

**TOWN OF ESSEX
AND
VILLAGE OF ESSEX JUNCTION, Vermont
2017 All-Hazards Mitigation Plan**

**Annex 6 to the
2017 Chittenden County Multi-Jurisdictional
All-Hazards Mitigation Plan**

Prepared by:

The Chittenden County Regional Planning Commission

and the

Town of Essex and the Village of Essex Junction, Vermont

*Adopted by the Town of Essex Selectboard
on July 13, 2017*

*And by the Village of Essex Junction Village
Trustees*

on June 27, 2017

Approved by FEMA on August 21, 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 Essex and the Village of Essex Junction;
- 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 Hazards by type with the most risk in Essex and Essex Junction are:

<u>Natural Hazards:</u>	Severe Winter Storm, Fluvial Erosion and Severe Rainstorm
<u>Technological Hazards</u>	Water Pollution, Power Loss and Hazardous Materials Incident
<u>Societal Hazards</u>	Key Employer Loss and Economic Recession

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 *2016 Essex Town Plan* and the *2014 Village of Essex Junction Comprehensive 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.

This section includes the following Mitigation Actions planned by the Town:

Category A: Improve capabilities of existing road and stormwater management infrastructure to address identified vulnerable infrastructure to mitigate Severe Rainstorm, Flooding, Fluvial Erosion and Water Pollution

- Action A-1: Stormwater Management
- Action A-2: Plan for Repair of Vulnerable Infrastructure
- Action A-3: Erosion Management
- Action A-4: Fluvial Erosion Hazard Mitigation Implementation

Category B: Operate an effective stormwater management system

- Action B-1: Mitigate impacts of runoff such as excessive flow, sediment load and excessive phosphorus discharge.
- Action B-2: Begin implementation of Flow Restoration Plans for Indian Brook and Sunderland Brook
- Action B-3: Develop Phosphorus Control Plan

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

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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 Essex and the Village of Essex Junction. Community planning can aid in significantly reducing the impact of expected, but unpredictable natural and human-caused events. The goal of this plan is to provide hazard mitigation strategies to aid in creating disaster resistant communities throughout 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 Hazard Mitigation Grant Program (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 Essex and Village of Essex Junction: Demographics and Development Characteristics

The Village of Essex Junction is an incorporated village located in the Town of Essex (cf. Figure 1.1). Each municipality has its own governing body and land use regulations. However, the Town of Essex includes the Village of Essex Junction. Some data sources only collect information at the town level and do not have separate data for the Village. Whenever possible, this local All Hazards Mitigation Plan provides data for both the Village and the Town.

The Town of Essex and the Village of Essex Junction are located in the center of Chittenden County. They are bounded on the west by Colchester and South Burlington, on the north by Westford, on the east by Jericho and on the south by Williston. Additionally, the Town of Essex shares corners with Underhill on the northeast and Milton on the northwest. The two jurisdictions encompass 39.43 square miles.

Based on U.S. Census data, the University of Vermont's Center for Rural Studies reports a municipal population of 10,316 people in Essex Town, and 9,271 people in Essex Junction Village for a combined total of 19,587 in 2010. Selected population characteristics are as follows:

Table 1-1 Essex and Essex Junction, selected population characteristics, 2010

Category	Village of Essex Junction		Essex Town outside the Village		Town and Village Combined	
	Number	%	Number	%	Number	%
Total Population	9,271	--	10,316	--	19,587	--
Median Age	38.9 years	--	--	--	39.9	--
Population age 65 years and over	1,037	11.2	1,129	10.9	2,166	11.1
Population under 10 years old	1,156	12.5	1,300	12.6	2,456	12
Population (and %) in group quarters	13	0.1	24	0.2	37	0.2

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

The following shows the types of housing within Essex, also based on the 2010 U.S. Census data:

Table 1- 2 Essex and Essex Junction, selected housing unit data, 2010 Census

Category	Village of Essex Junction		Essex Town outside the Village		Town and Village Combined	
	Number	%	Number	%	Number	%
Total Housing Units	4,009	--	4,137	--	8,146	--
Occupied housing units	3,875	96.7	4,012	97.0	7,887	98.2
Vacant housing units	134	3.3	125	3.0	259	3.2
Vacant housing units used for seasonal, recreational or occasional use	20	0.5	43	1.0	63	1.0
Detached 1-unit housing units	2,442	63.5	2,300	2300	4,742	62.9
Housing units with 5 or more units in structure	693	17.3	441	55.6	1,134	13.9
Mobile homes	26	0.6	58	1.4	84	1.0
Housing structures built in 1939 or earlier	454	11.3	218	5.3	672	8.2

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

The concentration of residential and commercial/industrial development in Essex is shown in *Figure 1-1*. Population in the two jurisdictions is tightly concentrated in Essex Junction and near Essex Center. The current development pattern in the municipalities consists of steady growth of single family homes, condominiums and apartments in permitted subdivisions within the sewer and water service areas coupled with similar growth in the construction of randomly placed single-family homes on large lots in the outlying portions of Essex (outside the sewer service area). Generalized zoning for the Village and Town is depicted in *Figure 1-2*.

