Weather Service station in South Burlington.	Yes, if FEMA declares disaster but data co-mingled with flood and fluvial erosion events. See 3.3 below.
Extreme Temperatures (2.1.1.5)	No, occurs across the municipality and not mapped.	*Yes but only at single point of National Weather Service station in South Burlington	‡Data not systematically collected on impacts.
Wildfire (2.1.1.6)	No, occurs across the municipality and not mapped.	Some compiled data on a countywide basis as shown in the Multi-Jurisdictional Plan but no systematic data collected after 2010.	‡Data not systematically collected on impacts.

** It is useful to note that while this NWS data is reliable it represents one discrete location in a county that has an area of 620 square miles in area. Likewise, while there are likely other systematic point-specific records being collected by individuals, business or organizations these data do not appear to be easily accessible. Finally, even if such data were accessible, only if the data was collected by mutually compatible means would it be useful.*

‡An intensive search of municipal public works records may reveal documentation of some prior repair or labor costs associated with frozen or burst sewer and/or water pipes caused by Extreme Cold. However, such analysis would show where past events happened not the location of inadequately buried pipes which might be vulnerable to future events.

‡ An intensive search of fire department records may reveal documentation of locations and acres burned caused by Wildfire. However, such analysis would show where past events happened but would not show the location of areas susceptible to future events (warnings by the US Forest Service and local fire departments are not location-specific) nor the location of individuals who are likely to unwisely burn trash or leaves or fail to extinguish a campfire during dry conditions.

This Plan profiles several Technological Hazards. Prior to this discussion of Hazards and the subsequent analysis of Risk and Vulnerability, it will be first helpful to summarize the general state of knowledge regarding Location, Extent and Impact in Town of Richmond for these hazards.

Hazard (section of MJAHP where discussed)	Are Location data available?	Are Extent data available?	Are Impact data available?
Water Pollution (2.2.1)	Streams with water quality concerns are identified in Tactical Basin plans.	Phosphorus-loading for general locations is known but non-point sources are varied and dispersed. A road erosion inventory was performed in 2016 but data analysis is not yet complete and projects have not yet been prioritized or scoped.	Annual budgetary impacts to individual municipalities are significant but vary depending upon location and whether they are a designated MS4 community. Richmond is not an MS-4 however the municipality is subject to the requirements of the pending Municipal Roads General Permit.
Hazardous Materials Incident (2.2.2)	Storage locations are known (see listing below of addresses). Incidents occurring during transportation could occur anywhere.	Rough estimates of spill amounts are recorded.	No formal data readily available on cleanup costs.
Power Loss (2.2.3)	Outage locations not mapped.	During an actual outage some data is recorded on duration although typically this is stated as “x,000 customers within the power company’s service area”.	Outage data are broad and refer to total customers within a county.
Invasive Species (2.2.4)	Several species known to occur but no systematic mapping has taken place.	No formal damage has been documented to date.	No formal damage has been documented to date.
Multi-Structure Fire	Could happen	Data not formally	Data not formally

(2.2.5)	anywhere within the more developed portions of the municipality.	collated across agencies.	collated across agencies.
Major Transportation Incident (2.2.6)	Depending upon type of incident, could happen anywhere.	No formal database of damages.	Varies depending upon type of incident.
Water Supply Loss (2.2.7)	Water distribution systems are mapped (<i>cf. Figure 1.4</i>). Residences and businesses outside of these service areas use private wells	Data not formally collated across agencies.	Data not formally collated across agencies.
Sewer Service Loss (2.2.8)	Sewer lines are mapped (<i>cf. Figure 1.4</i>). Many residences and businesses use private septic systems.	Data not formally collated across agencies.	Data not formally collated across agencies.
Natural Gas Service Loss (2.2.9)	There is VT Gas service in the village (<i>cf. Figure 1.4</i>) but specific locations of loss not recorded.	Information for this rare occurrence not publicly available.	No formal damage has been documented to date.
Telecommunications Failure (2.2.10)	Depending upon type of incident, could happen anywhere.	Information for this rare occurrence not publicly available.	No formal damage has been documented to date
Other Fuel Service Loss (2.2.11)	Distribution points of fuels such as firewood, fuel oil and propane are individual addresses and not mapped nor publicly available.	No formal loss of service has been documented.	No formal damage has been documented to date.

The following discussion of societal hazards is based upon qualitative information from discussions with Chittenden County law enforcement professionals as well as quantitative data from the State of Vermont.

Hazard (section of MJAHP where discussed)	Are Location data available?	Are Extent data available?	Are Impact data available?
Crime (2.4.1.1)	Significant incidents could happen anywhere in the municipality.	Data collection is not standardized across all municipalities.	Significant socio-economic impacts.
Civil Disturbance (2.4.1.2)	Would occur across the community.	Historic data on unemployment levels & poverty rates.	Longer lasting impacts hard to measure below county level.
Terrorism (2.4.1.3)	The FBI does not share a list of potential targets.	Unknown but assumed to be significant if incident occurs.	Unknown but assumed to be significant if incident occurs.
Economic Recession (2.4.1.4)	County-wide. Significant incidents can happen anywhere. The likelihood of an event may not be geographically likely but rather related to the type of event (political event, sporting event, protest, etc.)	No formal damage has been documented to date	No formal damage has been documented to date
Key Employer Loss (2.4.1.5)	Could happen anywhere	Data not formally collated across agencies.	Other than 1917 Influenza epidemic no formal damage has been documented to date.
Epidemic (2.4.1.6)	Depending upon type of employer	No formal database of damages.	No formal database of key employer loss is maintained

SECTION 3: RISK ASSESSMENT

3.1 Mapped Hazard Areas

3.1.1 Flood Hazard Areas

In 1984, Richmond began participation in the NFIP Emergency Program. The Town has been issued official FEMA Floodplain maps, including most recently issuance of Digital Flood Insurance Rate Maps (DFIRM) by FEMA. After the issuance in 2011 of initial draft DFIRM, the Town completed a study of the town's floodplain and successfully sought amendments to their identified flood hazard areas. New DFIRMs went into effect in August 2014.

The town is participating in the regular NFIP as of January 2017. Richmond's most recent Zoning Regulations adopted in 2013, designate a Flood Hazard Overlay District for areas designated as FEMA Special Flood Hazard Areas or within 100 feet of the SFHA and not above the base flood elevation. Development is highly restricted in the overlay district. No new development is allowed in the overlay district except limited conditional uses, such as improvements to existing structures and infrastructure and infrastructure projects that cannot be located elsewhere.

A simple GIS intersection analysis reveals that portions of town roads are also located within the 100-year floodplain as well as culverts and bridges and utility poles. Unfortunately, this level of analysis does not take into account the fluvial geomorphology (volume, velocity, direction, etc.) nor, most critically, does it factor in the elevation of the road relative to flood elevation. Analysis also reveals farmland located within the floodplain, however, without detailed studies at each location it is not currently possible to predict how many cubic yards of productive soils would be a net loss during a flood event.

Figure 2.1 shows the current extent of the FEMA-FIRM flood hazard area in Richmond, as well as structures, infrastructure, and critical facilities located in the flood hazard area.

The only systematic data on river flow in the municipality is collected on the Winooski River at a gauge downstream of Richmond at a location straddling South Burlington and Essex Junction (cf. Section 2.1.1.3 of the MJAHMP). While the data has been collected since the massive 1927 flood, once dams were constructed by the mid-1930s, water flows became more tightly regulated for flood control and electricity generation and therefore recorded peak flows may not accurately measure total rainfall or total discharge.

3.1.2 Fluvial Erosion Hazard and River Corridor Areas

During development and adoption of both the 2005 and 2011 Multi-Jurisdictional Plan and the municipal AHMPs, threats from stream erosion were identified as Fluvial Erosion Hazard (FEH) Areas through the analytical lens of Stream Geomorphic Assessment (SGA). The SGA approach is still used by the Vermont Agency of Natural Resources but the Vermont General Assembly adopted two related terms that are now used in managing fluvial erosion hazards. ANR now identifies and maps:

- *River Corridor* which 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 10 V.S.A. §1422, and for minimization of fluvial erosion hazards, as delineated by the Agency in accordance with the ANR Flood Hazard Area and River Corridor Protection Procedures.

- *River Corridor Protection Area* means the area within a delineated river corridor subject to fluvial erosion that may occur as a river establishes and maintains the dimensions, pattern, and profile associated with its dynamic equilibrium condition and that would represent a hazard to life, property, and infrastructure placed within the area. The river corridor protection area is the meander belt portion of the river corridor without an additional allowance for a riparian buffer to serve the functions of bank stability and slowing flood water velocities in the near-bank region

Phase I assessments have been completed for Snipe Island Brook, Owls Head Brook, and the Jericho Road/Southview Drive tributary of the Winooski. Phase II assessments have been completed for all of the Johnnie Brook and Huntington River, parts of the Governor Peck Road tributary of the Winooski and parts of the Stage Road tributary of the Winooski. A corridor management plan for the Huntington River has been developed. No assessments have been completed of the main branch of the Winooski. *Figure 2.1* indicates all portions of the streams in Richmond that would be captured by the RCPA and/or RC.

3.1.3 Repetitive Loss Properties and National Flood Insurance Program

Repetitive loss properties are public or private buildings insured under the National Flood Insurance Program that have made at least two insurance claims of more than \$1,000 each during a ten year period. According to the National Flood Insurance Program, there are three such properties located in the Town of Richmond. One is located on Bridge Street in the business district of Richmond and two are located in the hamlet of Jonesville. All three are residential properties.

The status of the town participation’s in the National Flood Insurance Program is as follows:

Initial Flood Hazard Boundary Map	Initial Flood Insurance Rate Map	Current effective Map Date	Date of joining Regular NFIP	Date of most recent Community Assistance Visit
03/22/74	07/02/82	08/04/14	07/05/82	12/14/15

The Town Zoning Administrator and the Town’s Development Review Board (DRB) monitor compliance with the National Flood Insurance Program. The DRB reviews and adjudicates applications for development within the floodplain including any proposed new construction in the SFHA which is highly regulated. The Town also works with DEC to respond to any local requests for Floodplain identification including questions about mapping.

3.2 Other Information

The following hazards are not formally analyzed nor mapped due to the random nature of where such damage occurs. However, they occur with some frequency and therefore are discussed here.

3.2.1 1998 Ice Storm Damage

The Town of Richmond was not affected by the ice storm as temperatures were below freezing due to the town’s higher elevation

3.2.2 Severe rainstorms

In prior versions of this Annex and the County Plan, damage to roads, culverts and bridges from thunderstorm events was discussed as either the result of flooding or fluvial erosion. It was assumed that overflowing nearby streams, rivers or lakes were the cause of the damage. Analysis has shown that this

damage is caused by intense, localized thunderstorms which cause excessive and rapid water flows on and over paved and gravel roads, roadside ditches, driveway culverts, stormwater systems, etc. In many cases, damaged infrastructure is located nowhere near a formally mapped Floodplain or Fluvial Erosion Hazard Area or River Corridor. This was the case in more recent FEMA-declared disasters in the summer of 2013 and 2015. Because of this new information, CCRPC has decided to add “Severe rainstorm” to the 2016 Update to the County Plan and its annexed local AHMPs. While past damage locations can sometimes be mapped (depending upon the degree and accuracy of data collection efforts) this may or may not provide any degree of predictability of the potential locations for future events.