Table 1-3 Town of Essex and Village of Essex Junction, Historic Combined Population Trends

Year	Population
1980	14,329
1990	16,498
2000	18,626
2010	19,587
2014	20,724
Source: April 1 Census Counts for 1980-2010, July 1 ACS 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 Essex and Essex Junction All Hazards Mitigation Plan

CCRPC staff met several times with various Town and Village 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 the Town, and determining whether the overall scoring still makes sense
2. Discussing any newly significant hazards in the Town 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.

These first set of meetings were held between August 24 and December 1, 2015. Staff met with:

- Dana Hanley (Community Development Director, Essex)
- Greg Duggan (Planner, Essex)
- Robin Pierce (Community Development Director, Essex Junction)
- Rick Jones (Public Works Superintendent, Essex Junction)
- Jim Jutras (Water Quality Superintendent, Essex Junction)
- Dennis Lutz (Public Works Director, Essex and Essex Junction)
- Chris Gaboriault (Fire Chief, Essex Junction)
- Pat Scheidel (Municipal Manager for Essex and Essex Junction)
- Brad LaRose (Chief, Essex Police)

- Charles Cole (Fire Chief, Essex).

Based on this meeting, CCRPC Staff developed memos for Essex’s Selectboard and Planning Commission and for the Essex Junction Village Trustees 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. The Planning Commission reviewed the draft during September and October, and Selectboard and Village Trustees received the memo during November. The meeting was open to the public and was duly warned in compliance with the Vermont Open Meeting Law (*1 V.S.A. §§ 310-314*). The memos, as meeting materials, were also available to the public. Members of the public who attended the meeting were able to review the memo and provide comments on the development of the plan. The Planning Commission and Selectboard offered changes regarding the ranking of hazards and the prioritization of mitigation strategies, which were incorporated into the plan.

In addition, the following materials were reviewed:

1. The 2014 Village of Essex Junction Comprehensive Plan and the 2016 Essex Town Plan
2. River corridor plan for the Browns River
3. Phase II Stream Geomorphic Assessment Report for Alder Brook
4. Flow restoration plans for Indian Brook and Sunderland Brook
5. Information on previous disasters
6. Information from Vermont Agency of Natural Resources on fluvial erosion hazards and flood hazards
7. Information from the Vermont Agency of Transportation on town roads, bridges, culverts and high crash locations.
8. 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 intern 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 and village 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 2016 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 development 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 Essex and Village of Essex Junction 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 regards 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 Essex and Village of Essex Junction**, 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 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 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.

No comments were received on the draft Town of Essex and Village of Essex Junction 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 Review and adoption process

On July 31, 2016 the first draft of this local Essex and Essex Junction 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.

CCRPC staff, working in concert with municipal staff, then made revisions to the Plan to address the required revisions.

The revised final draft annex was submitted to VDEMHS and FEMA for formal review and approval pending municipal adoption on March 17, 2017. On April 25, 2017, FEMA Region One issued a notice that the Town of Essex and Village of Essex Junction 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 Essex Selectboard and Village of Essex Junction Village Trustees members May 4, 2017. CCRPC also provided draft language for a resolution of adoption to be discussed at a regularly scheduled and properly warned Town of Essex Selectboard meeting on July 13, 2017 and Village of Essex Junction Village Trustees meeting on June 27, 2017.

The revised annex was adopted by the Selectboard on July 13, 2017 and by the Village Trustees on June 27, 2017. After correction of minor grammatical and formatting errors, a final copy of the Plan as well as copies of the adoption resolutions were sent to VDEMHS and FEMA Region One on July 28, 2017. On August 21, 2017 issued a letter that the Town of Essex and Village of Essex Junction Plan was approved.

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 Essex and the Village of Essex Junction 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 municipalities 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 in early 2022).

Finally, it should be reemphasized that the Essex and Essex Junction may review and update their 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 5-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 in 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 on Figure 4.1.