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. The National Climatic Data Center indicates that nine high-wind events have occurred in Richmond since 1993. Structures within the village and various barns have also been struck by lightning in recent years.

A significant portion of the Town of Richmond’s road infrastructure as well as the driveways of private homes and businesses consist of gravel and/or dirt and are therefore susceptible to damage from intense severe rainstorms. Damage occurring in DR#-4120 (noted below) included significant damage from severe rainstorms.

3.2.3 High Crash Locations

The following High Crash Locations have been identified by the Vermont Agency of Transportation in Richmond.

Table 3-1 Town of Richmond, high accident road sections, based on 2010-2014 data

Road	Road Type	Section (miles)	Severity Index (\$/crash)
US-2	Major Collector (r)	0.553 - 0.853	\$17,167
US-2	Major Collector (r)	1.053 - 1.353	\$24,950
US-2	Major Collector (r)	4.853-5.153	\$272,871
US-2	Major Collector (r)	6.053-6.353	\$8,900
I-89	Interstate, Rural (u)	73.800 - 74.100	\$22,704
I-89	Interstate, Rural (u)	78.000 - 78.300	\$21, 061
VT-117	Minor Arterial (r)	0.276-0.576	\$17,650
FAS 0209	Major Collector (r)	4.770-5.070	\$26,400
FAS 0211	Major Collector (r)	0.040-0.340	\$22,900
FAS 0211	Major Collector (r)	0.840-1.140	\$267,233

Source: VTrans

3.2.4 Road Infrastructure Failure

Of the 25 bridges inventoried by VTrans for Richmond, 6 are rated functionally deficient and 4 are rated structurally deficient. One bridge in Richmond over the Huntington River is rated Scour Critical with regards to fluvial undermining of bridge structure. Some of the most vulnerable infrastructure are road culverts. For a listing of culverts identified as “geomorphically-incompatible” either due to inadequate size or improper alignment, see Section 4.2.2.

3.2.5 Hazardous Substances

Hazardous material release is discussed as a possible hazard in the Multi-Jurisdictional All-Hazards Mitigation Plan. According to Vermont Emergency Management, there are several reported hazardous material and petroleum storage sites in Richmond. Sites that contain large amounts of fuel or store what VEM calls Extremely Hazardous Substances are more likely to cause significant problems in a hazardous materials incident.

According to the 2014 hazardous materials data obtained from VEM, the following sites in Richmond stored either fuel in excess of 10,000 lbs or extremely hazardous substances.

Table 3-2 Town of Richmond, fuel storage sites in excess of 10,000 lbs.

Owner / Facility	Type of Substance
BLUE FLAME GAS/AMERIGAS	PROPANE
BLUE FLAME GAS/AMERIGAS	METHANOL
CUMBERLAND FARMS #8016	FUELS, GASOLINE
HARRINGTON'S IN VERMONT, INC.	PROPANE
HARRINGTON'S IN VERMONT, INC.	VARIOUS CLEANING CHEMICALS
RIVER ROAD LLCs., DBA PATTERSON FUELS	KEROSENE
RIVER ROAD LLCs., DBA PATTERSON FUELS	DIESEL FUEL
RIVER ROAD LLCs., DBA PATTERSON FUELS	FUEL OIL
RIVER ROAD LLCs., DBA PATTERSON FUELS	PROPANE
ROGERS ROAD LLC, DBA PATTERSON PROPANE	PROPANE
HEAT LTD., DBA PATTERSON FUELS	KEROSENE
HEAT LTD., DBA PATTERSON FUELS	DIESEL FUEL
HEAT LTD., DBA PATTERSON FUELS	FUEL OIL
HEAT LTD., DBA PATTERSON FUELS	PROPANE
MILTON-CAT, INC. - RICHMOND FACILITY	VARIOUS OILS
MILTON-CAT, INC. - RICHMOND FACILITY	PROPANE
RICHMOND MOBIL	FUELS, GASOLINE

Source: Vermont Emergency Management

Table 3-3 Town of Richmond, Extremely Hazardous Substances storage sites

Owner / Facility	Type of Substance
GREEN MOUNTAIN POWER CORPORATION - RICHMOND SUBSTATION #51	LEAD ACID BATTERIES
MILTON-CAT, INC. - RICHMOND FACILITY	SULFURIC ACID
RICHMOND VERBURG LANE	LEAD
RICHMOND VERBURG LANE	SULFURIC ACID
VERIZON WIRELESS	SULFURIC ACID

Source: Vermont Emergency Management

3.3 Previous FEMA-Declared Natural Disasters and Snow Emergencies

3.3.1 Public Assistance

Since 1990, Richmond has received public assistance funding from FEMA for the following natural disasters:

Table 3-4 Town of Richmond, FEMA-declared disasters and snow emergencies, 1990-2016

Date (FEMA ID#)	Type of Event	Total repair estimates
June 1990 (DR 875)	flooding	\$145,058
March 1992 (DR 938)	flooding	\$7,124
January 1996 (DR 1101)	flooding	\$31,586
July 1998 (DR 1228)	flooding	\$9,652
April 2001 (EM3167)	snow emergency	\$12,736
December 2010 (DR1951)	Severe storm	\$1,113
June 2011 (DR 1995)	Flooding	\$52,442
September 2011 (DR 4022)	Tropical Storm	\$124,169
August 2013 (DR 4140)	Flooding	\$137,906
June 2015 (DR 4232)	Severe storm and flooding	\$198,081

Sources: Vermont Department of Housing & Community Affairs; Vermont Agency of Transportation.

Dollar value figures represent the total estimated repair costs for damages suffered to municipal resources. This table does not include damage claims submitted to FEMA by non-municipal organizations or by private individuals or businesses.

The Town of Richmond was reimbursed at a rate of 75 percent by FEMA for the estimated repair costs. Funds provided in response to these natural disasters were used as follows:

- June 1990: Repaired flooding and silt erosion, Lawrence Rd, Stage Rd, Cochran's Rd. All dirt roads throughout Town were affected, required new ditching and gravel. Also upsized numerous culverts from 18" to 24".
- March 1992: East Hill Road washout.
- January 1996: Washout repairs at Johnnie Brook Road, Snipe Ireland Road and Stage Road. Replaced pavement at Collins Mt. Road and East Hill Road. Repaired pavement/parking area at Volunteers Green.
- July 1998: At Stage Road at location south of U.S Route 2, repaired and replaced 1,500 linear feet of aggregate road surface and lost fill. Also cleaned and shaped 400 linear feet of ditch.
- April 2001: Increased contractual costs for snow removal.

- December 2010: Money was spent to repair the roof of the Richmond Elementary School.
- June 2011: Money was used to repair damage to Kenyon Road, Collins Mountain Road, Wes White Hill Road, Williams Road, Palmer Lane and East Hill Road, as well as damage to Volunteers Park and the Richmond Elementary School grounds and playground.
- September 2011: Money was used to repair damage to the town’s forced sewer main on the Bridge Street Bridge, to the sewer pump station and wastewater treatment facility, to repair damage to Johnnie Brook Road, to repair damage to Volunteers Park, to repair damage to the Town Hall, for general debris removal, to repair damage to the water house and for emergency protective measures.
- August 2013: Money was used to repair damage to Grandview Drive, Cemetery Road, Christmas Hill Road, Wes White Hill Road, Snipe Ireland Road, Hidden Pines Circle, East Hill Road, Southview Drive, Collins Mountain Road, Wortheim Lane, Hillview Road, Lawrence Road, Williams Hill Road and Kenyon Road, and to repair damage to the town-wide storm drain system.
- June 2015: Money was spent to repair a gravel and road embankment failure on Dugway Road, to repair damage on Wes White Hill Road, to replace a road washed out near a culvert on Greystone Drive, and to repair a bridge on Cochran Road.

See *Figure 3.1.* to see locations where repairs funded in part with FEMA Public Assistance took place for disasters between 2001 and 2015. As the map shows, damage has tended to be concentrated in upland areas. Note that some Debris Removal and Protective Measures locations are shown at the location of the municipal office. This indicates assistance was at various locations throughout the municipality not that damage were incurred at the office.

3.3.2 Individual Assistance funds

As noted in Section 3.3 of the County Plan, due to privacy concerns, the individual homes or businesses which received Individual Assistance funds are not public information. However, the names of the streets of such homes or businesses from which claims are filed is available as are the funds provided. With regards to the Town of Richmond, data indicate that 10 individual assistance claims were approved after the June 2011 disaster and Tropical Storm Irene in September 2011. These streets are shown in *Figure 3.1.1.*

Table 3-5 Town of Richmond, location of individual assistance claims, Spring 2011 flood & Tropical Storm Irene, September 2011

Disaster Date	Damaged Address Street	# of Registration	Amount
June 2011	BEAVER POND HL	1	\$2,048.72
June 2011	HUNTINGTON ACRES	2	\$3,748.00
June 2011	WES WHITE HL	1	\$141.51
September 2011	BEAVERBROOK FARM RD	1	\$23,987.56
September 2011	BRIDGE ST	4	\$36,674.76
September 2011	COCHRAN RD	1	\$12,518.64
September 2011	ESPLANADE	1	\$94,322.70
September 2011	HUNTINGTON RD	1	\$2,265.04
September 2011	JOHNNIE BROOK RD	1	\$14,604.59

September 2011	JONES MILL RD	1	\$3,229.61
September 2011	OLD BROOKLYN CT	1	\$32,307.99
September 2011	SUMMERS ST	1	\$2,607.98

3.4 Future Events

Although estimating the risk of future events is far from an exact science, CCRPC staff used best available data and best professional judgment to conduct an updated Hazards Risk Estimate analysis, which was subsequently reviewed and revised by town officials in Fall 2015. This analysis assigns numerical values to a hazard’s affected area, expected consequences, and probability. This quantification allows direct comparison of very different kinds of hazards and their effect on the county, and serves as a rough method of identifying which hazards hold the greatest risk. CCRPC staff applied the following scoring system:

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.