2.1.1 Profiled Hazards

This Plan profiles six (6) 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 Essex and Essex Junction 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. See Figure 2.1	*Yes but only at a few discrete locations with gauge data such as the USGS station located in Williston and Essex Junction in the Winooski River. See County MJAHP for details.	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 protection areas) are mapped in the municipality. See Figure 2.1	Though fluvial erosion is considered a significant hazard 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.	Yes, if FEMA declares disaster but data co-mingled with 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. 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 were 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 Essex and Essex Junction for these hazards:

Hazard (section of MJAHP where discussed)	Are Location data available?	Are Extent data available?	Are Impact data available?
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<p>Water Pollution (2.2.1)</p>	<p>Indian and Sunderland Brooks are impaired streams. The Town and the Village are subject to the requirements of a Municipal Separate Storm Sewer System (MS4) Permit as well as the Vermont Clean Water Act.</p>	<p>Phosphorus-loading for general locations is known but non-point sources are varied and dispersed. A road erosion inventory of gravel roads in Essex was performed in 2016 but data analysis is not yet complete and projects have not yet been prioritized or scoped. Remaining hydrologically-connected road segments in the Village and the Town will be inventoried in 2017 or 2018.</p>	<p>Annual budgetary impacts to individual municipalities are significant but vary depending upon location and whether they are a designated MS4 community. Both Essex and Essex Junction are MS4 permitted communities.</p>
<p>Hazardous Materials Incident (2.2.2)</p>	<p>Storage locations are known (see listing below of addresses). Incidents occurring during transportation could occur anywhere.</p>	<p>Rough estimates of spill amounts are recorded.</p>	<p>No formal data readily available on cleanup costs.</p>
<p>Power Loss (2.2.3)</p>	<p>Outage locations not mapped</p>	<p>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”.</p>	<p>Outage data is broad and refers to total customers within a county.</p>
<p>Invasive Species (2.2.4)</p>	<p>Several species known to occur in upland and agricultural areas but no systematic mapping has taken place.</p>	<p>No formal damage has been documented to date</p>	<p>No formal damage has been documented to date</p>

Multi-Structure Fire (2.2.5)	Could happen anywhere within the more developed portions of the municipality	Data not formally collated across agencies	Data not formally 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 (Figure 1.4)	Data not formally collated across agencies	Data not formally collated across agencies
Sewer Service Loss (2.2.8)	Sewer lines are mapped (Figure 1.4)	Data not formally collated across agencies	Data not formally collated across agencies
Natural Gas Service Loss (2.2.9)	General areas of services are known 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 MJAHMP 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 municipalities.	Significant socio-economic impacts

Economic Recession (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
Civil Disturbance (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
Epidemic (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
Key Employer Loss (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 1981, Essex began participation in the NFIP Emergency Program. In 2012, Essex Junction began participating 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. New DFIRM Maps went into effect on 7/18/2011.

The town is participating in the regular NFIP as of January 2017. Essex and Essex Junction's most recent Zoning Regulations 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 these overlay districts. 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.

According to the municipal plans of both the Town of Essex and the Village of Essex Junction, lands along the following drainages have been designated flood hazard areas: Indian Brook, Alder Brook, Browns River, Abbey Brook, and the Winooski River. Within the Village of Essex Junction is a large farm known as the Whitcomb Farm. A significant portion of the lower elevations of the farm are within the 100-year floodplain.

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

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

Parts of Essex Town and Essex Junction lie downstream of the Essex Dam #19, which is the only high-hazard dam located in Chittenden County. Green Mountain Power, which owns the dam, has mapped the area that would be inundated in the unlikely event of a dam failure. Inundation maps are routinely reviewed and updated to identify new developments that might be affected by inundation. The emergency action plan for the dam is updated annually and provided to appropriate first-responder organizations.

The only systematic data on river flow in the municipality is collected on the Winooski River at a gauge at a location straddling South Burlington and Essex Junction (cf. Section 2.1.1.3 of the MJAHP). 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 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*, which is 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 II SGA work has been completed on Indian Brook, Alder Brook and the Browns River in Essex and Essex Junction, and a River Corridor Plan was developed for the Browns River. Phase 2 SGA based River Corridor Protection Areas (formerly Fluvial Erosion Hazard Areas) were developed for Indian Brook, Alder Brook, portions of Abbey Brook and the Browns River. Figure 3.2 shows the progress of geomorphic assessments and identified Phase 2 SGA based River Corridor Protection Areas (RCPA) in Essex and Essex Junction. A River Corridor is also defined for the Winooski River. Figure 2.1 indicates all portions of the streams in Essex and Essex Junction 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 no such properties located in the Town of Essex or the Village of Essex Junction.

The status of the Town and Village’s 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
9/20/74 (Essex)	1/16/81 (Essex)	7/18/2011	1/16/81 (Essex)	4/5/2004 (Essex)

6/28/74 (Essex Junction)	1/2/81 (Essex Junction)		4/12/12 (Essex Junction)	2/27/2012 (Essex Junction)
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The Town’s Administrative Officer is responsible for assuring compliance by landowners with the NFIP in both municipalities. The Zoning Boards of Adjustment (Essex and Essex Junction) review and adjudicate applications for development within the floodplain. These DRBs review and adjudicate applications for development within the floodplain including any proposed new construction in the SFHA which is highly regulated. The Town and Village also work with DEC to respond to any local requests for Floodplain identification including questions about mapping.