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

As explained in detail in Section 3.4 of the Multi-Jurisdictional Plan, for the 2011 Plan, the following Hazards were considered to occur or have the potential to occur with sufficient frequency and/or severity to be profiled for Risk Estimation in that Plan:

Natural Hazards:

- Drought
- Flooding
- Fluvial erosion
- High winds
- Landslide
- Lightning
- Multi-structure urban fire
- Radiological (natural)
- Wildfire
- Winter storm

Technological Hazards:

- Gas service loss
- Hazardous materials incident
- Major transportation incident
- Military ordnance incident
- Power loss
- Radiological incident
- Sewer service loss
- Telecommunications failure
- Water service loss

Societal Hazards:

- Crime
- Civil disturbance
- Economic recession
- Epidemic
- Key employer loss
- Terrorism

For the 2017 update, the CCRPC and its All-Hazards Mitigation Plan Update Committee made slight changes to this list by consolidating some hazards or delineating hazards with more specificity as follows:

Natural Hazards:

Technological Hazards:

Societal Hazards:

- Flooding
- Fluvial erosion
- Severe rainstorm
- Wildfire
- Severe Winter storm
- Extreme temperatures
- Hazardous materials incident
- Major transportation incident
- Multi-structure fire
- Natural gas service loss
- Pollution
- Power loss
- Sewer service loss
- Telecommunications failure
- Water service loss
- Other fuel service loss
- Invasive Species
- Crime
- Civil disturbance
- Economic recession
- Epidemic
- Key employer loss
- Terrorism

3.4.1 Natural Hazards

For the 2011 Hazard and Risk Estimation analysis for Richmond, the following natural hazards received the highest risk ratings out of a possible high score of 80:

- Severe Winter Storm (40)
- Flooding (28)
- Fluvial Erosion (20)

For the 2017 update, the following natural hazards received the highest risk ratings out of a possible high score of 80 (see Table below):

- Fluvial Erosion (50)
- Flooding (45)
- Severe Winter Storm (45)

Although fluvial erosion does not affect as wide an area as flooding or severe winter storms, its impacts tend to be more damaging.

Table 3-6 Natural hazards risk estimation matrix, Richmond

Risk Characteristic		Fluvial Erosion	Flooding	Winter Storm	Severe Rainstorm	Extreme Temperatures	Wildfire
Area Impacted	0 = No developed area impacted						
	1 = Less than 25% of developed area impacted		1		1	1	1
	2 = Less than 50% of developed area impacted						
	3 = Less than 75% of developed area impacted	3					
	4 = Over 75% of developed area impacted			4			
Health and Safety Consequences	0 = No health and safety impact				0	0	
	1 = Few injuries or illnesses	1		1			1
	2 = Few fatalities but many injuries and illnesses		2				
	3 = Numerous fatalities						
Property Damage	0 = No property damage						0
	1 = Few properties destroyed or damaged			1	1	1	
	2 = Few destroyed but many damaged	2	2				
	2 = Few damaged and many destroyed						
	3 = Many properties destroyed and damaged						
Environmental Damage	0 = Little or no environmental damage						
	1 = Resources damaged with short-term recovery			1	1	1	1
	2 = Resources damaged with long-term recovery	2	2				
	3 = Resources destroyed beyond recovery						
Economic Disruption	0 = No economic impact					0	0
	1 = Low direct and/or indirect costs			1	1		
	2 = High direct and low indirect costs	2	2				
	2 = Low direct and high indirect costs						
	3 = High direct and high indirect costs						
TOTAL SCORE		10	9	8	4	3	3
Probability of Occurrence	1 = Unknown but rare occurrence						
	2 = Unknown but anticipate an occurrence						
	3 = 100 years or less occurrence						
	4 = 25 years of less occurrence				4	4	4
	5 = Once a year or more occurrence	5	5	5			
TOTAL RISK RATING		50	45	40	16	12	12

3.4.2 Technological Hazards

In the 2011 Hazard and Risk Estimation analysis for Richmond, the following technological hazards received the highest risk ratings out of a possible high score of 80:

- Power Loss (35)
- Telecommunications Failure (28)
- Major Transportation Incident (28)

For the 2017 update, the following technological hazards received the highest risk ratings out of a possible high score of 80 (see Table below):

- Major Transportation Incident (40)
- Power Loss (25)

Richmond is vulnerable to power loss because the population is dispersed and repairing utility infrastructure in rural areas can take more time. Richmond contains Interstate 89, Route 2 and a railroad, which are all potential sources of major transportation incidents.

Power loss and telecommunications failure were both identified as the most significant technological hazards in the 2011 plan. Though cellular service is somewhat more reliable than it was five years ago, power loss remains significant for residents of rural areas.

Table 3-7 Technological hazards risk estimation matrix, Richmond

Risk Characteristic		Major Transportation Incident	Power Loss	Other Fuel Service Loss	Water Pollution	Water Service Loss	Telecommunications Failure	Sewer Service Loss	Hazardous Materials Incident	Multi-structure fire	Invasive Species	Gas Service
Area Impacted	0 = No developed area impacted											
	1 = Less than 25% of developed area impacted	1		1	1		1	1	1	1	1	1
	2 = Less than 50% of developed area impacted		2			2						
	3 = Less than 75% of developed area impacted											
	4 = Over 75% of developed area impacted											
Health and Safety Consequences	0 = No health and safety impact										0	
	1 = Few injuries or illnesses		1	1	1		1	1	1	1		1
	2 = Few fatalities but many injuries and illnesses	2				2						
	3 = Numerous fatalities											
Property Damage	0 = No property damage					0	0				0	
	1 = Few properties destroyed or damaged	1	1	1	1			1	1	1		
	2 = Few destroyed but many damaged											2
	2 = Few damaged and many destroyed											
	3 = Many properties destroyed and damaged											
Environmental Damage	0 = Little or no environmental damage		0	0		0	0			0		
	1 = Resources damaged with short-term recovery				1			1			1	1
	2 = Resources damaged with long-term recovery	2							2			
	3 = Resources destroyed beyond recovery											
Economic Disruption	0 = No economic impact											
	1 = Low direct and/or indirect costs		1		1			1	1	1	1	1
	2 = High direct and low indirect costs	2		2		2	2					
	3 = Low direct and high indirect costs											
	4 = High direct and high indirect costs											
TOTAL SCORE		8	5	5	5	6	4	5	6	4	3	6
Probability of Occurrence	1 = Unknown but rare occurrence											1
	2 = Unknown but anticipate an occurrence								2			
	3 = 100 years or less occurrence					3		3		3		
	4 = 25 years of less occurrence			4	4		4					4
	5 = Once a year or more occurrence	5	5									
TOTAL RISK RATING		40	25	20	20	18	16	15	12	12	12	6

3.4.3 Societal Hazards

In the 2011 Hazard and Risk Estimation analysis for Richmond, the following societal hazards received the highest risk ratings out of a possible high score of 80:

- Economic Recession (24)
- Epidemic (21)

For the 2016 update, the following societal hazards received the highest risk ratings out of a possible high score of 80 (see Table below):

- Economic Recession (24)
- Epidemic (21)
- Crime (16)

Economic recession is highly ranked for both its direct impacts and its secondary effects on health, safety, and the environment. In a recession, property owners may not be able to maintain their properties, which are then more vulnerable to natural hazards. The likelihood of an epidemic is difficult to gauge, but given Richmond's lack of medical facilities, its consequences could be severe. Major crime is rare in the town, but small crimes are very common.

Epidemic and economic recession were both identified as threats in the 2011 plan, and the risk of them remains low but still exists. The risk of crime is perceived as being higher now. This is related to Vermont's opioid epidemic. Drug use and crimes related to drug use, while still rare compared to the situation in major cities, are a major point of discussion in Vermont. Residents of small towns no longer feel immune to crime, increasing the ranking of this hazard.

Table 3-8 Societal hazards risk estimation matrix, Richmond

Risk Characteristic		Economic Recession	Epidemic	Crime	Key Employer Crisis	Civil Disturbance	Terrorism
Area Impacted	0 = No developed area impacted						
	1 = Less than 25% of developed area impacted			1	1	1	1
	2 = Less than 50% of developed area impacted	2	2				
	3 = Less than 75% of developed area impacted						
	4 = Over 75% of developed area impacted						
Health and Safety Consequences	0 = No health and safety impact				0		
	1 = Few injuries or illnesses	1		1		1	
	2 = Few fatalities but many injuries and illnesses		2				2
	3 = Numerous fatalities						
Property Damage	0 = No property damage	0	0		0		
	1 = Few properties destroyed or damaged			1		1	1
	2 = Few destroyed but many damaged						
	2 = Few damaged and many destroyed						
	3 = Many properties destroyed and damaged						
Environmental Damage	0 = Little or no environmental damage	0	0	0	0	0	0
	1 = Resources damaged with short-term recovery						
	2 = Resources damaged with long-term recovery						
	3 = Resources destroyed beyond recovery						
Economic Disruption	0 = No economic impact						
	1 = Low direct and/or indirect costs			1		1	
	2 = High direct and low indirect costs				2		2
	3 = Low direct and high indirect costs	3	3				
	4 = High direct and high indirect costs						
TOTAL SCORE		6	7	4	3	4	6
Probability of Occurrence	1 = Unknown but rare occurrence						1
	2 = Unknown but anticipate an occurrence					2	
	3 = 100 years or less occurrence		3		3		
	4 = 25 years of less occurrence	4		4			
	5 = Once a year or more occurrence						
TOTAL RISK RATING		24	21	16	9	8	6

3.4.4 Hazard Summary

According to the risk estimation analysis, the three highest rated hazards by type for Richmond are:

Natural Hazards

- Fluvial Erosion (50)
- Flooding (45)
- Severe Winter Storm (40)

Technological Hazards

- Major Transportation Incident (40)
- Power Loss (25)

Societal Hazards

- Epidemic (24)
- Economic Recession (21)
- Crime (16)

It should be noted that the three natural hazards on the list—flooding, fluvial erosion and severe winter storm—could be the cause of the highest-rated technological hazards, power loss and telecommunications failure.

SECTION 4: VULNERABILITY ASSESSMENT

As discussed in Section 4 of the County Plan, typical vulnerabilities from the County’s common hazards consist primarily of:

- Damage to public infrastructure especially roads and culverts;
- Temporary closures of roads and bridges including from debris;
- Temporary loss of power and/or telecommunications;
- Temporary isolation of vulnerable individuals such as the elderly or those in poverty.

More specifically, these vulnerabilities typically occur in association with the Profiled Natural Hazards as follows:

Table 4-1 Town of Richmond: Natural Hazards and typical vulnerabilities

Hazard	Typical vulnerabilities	Occasional additional vulnerability
Severe Winter Storm	-temporary closures of roads and bridges including from debris; -temporary loss of power and/or telecommunications, and -temporary isolation of vulnerable individuals	-budget impacts from debris cleanup
Flooding	-temporary closures of roads and bridges including from debris; -temporary loss of power and/or telecommunications, and -temporary isolation of vulnerable individuals -damage to public infrastructure	-budget impacts from road/bridge closures and repairs to public infrastructure -damages to individuals’ properties and businesses
Fluvial Erosion	-temporary closures of roads and bridges including from debris; -temporary loss of power and/or telecommunications, and -temporary isolation of vulnerable individuals -damage to public infrastructure	-budget impacts from road/bridge closures and repairs to public infrastructure -damages to individuals’ properties and businesses
Severe Rainstorm	-temporary closures of roads and bridges including from debris; -temporary loss of power and/or telecommunications, and -temporary isolation of vulnerable individuals -damage to public infrastructure	-budget impacts from road/bridge closures and repairs to public infrastructure -damages to individuals’ properties and businesses
Extreme Temperatures	-damage to public infrastructure -loss of water service	-budget impacts due to needed repairs
Wildfire	-damage to private property	

Relative to the County as a whole the Town of Richmond has a higher vulnerability to:

- Severe Rainstorms, Fluvial Erosion due to high amount of gravel roads and mountainous terrain.
- Flooding due to the presence of the Winooski River (although the latter is mitigated by several dams) and the Huntington River.

Vulnerabilities with regard to Technological Hazards are harder to project as these incidents occur with less frequency and less predictability.

Table 4-2 Town of Richmond: Technological Hazards and typical vulnerabilities

Hazard	Typical vulnerabilities	Occasional additional vulnerability
Major Transportation Incident	-temporary closures of transportation infrastructure -injuries, deaths	-if major event, potential long term closure of infrastructure.
Power Loss	-temporary loss of electrical service -temporary impacts to vulnerable individuals -damage to public infrastructure	-if extended event, damage to perishable goods or business income. -if extensive loss, potential budget impacts to service providers.
Hazardous Materials Incident	-temporary closures of roads and bridges during cleanup.	-if large event, potential high cleanup costs. -injuries to persons
Water Service Loss	-temporary loss of service -temporary impacts to vulnerable individuals	-if extensive loss, potential budget impacts to service providers.
Gas Service Loss	-temporary loss of service -temporary impacts to vulnerable individuals	-if extensive loss, potential budget impacts to service providers.
Telecommunications Failure	-temporary loss of service -temporary impacts to vulnerable individuals	-if extensive loss, potential budget impacts to service providers.
Other Fuel Service Loss	-temporary loss of service	-if extensive loss,

	-temporary impacts to vulnerable individuals	potential budget impacts to service providers.
Sewer Service Loss	-temporary loss of service -temporary impacts to vulnerable individuals	-if extensive loss, potential budget impacts to service providers.
Water Pollution	-ongoing budgetary impacts due to permit requirements.	-if repeat events, impacts to tourism-based businesses
Invasive Species	-small but ongoing cost to monitoring level of occurrence	-unknown at this point.

Relative to the County as a whole the Town of Richmond has a slightly higher vulnerability to:

- Major Transportation Incident due to the transit of a railroad line and Interstate 89 through the Town.
- Power Loss and Telecommunications Failure due to its mountainous terrain

With regard to Societal Hazards, vulnerabilities are typically more dispersed among individuals and societal sectors compared to the natural environment and to technology which is fixed.

Table 4-3 Town of Richmond: Societal Hazards and typical vulnerabilities

Hazard	Typical vulnerabilities	Occasional additional vulnerability
Crime	-increased demands on police services and social services	-injuries -deaths
Epidemic	-temporary closures of schools, businesses, places of assembly -increased demand on medical services	-if an epidemic is widespread and long-lasting, impact could be severe
Key Employer Loss	-loss of economic activity -loss of portion of tax base -increased demands on social services	-effects increased if employer is of significant size
Economic Recession	-loss of economic activity -increased demands on social services -some loss of tax revenue	-effects increased if event is of extended duration

Civil Disturbance	-injuries to persons -damage to public and private property	-budget impacts to police services depending upon severity of event -deaths
Terrorism	-injuries to persons -damage to public and private property	-budget impacts to police services depending upon severity of event -deaths

Relative to the County as a whole there are insufficient data to conclude whether the Town is more vulnerable to one of the six Societal Hazards noted above.

With regard to the vulnerability of critical facilities, infrastructure and vulnerable populations, quantitative and locational data for the Town are available as follows.

4.1 Critical Facilities

The Center for Disaster Management and Humanitarian Assistance defines critical facilities as: “Those structures critical to the operation of a community and the key installations of the economic sector.” *Figure 1.4* shows the geographic distribution of some critical facilities and utilities. The table below identifies critical facilities in Richmond excluding critical facilities designated as hazardous materials and petroleum storage sites, which are shown in Section 3.2.5. This list includes all critical facilities, not only the facilities located in designated hazard areas.

Table 4-4 Critical facilities in the Town of Richmond

Facility Type	Number of Facilities
Veterinary Hospital / Clinic	1
Education Facility	2
Fire Station	1
Emergency Shelters	1
Emergency Operations Center	1
Energy	1
Government and Military	2
Mail and Shipping	1
Water Supply and Treatment	2

Source: VCGI

Of these, only the Town’s Water and Wastewater Treatment Plant is located within a mapped Hazard Area. It is located just within the SFHA and fully within the River Corridor.

4.2 Infrastructure

4.2.1 Town Highways

The following is a statistical overview of roads in the Town of Richmond. These tables show the range of road types within the town, from Interstate 89 to unimproved unpaved roads. The different road types have different hazard vulnerabilities. Unpaved roads are more vulnerable to being washed out in a flood or heavy storm, while traffic incidents are more likely to occur on large, arterial roads.

Municipal highways, bridges and dams are well mapped in Chittenden County. The following three tables show the diversity of municipal highways and road surface in the Town of Richmond.

The Vermont Agency of Transportation divides municipal (town) highways into various classes as follows:

Class 1 town highways are subject to concurrent responsibility and jurisdiction between the municipality and VTrans. Class 1 town highways are state highways in which a municipality has assumed responsibility for most of the day to day maintenance (pot hole patching, crack filling, etc.). The state is still responsible for scheduled surface maintenance or resurfacing. In Chittenden County Class 1 highways are generally paved.

Class 2 town highways are primarily the responsibility of the municipality. The state is responsible for center line pavement markings if the municipality notifies VTrans of the need. The municipality designates highways as Class 2 with approval from VTrans. These are generally speaking the busier roads in a given town second to Class 1. In Chittenden County, most Class 2 highways are generally paved although in the more isolated areas these are gravel roads.

Class 3 town highways are the responsibility of and designated by the municipality. These are to be maintained to an acceptable standard and open to travel during all seasons. In Chittenden County, Class 3 roads are both paved or gravel.

Class 4 town highways are all other highways and the responsibility of the municipality. However, pursuant to Vermont State Statutes, municipalities are not responsible for maintenance of Class 4 town highways. These are generally closed during the winter and minimally maintained and almost exclusively dirt.

Table 4-5 Town highway mileage by class, Town of Richmond

Class 1	Class 2	Class 3	Class 4	State Hwy	Fed Hwy	Interstate	Total 1, 2, 3, State Hwy
	15.630	30.400	3.290	0.748	6.379	7.200	46.778

Source: derived from VTrans TransRDS GIS data – surface class and arc length, 2015

Table 4-6 Town highway mileage by surface type, Town of Richmond

Paved	Gravel	Soil or Graded	Unimproved	Impassable	Unknown	Total
39.948	20.678	1.78	0	2.81	0.83	66.046

Total Known	Total Unpaved	% Paved	% Unpaved
65.216	25.268	61.3%	38.7%

Source: derived from VTrans TransRDS GIS data – surface class and AOTmiles, 2015

See Figure 3.2 for locations of paved vs. gravel and/or soil roads.

4.2.2 Bridges, Culverts, and Dams

There are a variety of bridges, culverts and dams located in the municipality. As noted in Section 4 of the County Plan, a large portion of the County’s stream have had detailed Phase II Stream Geomorphic Assessments conducted. With regard to Richmond, studies identify specific stream reaches where fluvial erosion is a concern as well as where infrastructure, primarily culverts, as noted in the table below (and illustrated in Figure 2.1) is at risk.

Table 4-7 Culverts with geomorphic compatibility rating of “Mostly Incompatible” or “Incompatible”

Bankfull Width	Compatibility Score	Location	Road Name	Stream Name
52.17	7	Structure located farthest up Snipe Ireland Road	SNIPE IRELAND RD	Snipe Ireland Brook
37.50	8	Access to Marcelino Quarry.	Private Quarry Access	Governor Peck Rd. tributary
36.91	9	Under I-89 bridges on Stage Road	I-89	Trib to Winooski River
50.00	9	@ Taft corners sign on I-89	I-89	Trib to Winooski River
58.82	9	Crossing of railroad that parallels the Winooski River.	Railroad	Stage Road Tributary
58.82	9	Besaw Road and junction with Huntington Road	BESAW RD	Trib to Johnnie Brook
57.14	10	Junction of Hinesburg Road & Huntington Road	HINESBURG RD	Trib to Johnnie Brook
47.37	10	Just above Besaw road	HUNTINGTON RD	Trib to Johnnie Brook
<p>Mostly incompatible $5 < GC < 10$ % Bankfull Width + Approach Angle scores < 2</p>		<p>Structure mostly incompatible with current form and process, with a moderate to high risk of structure failure. Re-design and replacement planning should be initiated to improve geomorphic compatibility.</p>		
<p>Fully incompatible $0 < GC < 5$ % Bankfull Width + Approach Angle scores < 2 AND Sediment Continuity + Erosion and Armoring scores < 2</p>		<p>Structure fully incompatible with channel and high risk of failure. Re-design and replacement should be performed as soon as possible to improve geomorphic compatibility.</p>		

Information on dams is available from two sources: a database of dams regulated by the Vermont Department of Environmental Conservation and the National Dam Inventory maintain by the U.S. Army Corps of Engineers. Information from the DEC is as follows:

Table 4-8 Dams under the jurisdiction of VT Department of Environmental Conservation

DamName	StateID	Location (Town)	Hazard Class	Owner
Gillette Pond	166.01	Richmond	Low	Private

Dams under the jurisdiction of VT Department of Environmental Conservation (DEC) pursuant to 10 VSA Chapter 43 §1081 and subject to 10 VSA Chapter 43 §1082 Authorization (i.e. dams capable of impounding more than 500,000 cubic feet of water or other liquid.

This dam is constructed of stones and earthfill, and was originally built in 1900 for water storage.

The National Dam Inventory identifies one dam in the municipality:

Table 4-9 National Dam Inventory Data

Name	Owner	River	Description	Maximum Storage (acre/feet)	Hazard Potential
Richmond Pond	Prelco, Inc.	Snipe Island Brook	Material, original purpose and date of construction unrecorded	0	Low-losses limited to owner's property.

Source: National Dam Inventory

Last but not least there is one particular large beaver dam located adjacent to Hinesburg Road.

4.2.3 Water, Wastewater and Natural Gas Service Areas

The town operates a water system and wastewater system that serves the village area along Route 2 and surrounding streets. Residents and businesses outside of this service area receive water from wells and dispose of wastewater through septic systems. The private utility, Vermont Gas, does provide natural gas to homes and businesses in the village. (cf. Figure 1.4).

4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines

There are several VELCO high-tension power lines in the Town (cf. Figure 1.4). One parallels the rail lines, another runs due west along the hills north of the rail line, and a spur runs south in the western half of the Town into Hinesburg. Above ground telecommunication land lines run along the street grid.

4.3 Estimating Potential Losses in Designated Hazard Areas.

A simple GIS intersection of e-site data with the 2010 FIRM floodplain data indicates the following with regard to structures located in mapped flood hazard areas (cf. Figure 2-1):

- 117 residential structure and 15 commercial/industrial structures are located within the 100-year floodplain. Based on the 2014 median grand list values, the estimated potential loss due to a major flood event inundating the floodplain is \$28,188,588.

- These estimates only take structures into account. It does not account for personal property or business losses.

A simple GIS intersection of esite data with the 2016 River Corridor Protection Area data (*cf. Figure 2-1*) indicates the following with regard to structures vulnerable to Fluvial Erosion.