3.2 Non-designated Hazard Areas

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

Damage from the 1998 ice storm (DR-1201) was considered light in both jurisdiction, and was limited to tree fall and limb damage. Damage occurred throughout Essex Junction, while in Essex the damage was concentrated west of Old Stage Road. Neither municipality received formal Public Assistance dollars as part of this disaster. Some smaller winter storm events have occurred since then, including most recently DR-4163, declared in January 2014. However, mapping the locations of potential future events is not feasible as their occurrence is a function of numerous climatic variables.

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 2017 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.

A portion of the Town of Essex’s road infrastructure as well as the driveways of some 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.

Ridgeline and hilltop homes, utility lines, and homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. Since 2011, 6 high wind events have been specifically identified as affecting Essex and Essex Junction by the National Climatic Data Center. According to the National Climatic Data Center, lightning has struck once in Essex Junction since 2011.

3.2.3 High Crash Locations

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

Table 3-1 Essex and Essex Junction, high accident intersections, based on 2010-2014 data

Intersection	Severity Index (\$/crash)
Intersection of VT 15 and Susie Wilson Road	\$17,429
Intersection of VT 15 and West Street	\$26,679
Intersection of Susie Wilson Road and Kellogg Road	\$11,645

Source: VTrans

Table 3-2 Essex and Essex Junction, high crash road sections, 2010-2014

Road	Road Type	Section (miles)	Severity Index (\$/crash)
VT 2A	Minor Arterial	0.278-0.578	\$16,425
VT 2A	Minor Arterial	0.578-0.878	\$17,189
VT 2A	Minor Arterial	2.478-2.778	\$19,8971
VT 15	Principal Arterial	1.282-1.582	\$14,112
VT 15	Principal Arterial	1.582-1.882	\$17,445
VT 15	Principal Arterial	2.082-2.382	\$15,116
VT 15	Principal Arterial	3.682-3.982	\$18,213
VT 15	Principal Arterial	4.782-5.082	\$18,555
VT 289	Freeway	0.000-0.300	\$17,154
Susie Wilson Road	Urban Collector	0.000-0.300	\$22,248

Source: Vermont Agency of Transportation

3.2.4 Road Infrastructure Failure

Of the 21 bridges inventoried by VTrans for Essex and Essex Junction, two are rated functionally deficient. None of the bridges in Essex or Essex Junction are rated Scour Critical with regards to fluvial undermining of bridge structure. Details on the bridges in the town are found in Table 4-4. 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 VDEMHS, as of May 2016 there are many reported hazardous material storage sites in Essex and Essex Junction. 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.

Table 3-3 Essex and Essex Junction, fuel storage sites in excess of 10,000 lbs.

Owner / Facility	Type of Substance	Location
ESSEX EXXON	BENZINE (MOTOR FUEL)	ESSEX
ESSEX GULF	BENZINE (MOTOR FUEL)	ESSEX
SIMON'S ESSEX CENTER STORE & DELI	DIESEL FUEL	ESSEX
SIMON'S ESSEX CENTER STORE & DELI	GASOLINE	ESSEX
ESSEX CENTER SHELL-ROUTE 15	GASOLINE	ESSEX CENTER
ESSEX DISCOUNT BEVERAGE	GASOLINE	ESSEX CENTER
ESSEX DISCOUNT BEVERAGE	DIESEL FUEL	ESSEX CENTER
ESSEX DISCOUNT BEVERAGE	KEROSENE	ESSEX CENTER
SIMONS ESSEX CENTER	FUELS, GASOLINE	ESSEX CENTER
SIMONS ESSEX CENTER	DIESEL	ESSEX CENTER
DAVE WHITCOMB SERVICE CENTER	GASOLINE	ESSEX JUNCTION
ESSEX COLONIAL MART	DIESEL FUEL	ESSEX
ESSEX COLONIAL MART	GASOLINE	ESSEX
ESSEX Go Go	GASOLINE	ESSEX
FAIRGROUND BEVERAGE	GASOLINE	ESSEX JUNCTION
FAIRGROUND BEVERAGE	DIESEL FUEL	ESSEX JUNCTION
GLOBAL FOUNDRIES	PETROLEUM PRODUCTS (FUEL OIL #2, #6, & PROPANE)	ESSEX JUNCTION
MAPLEFIELDS @ ESSEX	FUELS, GASOLINE	ESSEX
SIMON'S Rt 2A STORE, LLC	FUELS, GASOLINE	ESSEX
BUSHEY'S AUTO REPAIR II (SUNOCO)	DIESEL FUEL	ESSEX JUNCTION.
BUSHEY'S AUTO REPAIR II (SUNOCO)	GASOLINE	ESSEX JUNCTION.
MIKE BUSHEY AUTO, INC. (SUNOCO)	GASOLINE	ESSEX JUNCTION.
RIVER ROAD BEVERAGE AND REDEMPTION	GASOLINE	ESSEX
ESSEX JUNCTION, VT POP 1	DIESEL FUEL #2	ESSEX JUNCTION
BILL BUSHEY SUNOCO INC.	FUELS, GASOLINE	ESSEX JUNCTION
GREEN MOUNTAIN POWER CORPORATION - ESSEX PLANT #19	DIESEL FUEL	ESSEX JUNCTION
LAMELL LUMBER CORP	DIESEL FUEL	ESSEX
ROBINSONS INC	KEROSENE	ESSEX JUNCTION
ROBINSONS INC	DIESEL FUEL	ESSEX JUNCTION
ROBINSONS INC	FUEL OIL, [NO. 2]	ESSEX JUNCTION