- There are 12 residential structures and 0 commercial/industrial structures located in the RCPA. Based on the 2014 median grant list values, the estimated potential loss due to an event in the river corridor is \$2,911,400.

At this time, a more detailed analysis of potential losses to structures, infrastructure, and agricultural lands cannot be made. Such an analysis would require individual site visits and analysis conducted by both river geomorphologists and structural engineers which is beyond the capacity of the CCRPC due to funding limitations.

4.4 Vulnerable Populations

Like most of the County’s rural communities, census data more detailed than the town boundaries is not available to see if there are concentrations of either elderly populations or low-income populations. In other words, the town’s boundaries form one single census tract. Demographic information on the relative percentages of vulnerable populations is as follows:

Table 4-10 Vulnerable populations, Richmond

	Richmond	Chittenden County	Vermont	National
Percent Minority (non-white) ¹		7.7%	4.8%	26.7%
Children <18 in poverty ¹		11.1%	14.8%	21.6%
Families w/children in poverty ¹		10.5%	13.4%	17.8%
Families w/ female householder, no husband present w/children in poverty ¹		37.0%	37.4%	40%
Population, age 65+ in poverty ¹		6.5%	7.5%	13.4%

¹US Census Bureau, 2010-2014 5-Year Estimates, American Community Survey

Given the coarseness of the available data, CCRPC is not able to determine specific locations with a concentration of vulnerable individuals within individual municipalities. However, a useful analysis known as a Social Vulnerability Analysis has been prepared by the Vermont Department of Health. Data for the Town is shown in *Figure 4.1*.

The Social Vulnerability Index (SVI) draws together 16 different measures of vulnerability in three different themes: socioeconomic, demographic, and housing/transportation. The 16 individual measures include poverty, unemployment, per capita income, educational attainment, health insurance, children/elderly, single parent households, disability, minority, limited English,

location of apartment buildings, mobile homes, crowding, no vehicle access, and population living in group quarters. The measures are combined to create relative vulnerability index. For every vulnerability measure, census tracts above the 90th percentile, or the most vulnerable 10%, are assigned a flag. The vulnerability index is created by counting the total number of flags in each census tract. It is important to remember that this Social Vulnerability Index is just a first step in screening for populations that may be more or less vulnerable to a variety of hazard. Depending on the situation, different measures could be more or less important and should be looked at more closely. These data are NOT saying that one census tract is more vulnerable than another. Rather it is saying that there is a higher concentration of various vulnerable populations living within a tract and seeks to identify the conditions that make a population vulnerable.

4.5 Land Use and Development Trends Related to Mitigation

As noted in the Introduction, Richmond’s land use is primary residential and agricultural. An analysis of GIS data shows the following percentages for land use and the percentages of land allocated to each zoning district.

Table 4-11 Structures compared to zoning, Town of Richmond

Richmond Structures	Percent		Richmond Zoning	Area (mi ²)	Percent
Residential	89.07%		Agricultural / Residential	30.13075	91.47%
Commercial	5.81%		Commercial	0.169229	0.51%
Industrial	0.51%		Gateway Commercial	0.122135	0.37%
Institutional / Infrastructure	0.97%		High Density Residential	1.917551	5.82%
Mass Assembly	1.02%		Industrial / Commercial	0.280488	0.85%
Leisure / Recreation	0.06%		Mobile Home Park	0.189833	0.58%
Natural Resources	0.23%		Residential / Commercial	0.057463	0.17%
Total:	97.67%		Village Commercial	0.072532	0.22%

Source: 2015 e911 Data and 2013 Town of Richmond Zoning Regulations, Note: The structure categories relate to the Land Based Classification System (LBCS) used in the 2011 AHMP not E-911 site types. E-911 site types were assigned to each LBCS category to create synergy between the 2011 AHMP and 2017 AHMP.

4.5.1 Conserved or Undevelopable Parcels

There are a handful of conserved parcels in Richmond. Most parcels have been conserved for their scenic, agricultural or natural resource values.

Table 4-12 Conserved Land, Town of Richmond

Total Acres	Acres of Public Land	Percent Public	Acres of Conserved Land	Percent Conserved	Total Public & Conserved	Percent Conserved Land
21,063.02	2,173.75	10%	699.96	3%	2,873.81	14%

Source: VLT Data and ANR Public Lands

In 2010, the Town of Richmond created a Conservation Reserve Fund for use in the conservation of natural, agricultural and historic resources. Money for the fund comes from property taxes at a rate of \$10 per \$100,000 of assessed value. The fund has funded eight projects since its creation.

Additionally, as noted below in Table 5.1, the Town's zoning bylaws include a Flood Hazard Overlay District which precludes the construction of new homes or businesses and effectively acts as conserved land.

4.5.2 Recent and Future Development

It is likely that the current development pattern will continue, driven by the Town's easy access to Interstate 89. Residential growth is anticipated in the High Density Residential district as well as in scattered locations throughout the Agricultural/Residential District that encompasses most of the town. At this time, the main way CCRPC has to predict future development is by analysis of municipal zoning bylaws. As the municipality participates in the NFIP, zoning bylaws heavily regulate development in designated flood hazard areas. Additionally, the Town also regulates development near other waterbodies and wetlands. As a result, little to no development is likely to take place in flood hazard areas or river corridor protection areas. These zoning requirements effectively mitigate damages from Flood and Fluvial Erosion hazards to future structures.

As shown in *Figure 4.2*, from 2011 through 2014, the municipality has seen 7 housing units (in single family and multi-family structures) and no new commercial/industrial buildings constructed. **None** of these units or structures were constructed in the Special Flood Hazard Area, but one was in the River Corridor Protection Area.

As best can be ascertained based upon data maintained by the Chittenden County RPC and the Town of Richmond, since the adoption of the last municipal AHMP in 2011, development activity in the Town has not significantly increased vulnerability. Additionally, through at least 2021, there is no known or projected development of new buildings or infrastructure anticipated to be constructed in areas known to be particularly vulnerable to Natural Hazards.

SECTION 5: MITIGATION STRATEGY

The Town considered a range of mitigation actions across the categories of Planning and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, and Education and Awareness Programs. As is demonstrated in the discussion that follows the Town carries out numerous efforts as part of its day-to-day operations that fit within these categories and address and serve to mitigate the impacts of various hazards. The section concludes within an analysis of which vulnerabilities need additional attention and therefore stipulates discrete tasks to be carried out by the Town during the 5-year period this Plan is in effect to address these vulnerabilities.

5.1 Existing 2012 Town of Richmond Town Plan Objectives and Implementation Tasks That Support Hazard Mitigation

These tasks are described in the 2012 Town of Richmond Town Plan. The following selected excerpts illustrate how mitigation planning and activities is formally promoted and supported through the Town Plan.

5.1.1 General Goals:

The Town recognizes that conservation, outdoor recreation and open space lands are increasingly important to the well being of Town residents. In order to facilitate preservation of these lands while respecting the property rights of their owners, the Planning Commission will explore creative development techniques which may include building envelopes, planned unit and planned residential development, clustering, fixed area and sliding scale zoning, overlay districts, conservation subdivision design, and transfer of development rights. This process will include extensive public outreach as well as input from landowners in town.

5.1.2 Economic Development

Establish land use regulations that accommodate commercial and industrial growth; promote multiple uses in the village; and preserve residential areas, farms and natural areas. Promote appropriate regulations, as needed, to protect and improve the quality of Richmond's surface and ground waters.

5.1.3 Natural Resources

Encourage the conservation of land for protecting water quality, wildlife, natural resource functions, and for forestry, farming, recreation and educational opportunities. The Planning Commission will design zoning and subdivision regulations in accordance with state and federal laws to protect croplands, floodplains, water resources, scenic sites, wildlife habitat and to promote compact development patterns that promote the efficient use of land and the protection of important natural resources and open space. These revisions may include modification of district uses and lot dimensional requirements, expanding the use of Planned Unit Developments, offering of density bonuses in exchange for resource conservation, and the creation of provisions for the Transfer of Development Rights. The process of reviewing and modifying these regulations will include extensive public input.

5.1.4 Transportation

Make dangerous roads and intersections safer while retaining the rural and unique character of the community.

Utilities and Facilities

Provide and maintain adequate sewer and water services at reasonable rates for Richmond's village.

The Town Administrator will maintain up-to-date emergency response plans. The Town will cooperate with the school district to ensure that the elementary and middle schools are properly equipped to serve as emergency shelters for the Town.

5.2 Existing Town of Richmond Actions That Support Hazard Mitigation

The following table illustrates how mitigation activities and plans are carried out by various municipal departments, and whether such capabilities are adequate to address hazard vulnerabilities and whether the department, if needed, has the ability to improve policies and programs and programs to unmitigated vulnerabilities.

Table 5-1 Existing municipal capabilities addressing hazard mitigation, Town of Richmond

Types of Programs & Policies	Description / Details	1) Adequacy of municipal capabilities to address hazards 2) and ability to expand upon or improve policies & programs
Highway Services	Town Highway Department	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Public Works Department, through the strategies noted below is taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.
Highway personnel	5 FTE field personnel	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Public Works Department, through the strategies noted below is taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.
Water / Sewer Department	Public Works Department	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Public Works Department, through the strategies noted below is taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.
Water / Sewer Personnel	3.5 FTE water / sewer personnel.	1) Generally adequate with regards to mitigating the impacts of common hazards.. 2) No need to expand upon or improve policies & programs with regard to hazards under its purview.
Planning and Zoning personnel	1 FTE Town Planner; part-time zoning administrator	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) No need to expand upon or improve policies & programs with regard to hazards under its purview.
Residential Building Code / Inspection	No local building code.	1) Generally adequate with regards to mitigating the impacts of common hazards.. New construction must obtain a zoning permit. 2) No need to expand upon or improve policies & programs with regard to hazards under its purview.

		3) Note that commercial properties open to the public and all multi-family buildings of 3 units or more must be inspected and permitted by the Vermont Division of Fire Safety.
Town / Municipal Comprehensive Plan	2012	1) As noted at the start of Section 5, several elements of the municipal Comprehensive Plan promote Hazard Mitigation. 2) The Town is currently updating its Plan and will be referencing this 2017 AHMP accordingly.
Zoning Bylaws and Subdivision Regulations	2015	1) Generally adequate with regards to mitigating the impacts of common hazards.. 2) No need, at this time, to expand upon or improve policies & programs with regard to hazards under its purview.
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	Flood Hazard Overlay; Non-Developable Portions	1) Generally adequate with regards to mitigating the impacts of common hazards.. 2) No need, at this time, to expand upon current flood hazard bylaws. 3) Over the next five years, Town may consider adoption of River Corridor or River Corridor Protection Area zoning regulations.
Participation in National Flood Insurance Program (NFIP) and Floodplain/ Flood Hazard Area Ordinance	Yes / Yes	1) New DFIRMS adopted in 2014. The Town Zoning Administrator and the Town's Development Review Board (DRB) monitor compliance with the National Flood Insurance Program. The DRB reviews and adjudicates applications for development within the floodplain. 2) No need, at this time, to expand upon NFIP participation
Open Space Plans; Conservation Funds	Conservation Reserve Fund (1 cent on tax rate).	1) Yes 2) Municipality considers regulatory programs and voluntary conservation efforts as adequate to address any hazard mitigation concerns. However, various areas may be conserved in the future by the use of the Fund but as of now, specific parcels conducive to hazard mitigation have not yet been targeted.

The following table illustrates how Emergency Preparedness, Response & Recovery actions are carried out in the Town.

Table 5-2 Existing municipal emergency services & plans, Town of Richmond

Type of Existing Protection	Description /Details/Comments
Emergency Services	Emergency response personnel may have overlapping responsibilities with other town response organizations.
Police Services	Town of Richmond
Police Department Personnel	5 Paid FTE Officers, 4 Part-time Officers, 1 Paid FTE Admin
Fire Services	Richmond Volunteer Fire Department

Fire Department Personnel	-0- FTE, ~18 volunteers
Fire Department Mutual Aid Agreements	FD participates in the Chittenden County Mutual Aid compact
EMS Services	Richmond Rescue
EMS Personnel	3 paid FTE personnel, ~38 volunteers
EMS Mutual Aid Agreements	No formal agreements, however, regularly responds in Hinesburg, Jericho (north), Underhill, Williston and Waterbury. Occasionally responds to Duxbury and Starksboro.
Emergency Plans	
Local Emergency Operations Plan (LEOP)	2016
Primary Shelter	Camels' Hump Middle School
Replacement Power, backup generator	No
Secondary Shelter	Richmond Elementary School. Brewster Pierce School in Huntington is also a designated secondary shelter, to meet the needs of residents south of the Winooski River.
Replacement Power, backup generator	No

5.3 Town of Richmond All-Hazards Mitigation Goals

The following goals were first approved by the Town in its 2005 and 2011 AHMPs and approved by Town of Richmond officials during the development of this 2017 annex.

- 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 and as identified generally in the *Chittenden County Multi-Jurisdictional 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 stormwater management and the planning and development of various land uses.
- 5) Maintain existing municipal plans, programs, regulations, bylaws and ordinances that directly or indirectly support hazard mitigation.
- 6) Consider formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5), as well as incorporation of proposed new mitigation actions into the municipality's/town's bylaws, regulations and

ordinances, including, but not limited to, zoning bylaws and subdivision regulations and building codes.

- 7) Consider formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans & programs especially, but not limited to, as they relate to public facilities and infrastructure, utilities, highways and emergency services.

With regard to a more formal process by which the Town will integrate the requirements of this mitigation plan into the Town’s Comprehensive Plan, as required by Vermont law, municipalities must update their Comprehensive Plans every eight years. During any update process undertaken while this Plan document is in effect, the Town will review the recommended Actions detailed below to see if formal incorporation within the Comprehensive Plan (or any Plan implementation tasks) is warranted. Note that the Town is currently updating its Comprehensive plan.

Additionally, as the CCRPC is tasked with also reviewing and approving each such municipal comprehensive plan for consistency with various requirements in state statute and consistency with the Chittenden County Regional Plan (aka the ECOS 2013 Plan). This review includes a detailed staff critique with recommendations for improvement. This CCRPC review provides another opportunity to formally integrate elements of this local AHMP into the Town’s Comprehensive Plan.

With regard to a more formal process by which the Town will integrate the requirements of this mitigation plan while developing the Town’s annual capital improvement plans/budgets, for periods , the Town will review the recommended Actions detailed below to see if formal incorporation within these annual capital plans is warranted prior to annual review and voting by Town residents. Additionally, CCRPC staff can assist the town with drafting grant applications to fund mitigation projects.

5.4 Mitigation Actions

The following table below records the strategies from the 2011 Plan and progress on their implementation. This table also encapsulates the Town’s decision making with regards to which Actions to continue, which to establish as new actions and which to discontinue. During the development of this Municipal AHMP and its parent Multi-Jurisdictional AHMP, FEMA staff indicated to the CCRPC a need to separate out or remove strategies which are more properly considered to be Preparedness, Response or Recovery strategies rather than Mitigation. Additionally, upon revisiting and reviewing the 2011 actions and devising action for this 2017 local AHMP CCRPC and municipal staff thought it would be best to focus on known and likely actions with a high likelihood of implementation versus consideration of more expansive but largely aspirational strategies.

Table 5-3 Progress on the actions of the 2011 Richmond All-Hazards Mitigation Plan

Action	Task	Brief Description	Progress since 2011 and recommendations for 2017 Plan
Primary			

Responsible Entity			
#1 Complete fluvial geomorphology assessment and develop strategies in response to identified risk			
TBD, determined by funding.	River Corridor Management Plans	Where Phase I and II assessments are complete, develop a River Corridor Management Plan.	<p>Phase I assessments have been completed for Snipe Island Brook, Owls Head Brook, and the Jericho Road/Southview Drive tributary of the Winooski. Phase II assessments have been completed for all of the Johnnie Brook and Huntington River, parts of the Governor Peck Road tributary of the Winooski and parts of the Stage Road tributary of the Winooski.</p> <p>-A corridor management plan for the Huntington River has been developed.</p> <p>-No assessments have been completed of the main branch of the Winooski.</p> <p>For new Plan: The CCRPC will partner with the Town and with DEC to seek funds to complete a geomorphic assessment for the main branch of the Winooski through Richmond and develop a river corridor plan. This will be expensive but highly desired.</p>
Town Manager, Town Planner	Fluvial Erosion Hazard Mitigation Implementation	Implement strategies from above referenced Corridor Management Plan to mitigate losses from identified fluvial erosion hazards.	DELETING THIS SECTION AS BY THE TIME FUNDS IF/ARE OBTAINED, PLAN DEVELOPED AND PROJECTS SCOPED, 5 YEAR PERIOD OF AHMP PLAN WOULD BE OVER.
Town Manager, Town Planner	Flood Insurance Rating Map Updates	Review draft FIRM data. Develop strategies to mitigate losses from identified flood hazards.	<p>New flood regulation maps, based on FEMA's FIRMs, went into effect August 2014. Richmond has reviewed the FIRM maps with an engineer to verify their accuracy and successfully sought some changes. In 2014, the Town received FEMA buyout funds to purchase and demolish a flooded home on Cochran Road.</p> <p>2015 Richmond Zoning Regulations include a Shoreline Overlay District as well as a Flood Hazard Overlay District.</p> <p>RENAME TASK FOR 2017 PLAN AS FLOOD HAZARD MITIGATION IMPLEMENTATION and note planned projects such as buyouts of vulnerable homes.</p>
#2 Evaluate capabilities of existing road and stormwater management infrastructure			
Road Foreman	Infrastructure Assessment for Stormwater Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts and stormwater infrastructure.	<p>CCRPC completed an inventory for the town in 2015, which will be used to identify culverts for replacement.. Culvert #TH010003 on Huntington Road in Farris Corner was replaced and upsized based on the results of a hydrologic study.</p> <p><u>ASSESSMENT IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN</u></p>
Road Foreman	Infrastructure Assessment for Fluvial Erosion/Landslide Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts, bridges and other infrastructure to fluvial erosion.	<p>All bridges in Richmond are addressed by the state bridge inspection reports. Culvert assessment by the road crew is ongoing.</p> <p><u>ASSESSMENT IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN</u></p>

Road Foreman	Culvert Upgrades	Upgrade culverts and ditching along roads to mitigate against repeated damages from stormwater or spring snowmelt.	Culvert replacement is completed proactively when roads are repaired or replaced. Stone lining of ditches or other stormwater upgrades are also completed during road repairs. The road crew is adding headwalls to all culverts. CONTINUE FOR 2017 PLAN
Road Foreman	Continued Monitoring of Vulnerable Infrastructure	Monitor bridges and culverts with erosion and scouring concerns.	Monitoring is ongoing. <u>MONITORING IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN</u>
Road Foreman	Road Improvement	Consider paving certain road sections to lower overall maintenance costs, improve snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes.	New private roads must be paved for the town to accept them as public roads. CONTINUE FOR 2017 PLAN
Road Foreman	Erosion/Landslide Mitigation	Undertake erosion or landslide mitigation projects where roads regularly incur damage from adjacent rivers/streams and hillsides.	June 2015 storm damage on Wes White Hill Road and Dugway Hill Road has created an opportunity for the town to rebuild the nearby banks and slopes for 75' of each road. Approximately 2 miles of gravel roads are rebuilt each year to ensure good quality of the base and top layers. RENAME AS DRAINAGE IMPROVEMENTS FOR 2017 PLAN the Town anticipates rebuilding approximately 2 miles of gravel roads each year to ensure good quality of the base and top layers which will improve drainage and reduce the likelihood of damage in hazard events. Likely roads to be improved are Dugway and Kenyon.

5.4.1 Current Capabilities and Need for Mitigation Actions

The Town Comprehensive Plan's policies and programs that support hazard mitigation and the progress noted above demonstrate the variety of policies and actions forming the foundation of this All Hazards Mitigation Plan. As detailed in the Table below, generally, the Town considers its existing capabilities, regulatory structure and programs as adequate to address its vulnerabilities however continuation of existing mitigation actions or the implementation of new actions are warranted for the 5-year period this Plan is effect.

Table 5-4 Town of Richmond: Capabilities to address vulnerabilities from natural hazards

Hazard	Adequacy of Municipal Capabilities to address associated vulnerabilities (Excellent, Good, Average, Below	Additional expansion or improvement in policies & programs needed to address hazard given long-term vulnerability
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	Average)	
Severe Winter Storm	Excellent	No
Flooding	Excellent	Yes, see actions below.
Fluvial Erosion	Good	Yes, see actions below
Severe Rainstorm	Good	Yes, see actions below.
Extreme Temperatures	Good	No, rare occurrence and extent, impact & vulnerabilities are limited.
Wildfire	Excellent	No, rare occurrence and extent, impact & vulnerabilities are limited.

Table 5-5 Town of Richmond: Capabilities to address vulnerabilities from technological hazards

Hazard	Adequacy of Municipal Capabilities to address vulnerabilities (Excellent, Average, Below Average)	Additional expansion or improvement needed to address hazard given long-term vulnerability
Major Transportation Incident	Good + State agencies provide support	No, rare occurrence and extent, impact & vulnerabilities are limited.
Power Loss	Average. Private utilities are primarily responsible	No given that events are limited in duration and vulnerabilities are short-lived.
Hazardous Materials Incident	Good + State agencies provide support	No, rare occurrence and extent, impact & vulnerabilities are limited.
Water Service Loss	Excellent.	No, rare occurrence and extent, impact & vulnerabilities are limited.
Gas Service Loss	Average. Private utility is primarily responsible.	No, rare occurrence and extent, impact & vulnerabilities are limited.
Telecommunications Failure	Private utilities are primarily responsible	No, rare occurrence and extent, impact & vulnerabilities are limited.
Other Fuel Service Loss	Private businesses are primarily responsible	No, rare occurrence and extent, impact & vulnerabilities are limited.
Sewer Service Loss	Excellent.	No, rare occurrence and extent, impact & vulnerabilities are limited.
Water Pollution	Good	Yes, see actions below
Invasive Species	Average	No, rare occurrence and extent, impact & vulnerabilities are limited.