SIMON'S FIVE CORNERS STORE	FUELS, GASOLINE	ESSEX JUNCTION
STEVENS GAS SERVICE	PROPANE	ESSEX
VERIZON ESSEX JCT CO (VT474206)	DIESEL FUEL	ESSEX JUNCTION
VILLAGE OF ESSEX JUNCTION PUBLIC WORKS	DIESEL FUEL*	ESSEX JUNCTION
TOWN OF ESSEX	GASOLINE	ESSEX
TOWN OF ESSEX PUBLIC WORKS	DIESEL FUEL	ESSEX

Source: Vermont Emergency Management, Essex and Essex Junction Public Works Depts., and Essex Junction Fire Dept.

* Fuel stored in vehicles only. Bulk fuel no longer stored onsite.

Table 3-4 Essex and Essex Junction, Extremely Hazardous Substances storage sites

Owner / Facility	Type of Substance	Location
Essex Exxon	Benzine (Motor Fuel)	Essex
Essex Gulf	Benzine (Motor Fuel)	Essex
Verizon Wireless: Essex VT	Sulfuric Acid	Essex
Verizon Wireless: Essex VT	Sulfuric Acid	Essex
Simons Essex Center	Fuels, Gasoline	Essex Center
Simons Essex Center	Diesel	Essex Center
GLOBAL FOUNDRIES	Nitric Acid	Essex Junction
GLOBAL FOUNDRIES	Chlorine	Essex Junction
GLOBAL FOUNDRIES	Sulfuric Acid	Essex Junction
GLOBAL FOUNDRIES	Ammonia	Essex Junction
GLOBAL FOUNDRIES	Hydrogen Fluoride	Essex Junction
GLOBAL FOUNDRIES	Hydrogen Chloride	Essex Junction
GLOBAL FOUNDRIES	Hydrogen Peroxide	Essex Junction
GLOBAL FOUNDRIES	Boron Trichloride	Essex Junction
GLOBAL FOUNDRIES	Formaldehyde	Essex Junction
Verizon Wireless: Essex Junction	Sulfuric Acid	Essex Junction
Verizon Wireless: Essex Junction	Sulfuric Acid	Essex Junction
USPS-ESSEX JCT.VT P&DC	Sulfuric Acid in Batteries	Essex Junction
Essex Junction, VT POP 1	Sulfuric Acid	Essex Junction
Essex Hannaford	Refrigerant Gas R-134A	Essex
Essex Hannaford	Refrigerant R507	Essex
Essex Junction, VT POP 2	Sulfuric Acid	Essex Junction
Green Mountain Power Corporation - Essex Plant #19	Sulfuric Acid	Essex Junction
HUBER+SUHNER, Inc.	Sulfuric Acid	Essex
Verizon ESSEX JCT CO (VT474206)	Lead Acid Batteries	Essex Junction
Verizon SLC-96 HUT ON POLE 82 ON (VT4742039)	Lead Acid Batteries	Essex Junction

Village of Essex Junction Public Works	Diesel Fuel	Essex Junction
Village of Essex Junction Wastewater Facility	Sulfide CHEMets reagent*	Essex Junction
Village of Essex Junction Wastewater Facility	Ammonium Molybdate Reagent*	Essex Junction
Village of Essex Junction Wastewater Facility	Hydrochloric Acid Dilutions*	Essex Junction
Village of Essex Junction Wastewater Facility	Fluoride Reagent*	Essex Junction
Village of Essex Junction Wastewater Facility	Ferrous Chloride Solution	Essex Junction
Town of Essex	Gasoline	Essex
Town of Essex Public Works	Diesel Fuel	Essex

Source: Vermont Emergency Management, Essex and Essex Junction Public Works,, Essex Fire Dept. and Essex Junction Fire Dept.

* Public Works officials indicate that these chemicals are stored in minute quantities.