Table 5-6 Town of Richmond: Capabilities to address vulnerabilities from societal hazards

Hazard	Adequacy of Municipal Capabilities to address vulnerabilities (Excellent, Average, Below Average)	Additional expansion or improvement in policies & programs needed to address hazard given long-term vulnerability
Crime	Good +State agencies provide support.	No. Municipality participates in programs lead by regional and state entities.
Economic Recession	Good +State Agencies provide support	No Diversity of county economy mitigates vulnerabilities. The Town considers its municipal plan as also supportive of the goal of economic diversification.
Terrorism	Good +State & Federal agencies provide support	No, rare occurrence.
Civil Disturbance	Good + State agencies provide support.	No, rare occurrence
Epidemic	Average +State & Federal agencies provide support	No, rare occurrence. The Town’s abilities to mitigate an epidemic are limited The Town relies on state and school efforts related to epidemic preparedness, prevention and mitigation, and medical facilities and services in neighboring communities for response.
Key Employer Loss	Good +State agencies provide support	No. Diversity of employers in municipality mitigates vulnerabilities.

Note that this Plan does not recommend a discrete mitigation action regarding “future development.” Our justification for this is as follows:

- The municipality’s regulations, programming and staffing have prevented and will prevent new buildings and infrastructure being constructed in areas vulnerable to hazards. As documented in detail in section 4.6.2, despite active residential and commercial development, no structures and infrastructure subject to municipal regulation, have been constructed in either the Special Flood Hazard Areas or mapped River Corridor Protection Areas.
- For the next five years, there are NO known or anticipated plans for the construction of municipal infrastructure in areas vulnerable to hazards.
- There is no evidence that unwise or poorly regulated development in the municipality has been a significant contributor to putting people or property in harm’s way.

Therefore, the reader will note that the proposed Mitigation Actions for the next five years represent a much more focused and achievable list of actions focused on those hazards (e.g. Severe Rainstorm, Flooding, Fluvial Erosion, Water Pollution, etc.) that cause more frequent if less dramatic damages. It is these more mundane damages of erosion along road beds, damaged small culverts and the ongoing struggle to maintain and improve water quality (which cost the municipality and its taxpayers both time and money) that deserve the most attention rather than hazards that could hypothetically cause damage but which are rare and wherein the benefit-to-cost ratio for potential mitigation actions is weak (e.g. Major Transportation Incident, Hazardous Material Incident, Terrorism). No new discrete action is recommended with regards to Education & Awareness as the Town does not have adequate funds or staff to undertake such an effort nor is such an effort warranted given the identified vulnerabilities. **Lastly, it is also worthwhile to note that in comparison to the 2011 Plan the priorities for this 2017 Plan have not changed. The hazards and vulnerabilities remain the same as well. Indeed, the only real change is that there is a more heightened awareness due to the severity of recent disasters starting in 2011 to the present.**

5.4.2 Specific Mitigation Actions

The Town plans to conduct the following mitigation actions during the 5 year period this Plan is in effect.

CATEGORY A: Complete fluvial geomorphology assessment and address identified vulnerable infrastructure

Hazards Addressed: Severe Rainstorm, Flooding, Fluvial Erosion and Water Pollution

Vulnerabilities Addressed: Damage to new/existing public infrastructure and buildings; temporary closures of roads and bridges including from debris; temporary loss of power and/or telecommunications and temporary isolation of vulnerable individuals such as the elderly or those in poverty.

Status: Ongoing

Primary Responsible Entity: Town of Richmond Highway Foreman

Timeframe: Month 2017 through Month 2022 (update after FEMA approval date)

Funding Requirements and Sources: FEMA or other hazard mitigation grants; FHWA grants; VTrans grants; Municipal Operating and Capital budgets only if sufficient. Contingent on available resources and funding.

Rationale/Cost-Benefit Review: First, the Winooski River has the demonstrated potential to cause significant damages to private homes and businesses and public infrastructure. A detailed Fluvial Erosion Hazard assessment and development of a River Corridor Plan of its course through the Town of Richmond will enable the Town and the State of Vermont to understand which types of projects can be implemented to best mitigate its impacts. Secondly, the elevation of homes in the Winooski River's SFHA will definitely mitigate damages from any future floods. The Town is already in the process of conducting one such project and plans to do more.

Specific Identified Actions:

Action A-1: Complete Geomorphic assessment and corridor management plan for the Winooski River

The CCRPC will partner with the Town and with the Vermont DEC to seek funds to complete a geomorphic assessment for the main branch of the Winooski through Richmond and develop a river corridor plan. This will be expensive but highly desired. Completion of the assessment and the plan will identify areas vulnerable to flooding and fluvial erosion and provide an initial list of potential projects to address the vulnerabilities from these hazards such as floodplain access improvement and wetland restoration to attenuate the river's flow, streambank plantings, conservation easements, etc.

Action A-2: Flood Hazard Mitigation Project Implementation

One of the most effective means to directly mitigate impacts to homes from flood waters is to move them out of harm's way. In 2014, the Town received FEMA buyout funds to purchase and demolish a flooded home on Cochran Road. The Town will continue to pursue HMPG funds from FEMA and/or other sources to elevate at least 10 homes along the Winooski River above the Base Flood Elevation.

CATEGORY B: Improve capabilities of existing road and stormwater management infrastructure

Hazards Addressed: Severe Rainstorm, Flooding, Fluvial Erosion and Water Pollution

Vulnerabilities Addressed: Damage to new/existing public infrastructure and buildings; temporary closures of roads and bridges including from debris; temporary loss of power and/or telecommunications and temporary isolation of vulnerable individuals such as the elderly or those in poverty.

Status: Ongoing

Lead Responsible Entities: Town of Richmond Highway Foreman; Richmond Town Planner

Potential Partner Entities: VT ANR; Vermont Agency of Transportation (VTrans); CCRPC

Timeframe: Month 2017 through Month 2022 (update after FEMA approval date)

Funding Requirements and Sources: Various Federal and State grants; municipal operating funds only if sufficient. Contingent on available resources and funding.

Rationale/Cost-Benefit Review: These areas suffer low-level but consistent damage during heavy rains and snowmelt. Mitigating these problems would reduce short and long term maintenance costs and improve the flow of traffic for personal and commercial purposes during damage events.

Specific Identified Actions:

Action B-1: Culvert Upgrades

Upgrade culverts and ditching along roads to mitigate repeated damages from stormwater or spring snowmelt. Future projects will include:

- Culvert replacement completed proactively when roads are repaired or replaced.
- Stone lining of ditches or other stormwater upgrades are also completed during road repairs.
- Headwalls are added to culverts as needed.

Other potential locations include:

- The bridge near Dowd Farm will need replacement due to a shifting box culvert.
- Vulnerable culverts and bridges noted in Section 4 above.

Action B-2: Drainage Improvement

For 2017-2021, the Town anticipates rebuilding approximately 2 miles of gravel roads each year to ensure good quality of the base and top layers which will improve drainage and reduce the likelihood of damage in hazard events.

- Likely roads to be improved are Dugway Road and Kenyon Road.

Action B-3: Road Improvement

Within political and financial restraints, consider re-engineering certain sections of roads to lower overall maintenance costs and improve overall capability of roads to handle current and projected traffic volumes. Research costs and options and consider paving certain road sections to lower overall maintenance costs, improve snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Several roads in town would be candidates for paving as they are gravel roads connecting two paved roads.

- Potential target roads are Cemetery Road and Hillview Road

CATEGORY C: Implement Roads Stormwater Management Plan

Hazards Addressed: Water Pollution, Fluvial Erosion, Severe Rainstorm,

Vulnerabilities Addressed: damage to public infrastructure especially roads and culverts; impairment of local waterways and Lake Champlain, budgetary impacts

Status: Ongoing

Lead Responsible Entities: Town of Richmond Highway Foreman

Potential Partner Entities: VT ANR; Vermont Agency of Transportation (VTrans); CCRPC

Timeframe: Month 2017 through Month 2022 (update after FEMA approval date)

Funding Requirements and Sources: Various Federal and State grants especially VAOT Better Roads Grants and VANR Ecosystem Restoration Grants; municipal operating and capital budget funds if necessary.

Rationale / Cost-Benefit Review: The Vermont Clean Water Act, signed into law in the summer of 2015, authorized the development of a new Municipal Roads General Permit (MRGP) to lessen erosion from roads that have “hydrologically-connected” segments. This action is required by the Act. Additionally, the plans and their implementation will assist municipalities in mitigating erosion of connected infrastructure.

Specific Identified Actions:

Action C-1 Develop Roads Stormwater Management Plan

The Town will first complete an Inventory of Priority Road Segments (PRS)[aka “hydrologically-connected” road segments] both currently meeting and not meeting MRGP standards. The CCRPC has already conducted an inventory of Richmond’s in the summer of 2016 and has hired a consultant to begin to develop cost estimates for various erosion-reduction projects. The Town will then apply for MRGP coverage starting in July 2018. After issuance of the permit by the State, the Town will then work to use this information to develop a formal

Roads Stormwater Management Plan for submission to the VT-DEC in 2019. The Plan will include a remediation plan (capital budget) and implementation schedule for each site not currently meeting standards.

Action C-2 Begin Roads Stormwater Management Plan implementation

Obtain funding for and complete projects as identified in the Roads Stormwater Management Plan. Submit annual reports to DEC, documenting progress in remediation efforts towards meeting schedule to be in compliance with the MRGP. Reports will briefly describe which segments have been improved, practices installed, and whether segments now meet MRGP standards. The MRGP standards must be implemented on all priority road segments as soon as possible, but no later than 20 years from permit issuance.

5.4.3 Prioritization of Mitigation Strategies

The above mitigation actions were listed in order of priority. Descriptions of specific projects, where available, are listed in below. Because of the difficulties in quantifying benefits and costs, it was necessary to utilize a simple “Action Evaluation and Prioritization Matrix” in order to effect a simple prioritization of the mitigation actions identified by the jurisdiction. 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?

The ranking of these criteria is largely based on best available information and best judgment, as many projects are not fully scoped out at this time. The highest possible score is 45.

It is anticipated that, as municipalities begin 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, all proposed FEMA mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

Based on feedback from FEMA, CCRPC Staff have concluded that several strategies previously identified in 2011 by the Town of Richmond as mitigation strategies are more accurately classified as preparedness, response and recovery strategies. These strategies are not intended to mitigate against the hazards identified in Section 3, and should not be evaluated as such. As such, these strategies are not included in the prioritization below. However, they are discussed at the end of the plan to serve as a record of the strategies being undertaken by the Town in order to prepare for, respond to and recover from damage caused by those hazards.

Other than the reclassification of some strategies as non-mitigation strategies, there have not been significant changes in the prioritization of strategies between 2011 and now, with one notable exception. Strategies related to landslide assessment have been removed from the plan. CCRPC and municipal staff, in consultation with FEMA, have concluded that landslides are not a discrete threat in Chittenden County and are adequately captured in the plan’s discussion of fluvial erosion. Additionally, further work on the development of a Vermont-specific landslide risk estimation protocol has not progressed making landslide-specific strategies inappropriate at this time for inclusion in the County plan and its annexes.

Note that these priorities are within categories as this is more appropriate rather than ranking project that address different hazards.

Table 5-7 Town of Richmond mitigation action evaluation and prioritization matrix

Mitigation Category & Actions	Responds to significant (likely or high risk) hazard	Likelihood of funding	Protect threatened infrastructure	Implemented quickly	Socially / Politically acceptable	Technically Feasible	Administratively Realistic	Reasonable cost to benefit	Environmentally sound	TOTAL SCORE
CATEGORY A: Complete fluvial geomorphology assessment and address identified vulnerable infrastructure										
Action A-1: Complete Geomorphic assessment and corridor management plan for the Winooski River	5	5	5	5	4	5	5	5	5	44
Action A-2: Flood Hazard Mitigation Project Implementation	4	5	5	4	4	5	5	5	5	42
CATEGORY B: Improve capabilities of existing road and stormwater management infrastructure										
Action B-1: Culvert Upgrades	4	4	5	4	5	5	5	4	5	41
Action B-2: Drainage Improvement	4	4	4	4	5	5	5	4	5	40
Action B-3: Road Improvement	3	4	4	4	4	5	5	4	5	38
CATEGORY C: Implement Roads Stormwater Management Plan										
Action C-1: Develop Roads Stormwater Management Plan	5	3	5	3	4	4	4	3	5	36
Action C-2: Begin Roads Stormwater Management Plan implementation	5	3	5	3	4	4	3	3	5	35

5 = Excellent; 4=Good; 3=Average; 2=Below Average or Unknown; 1=Poor

5.5 Implementation and Monitoring of Mitigation Strategies

The following Table is intended to aid municipal officials in implementing their mitigation actions and to facilitate the annual monitoring & evaluation of the plan as outlined in Section 1.7.4 above.

Table 5-8 Town of Richmond Mitigation Actions: Implementation Monitoring Worksheet

<p>CATEGORY A: Complete fluvial geomorphology assessment and address identified vulnerable infrastructure to mitigate Severe Rainstorm, Flooding, Fluvial Erosion and Water Pollution and their associated vulnerabilities of:</p> <ul style="list-style-type: none"> • Damage to new/existing public infrastructure and buildings • Temporary road and bridge closure • Budgetary impacts • Temporary loss of power and/or telecommunications • Temporary isolation of vulnerable individuals 	
<p>Action (Primary Responsible Entity)</p>	<p>Report on Progress since Plan adoption <i>See Section 5.4 for details on locations identified during Plan development.</i></p>
<p><u>Action A-1: Complete Geomorphic assessment and corridor management plan for the Winooski River</u> (CCRPC, Town & VT-DEC)</p>	<p>-note any grants or funding source investigated -note any grants applied for/obtained -note progress on geomorphic assessment and/or river corridor plan if underway</p>
<p><u>Action A-2: Flood Hazard Mitigation Project Implementation</u> (Town Manager & Town Planner)</p>	<p>-note progress on home elevation projects.</p>

CATEGORY B: Improve capabilities of existing road and stormwater management infrastructure to mitigate Severe Rainstorm, Flooding, Fluvial Erosion and Water Pollution and their associated vulnerabilities of:

- Damage to new/existing public infrastructure and buildings
- Temporary road and bridge closure
- Budgetary impacts
- Temporary loss of power and/or telecommunications
- Temporary isolation of vulnerable individuals

Action (Primary Responsible Entity)	Report on Progress since Plan adoption <i>See Section 5.4 for details on locations identified during Plan development.</i>
Action B-1: Culvert Upgrades (Town Road Foreman)	-note annual # of culvert upgrades & on which roads
Action B-2: Drainage Improvements (Town Road Foreman)	-note year and road location of drainage improvements such as ditching, rock lining, etc.
Action B-3: Road Improvement (Town Road Foreman)	-note any options scoped/costed out -note any sections of roads paved

CATEGORY C: Implement Roads Stormwater Management Plan to mitigate Severe Rainstorm, Fluvial Erosion and Water Pollution and their associated vulnerabilities of:

- Damage to new/existing public infrastructure
- Impairment of local waterways and Lake Champlain
- Budgetary impacts

Action (Primary Responsible Entity)	Report on Progress since Plan adoption <i>See Section 5.4 for details on locations identified during Plan development.</i>
Action C-1 Develop Roads Stormwater Management Plan (Town Road Foreman)	-MRGP obtained from State? -note projects developed and scoped with costs -Roads Stormwater Management Plan filed with State
Action C-2 Begin Roads Stormwater Management Plan implementation (Town Road Foreman)	-note which RSMP projects underway/completed -note annual MRGP reports filed with State

5.6 Implementation of Preparedness, Response and Recovery Strategies

Based on feedback from FEMA, CCRPC Staff have concluded that several strategies previously identified in 2011 by the Town of Richmond as mitigation strategies are more accurately classified as preparedness, response and recovery strategies. These strategies are not intended to mitigate against the hazards identified in Section 3, and should not be evaluated as such. Rather, they are included here to serve as a record of the strategies being undertaken by the Town in order to prepare for, respond to and recover from damage caused by those hazards. The first table records the strategies from the 2011 Plan and progress that has been made towards them. The second table outlines the strategies that have been developed for implementation from 2017 through 2021.

Table 5-9 Town of Richmond: Progress on Preparedness, Response and Recovery Strategies since 2011

Action Primary Responsible Entity	Task	Brief Description	Progress
#4 Evaluate capabilities of existing and potential public shelters.			
Emergency Management Director	Confirm Existing Shelter Capability	Confirm capabilities of existing shelters, maintain same and improve upon if needed.	Camel's Hump Middle School still serves as the emergency shelter for the town. The school does not have a generator, but does have the wiring and hookups to accommodate one. Though the fire department can provide some generators, they do not have any of the capacity to power the whole school.
Emergency Management Director	Investigate Alternate Shelters	Investigate capabilities of other buildings sufficient to serve as smaller shelters.	There is the possibility for the Richmond Congregational Church to serve as a shelter, but there is no formal agreement with them currently.
#5 Mitigate against future damage to buildings and equipment from lightning strikes.			
Emergency Management Director	Vulnerable Infrastructure Inventory	Scope out cost to hire a consultant to conduct an inventory of buildings and infrastructure vulnerable to lightning strikes.	No progress.
Emergency Management Director, Town Manager	Vulnerable Infrastructure Protection	Within budget constraints, implement measures recommended by consultants.	No progress.
#6 Ensure town and school emergency plans are fully coordinated			
Emergency	Maintain	Maintain good	The school principals and the district

Management Director, School Principals, Fire Chief	Communications	communications between school and town officials regarding plans and safety issues	superintendent meet regular with the police and fire chiefs.
Emergency Management Director, School Principals, Fire Chief	Monitor Exercises	When evacuation drills and other exercises are carried out, monitor coordination between school and town officials.	There is a good relationship between the schools, the police department and the fire department. The departments assist with evacuation drills.
#7 Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident			
Emergency Management Director, Fire Chief, Police Chief	Evacuation and Sheltering Exercises	Conduct evacuation drills or exercises and evaluate performance.	Regular school-based drills are conducted and evaluated. No town-wide drills have been conducted.
Emergency Management Director, Fire Chief, Police Chief	Evacuation and Sheltering Plans	Review evacuation, sheltering, and relocation plans based on results of drills, exercises, and actual incidents.	Some progress has been made. For example, the town rarely opens CHMS as a shelter during disasters now because so few people use it. People are more likely to stay with relatives.
#8 Raise public awareness of hazards, hazard mitigation and disaster preparedness			
Town Manager; Fire Chief, Police Chief	School Programs	Continue school programs to raise student awareness of hazards, safety, preparedness and prevention.	The fire department conducts regular programs to teach children about fire safety.
Town Manager; Fire Chief; Police Chief	Family Programs	Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.	Richmond Rescue offers car seat safety checks and CPR and first aid training.
Town Manager; Fire Chief; Police Chief	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.	Ongoing. The fire department works to educate the public about fire hazards.

Town Manager; Fire Chief; Police Chief	Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate.	Richmond has developed a document “to provide the Planning & Zoning Office guidance in the administration of the Richmond Flood Hazard Overlay District Regulations appropriately, consistently, and fairly and to outline the necessary steps to ensure property owners are adequately informed about permit requirements directly following flood to ensure compliance with the NFIP.
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Table 5-10 Town of Richmond: Preparedness, Response and Recovery Strategies: 2017-2021

(Primary Responsible Entity)	Task	Brief Description
Category #1: Evaluate capabilities of existing and potential public shelters.		
Emergency Management Director	Confirm Existing Shelter Capability	Confirm capabilities of existing shelters, maintain same and improve upon if needed.
Emergency Management Director	Obtain generators for shelters	Generators should be obtained for the primary shelter and for the Town Offices
Emergency Management Director	Investigate Alternate Shelters	Investigate capabilities of other buildings sufficient to serve as smaller shelters. There is the possibility for the Richmond Congregational Church to serve as a shelter, but there is no formal agreement with them currently.
Emergency Management Director	Investigate Red Cross designation for shelters	Investigate whether the town should undergo the necessary training to gain Red Cross designation for the primary shelter
Category #2: Mitigate against future damage to buildings and equipment from lightning strikes.		
Emergency Management Director	Vulnerable Infrastructure Inventory	Scope out cost to hire a consultant to conduct an inventory of buildings and infrastructure vulnerable to lightning strikes.
Emergency Management Director, Town Manager	Vulnerable Infrastructure Protection	Within budget constraints, implement measures recommended by consultants.
Category #3 Ensure town and school emergency plans are fully coordinated		
Emergency Management Director, School Principals, Fire Chief	Maintain Communications	Maintain good communications between school and town officials regarding plans and safety issues
Emergency Management Director, School Principals, Fire Chief	Monitor Exercises	When evacuation drills and other exercises are carried out, monitor coordination between school and town officials.

#4 Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident		
#5 Raise public awareness of hazards, hazard mitigation and disaster preparedness		
Emergency Management Director, Fire Chief, Police Chief	Evacuation and Sheltering Exercises	Conduct evacuation drills or exercises and evaluate performance.
Emergency Management Director, Fire Chief, Police Chief	Evacuation and Sheltering Plans	Review evacuation, sheltering, and relocation plans based on results of drills, exercises, and actual incidents.
Town Manager; Fire Chief, Police Chief	School Programs	Continue school programs to raise student awareness of hazards, safety, preparedness and prevention.
Town Manager; Fire Chief; Police Chief	Family Programs	Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.
Town Manager; Fire Chief; Police Chief	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.
Town Manager; Fire Chief; Police Chief	Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate.
#6 Continue to plan for construction of a consolidated public safety building		
Town Manager, Town Planner, Consultants	New public safety building	Undertake a feasibility study to evaluate potential locations of a new public safety building.
Town Manager, Town Planner, Fire Chief, Police Chief	New public safety building	Construct a public safety building based on the results of the study