3.3 Previous FEMA-Declared Natural Disasters and Snow Emergencies

3.3.1 Public Assistance

Since 1990 Essex and Essex Junction have received public assistance funding from FEMA for the following natural disasters:

Table 3-5 Essex and Essex Junction, FEMA-declared disasters and snow emergencies, 1990-2016.

Date (FEMA ID#)	Type of Event	Total Repair Estimates
January 1996 (DR 1101)	flooding	\$88,341 (Town of Essex)
January 1998 (DR 1201)	ice storm	\$63,056 (Town of Essex) \$22,287 (Essex Junction)
April 2001 (EM 3167)	snow emergency	\$21,076 (Town of Essex) \$10,404 (Essex Junction)
August 2004 (DR 1559)	flooding	\$136,032 (Town of Essex)
December 2010 (DR 1951)	Severe storm	\$44,854 (Town of Essex) \$1,329 (Essex Junction)
June 2011 (DR 1995)	Flooding	\$70,669 (Town of Essex)
June 2013 (DR4120)	Flooding	\$260,650 (Town of Essex)
August 2013 (DR 4140)	Flooding	\$21,923 (Town of Essex)
January 2015 (DR 4163)	Ice storm	\$5,114 (Town of Essex)

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 Essex and the Village of Essex Junction were 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:

- **January 1996:** Funds were used for debris removal, immediate repair of washed out gravel roads, replacement of culverts, clearing of channels, and ditching. Costs were incurred for gravel, pipe, culverts, equipment rental, labor, Town equipment to repair damaged sections of numerous Town gravel roads. Some of the roads involved were Brigham Hill Road,

Osgood Hill Road, Sleepy Hollow Road, Indian Brook Road, Lost Nation Road, Hanley Lane, Saxon Hill and Weed Road. Most of the worst problems occurred on Brigham Hill Road near the Colchester Town Line and on Osgood Hill Road.

- January 1998: Widespread debris removal, tree cutting and road clearing from effects of ice storm.
- April 2001: Increased contractual costs for snow removal
- August 2004: Significant (several hundred feet) washout of gravel road surface of Pettingill Road, Curve Hill and Lost Nation Road. Other roads damaged, although to a lesser degree, included: Lamore Road, Discovery Road, McGee Road and Chapin Road. Minor spot damage as well on portions of Brigham Hill Road, Brigham Hill Lane and Old Stage Road.
- December 2010: Money was used for identifying and removing debris along town roads, replacing damaged fencing on a ball field, repairing a building at the Highway Garage Complex in Essex, and to repair traffic signals on Essex Way near Lang Farm Road.
- June 2011: Money was used to repair erosion to Osgood Hill Road and associated ditches, to repair erosion damage on Discovery Road, Lost Nation Road, Sleepy Hollow Road and Catella Road, to repair erosion damage to McGee Road and associated stone-lined ditch, to replace a washed-out box culvert on Doubleday Lane, to repair erosion and inundation flood damage along Pettingill Road, and to repair erosion damage and replace a culvert on Saxon Hill Road.
- June 2013: Money was used to repair road and ditch erosion on Sawmill Road, Osgood Hill Road and Old Pump Road, repair to the foundation of the Essex Free Library caused by flooding, to repair road washout and upsize a culvert along Weed Road, to repair road erosion, replace rip rap and repair ditching along Naylor Road, to repair road and ditch erosion and replace culverts along Sleepy Hollow Road and Essex Highlands Road, to repair road and ditch erosion, replace culverts and reestablish rip rap along Catella Road, to replace a wooden foot bridge and a culvert on the Lang Farm Foot/Bike path, to repair road erosion on Saxon Hill Road, and to repair the road shoulder and rock embankment on Upper Weed Road.
- August 2013: Money was used to repair road, culvert and ditch washout along Lost Nation Road and Essex Highlands Road.
- January 2015: Money was used for town-wide debris removal.

A variety of mitigation and reconstruction efforts were implemented with disaster relief funds as a result of the January 1996 flood and later declared emergencies. Needs highlighted by this event (which were met) included increased culvert pipe sizes, emergency overflow pipes and the establishment of improved drainage along roadways.

A previous mitigation project was implemented along Brigham Hill Road in 1998. The project included increased culvert sizing, ditching and reconstruction. The project has reduced the potential for erosion/re-occurrence. Additional stone-lining of ditches on grades greater than 4% was completed as a result of the August 2004 flooding.

As a result of the drought of August 1999, the affected residents have discussed connection to municipal water, where feasible. Some have drilled new wells.

Essex and Essex Junction always seek to “right-size” culverts and improve ditches when repairing or replacing infrastructure after a disaster. When funds allow, replacement infrastructure is installed that is better suited to the hydrological conditions of the affected areas. This mitigates risk from future events.

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 damages 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 in connection with the two Federal disasters in 2011 (Spring flooding and Tropical Storm Irene in September) 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, individual claims were filed at residences or business located on the following streets. These streets are shown in *Figure 3.1.1.*

Table 3-6 Essex and Essex Junction, 2011 Individual Assistance claims by Street

Damaged Address Street	Damage Amount
SOUTH ST	\$3,841.37
VILLA DR	\$393.57
COLBERT ST	\$1,266.62
GREENFIELD RD	\$591.99
IRA ALLEN DR	\$409.97
OLD COLCHESTER ROAD	\$3,709.00
PEARL ST	\$354.21
PERRY DR	\$1,422.80
PINECREST DR	\$9,760.99
PIONEER ST	\$21,432.32
RICHARD ST	\$199.99
RIVENDELL DR	\$429.79
S HILL DR	\$631.33
SOUTH ST	\$6,336.71
SUNSET DR	\$231.45
VILLA DR	\$1,321.30
WILLIAMS ST	\$536.39

Source: FEMA

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 for to be included in the Risk Estimation of this 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 2016 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:

- Flooding
- Fluvial erosion
- Severe Rainstorm
- Wildfire
- Winter storm
- Extreme temperatures

Technological Hazards:

- Hazardous materials incident
- Major transportation incident
- Multi-structure urban fire
- Natural gas service loss
- Pollution
- Power loss
- Sewer service loss
- Telecommunications failure
- Water service loss
- Other fuel service loss
- Invasive Species

Societal Hazards:

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

3.4.1 Natural Hazards

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

- Severe Winter Storm (55)
- Multi-structure Urban Fire (24)
- Flooding (20)
- High Winds (20)
- 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):

- Winter Storm (55)
- Fluvial Erosion (20)
- Severe Rainstorm (20)
- Flooding (20)

While flooding and fluvial erosion are likely to have a significant impact over a smaller area, severe winter storms tend to affect the entire town and are more common, hence the higher rating.

Table 3-7 Natural hazards risk estimation matrix, Essex and Essex Junction

Risk Characteristic		Score	Winter Storm	Flooding	Severe Rainstorm	Fluvial Erosion	Wildfire	Extreme Temperatures
	0 = No developed area impacted	0					0	0
Area	1 = Less than 25% of developed area impacted	1		1		1		
Impacted	2 = Less than 50% of developed area impacted	2			2			
	3 = Less than 75% of developed area impacted	3						
	4 = Over 75% of developed area impacted	4	4					
Health and	0 = No health and safety impact	0					0	
Safety	1 = Few injuries or illnesses	1		1	1	1		1
Consequences	2 = Few fatalities but many injuries and illnesses	2	2					
	3 = Numerous fatalities	3						
Property	0 = No property damage	0						0
Damage	1 = Few properties destroyed or damaged	1		1	1	1	1	
	2 = Few destroyed but many damaged	2	2					
	2 = Few damaged and many destroyed	2						
	3 = Many properties destroyed and damaged	3						
Environmental	0 = Little or no environmental damage	0			0			0
Damage	1 = Resources damaged with short-term recovery	1	1	1		1	1	
	2 = Resources damaged with long-term recovery	2						
	3 = Resources destroyed beyond recovery	3						
Economic	0 = No economic impact	0						
Disruption	1 = Low direct and/or indirect costs	1		1	1	1	1	1
	2 = High direct and low indirect costs	2	2					
	2 = Low direct and high indirect costs	2						
	3 = High direct and high indirect costs	3						
	TOTAL SCORE		11	5	5	5	3	2
Probability of	1 = Unknown but rare occurrence	1						
Occurrence	2 = Unknown but anticipate an occurrence	2						
	3 = 100 years or less occurrence	3					3	
	4 = 25 years of less occurrence	4		4	4	4		4
	5 = Once a year or more occurrence	5	5					
	TOTAL RISK RATING		55	20	20	20	9	8

3.4.2 Technological Hazards

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

- Power Loss (36)
- Telecommunications Failure (28)
- Major Transportation Incident (28)
- Hazardous Materials Incident (27)
- Water Service Loss (24)

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

- Water pollution (28)
- Major Transportation Incident (28)
- Power Loss (28)
- Hazardous Materials Incident (27)
- Multi-structure fire (24)

Essex and Essex Junction are both affected by the Lake Champlain TMDL, elevating concerns about water pollution in both municipalities. Transportation incident refers to accidents with a large number of vehicles, boat or rail incidents, or road infrastructure failure. Accidents involving a few vehicles are a common occurrence, and tend not to rise to the level of hazard rated here. Although Essex does not contain any interstate or structurally deficient bridges, it does contain arterial roads and an active rail line, which increase the risk for both a major transportation incident and a hazardous materials incident. The VT 2A bridge between Essex Junction and Williston is a high traffic bridge; even temporary closure of this bridge would impede emergency responders coming from or going to neighboring communities. The presence of large amounts of chemicals at GLOBAL FOUNDRIES also increases the risk of a hazardous materials incident. The State has recently installed new monitoring wells. Additionally, given the dense nature of Essex Junction and some parts of Essex, a multi-structure fire remains a concern.

Table 3-8 Technological hazards risk estimation matrix, Essex and Essex Junction

Risk Characteristic		Power Loss	Major Transportation Accident	Water Pollution	Hazardous Materials Incident	Multi-structure urban fire	Telecommunications Failure	Water Service Loss	Invasive Species	Gas Service Loss	Sewer Service Loss	Other Fuel Service Loss
	0 = No developed area impacted											
Area	1 = Less than 25% of developed area impacted		1	1	1	1			1			1
Impacted	2 = Less than 50% of developed area impacted	2					2	2		2	2	
	3 = Less than 75% of developed area impacted											
	4 = Over 75% of developed area impacted											
Health and Safety	0 = No health and safety impact								0			
Consequences	1 = Few injuries or illnesses			1	1	1	1			1	1	1
	2 = Few fatalities but many injuries and illnesses	2	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
	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	0				0	0	0		0		0
	1 = Resources damaged with short-term recovery		1								1	
	2 = Resources damaged with long-term recovery			2	2				2			
	3 = Resources destroyed beyond recovery											
Economic Disruption	0 = No economic impact											
	1 = Low direct and/or indirect costs										1	
	2 = High direct and low indirect costs	2	2	2	2	2	2	2	2	2		2
	3 = Low direct and high indirect costs											
	4 = High direct and high indirect costs											
	TOTAL SCORE	7	7	7	9	6	5	5	5	6	6	5
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	4		4	4	4	4			
	5 = Once a year or more occurrence											
	TOTAL RISK RATING	28	28	28	27	24	20	20	20	18	12	5

3.4.3 Societal Hazards

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

- Key Employer Loss (28)
- Epidemic (21)
- Economic Recession (21)

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

- Key Employer Loss (28)
- Epidemic (21)
- Economic Recession (21)

As one of the largest private employers in the state, GLOBAL FOUNDRIES' in Essex Junction is important to both communities, as well as to the region. GLOBAL FOUNDRIES, formerly IBM, cut employment from around 8,500 in 2001, to about 5,000 jobs in 2009 to a level in 2017 fluctuating between 2,500 to 3,000. The economic impacts of these job losses are felt in reduced business for local firms, reduced property values, and lower tax receipts for local government. The uncertainty surrounding the future of GLOBAL FOUNDRIES is a source of significant worry for both municipalities. The closure of GLOBAL FOUNDRIES would have profound economic impacts. It would be difficult to find new businesses to fill the facility, and it is unclear how facility closure would affect ongoing remediation of contaminated groundwater.

Therefore, 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. Crime also tends to increase in recessions.

The likelihood of an epidemic is difficult to gauge, but its consequences could be severe.

Table 3-9 Societal hazards risk estimation matrix, Essex and Essex Junction

Risk Characteristic		Score	Key Employer Crisis	Epidemic	Economic Recession	Crime	Terrorism	Civil Disturbance
Area Impacted	0 = No developed area impacted	0						
	1 = Less than 25% of developed area impacted	1			1	1	1	
	2 = Less than 50% of developed area impacted	2	2	2				
	3 = Less than 75% of developed area impacted	3			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		1
	2 = Few fatalities but many injuries and illnesses	2		2			2	
	3 = Numerous fatalities	3						
Property Damage	0 = No property damage	0	0	0	0			
	1 = Few properties destroyed or damaged	1				1		1
	2 = Few destroyed but many damaged	2					2	
	2 = Few damaged and many destroyed	2						
	3 = Many properties destroyed and damaged	3						
Environmental Damage	0 = Little or no environmental damage	0		0		0	0	0
	1 = Resources damaged with short-term recovery	1			1			
	2 = Resources damaged with long-term recovery	2	2					
	3 = Resources destroyed beyond recovery	3						
Economic Disruption	0 = No economic impact	0						
	1 = Low direct and/or indirect costs	1				1		1
	2 = High direct and low indirect costs	2			2			
	3 = Low direct and high indirect costs	2	3	3			3	
	4 = High direct and high indirect costs	3						
TOTAL SCORE			7	7	7	4	8	4
Probability of Occurrence	1 = Unknown but rare occurrence	1						
	2 = Unknown but anticipate an occurrence	2					2	
	3 = 100 years or less occurrence	3		3	3			3
	4 = 25 years of less occurrence	4	4			4		
	5 = Once a year or more occurrence	5						
TOTAL RISK RATING			28	21	21	16	16	12

3.4.4 Hazard Summary

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

Natural Hazards

- Winter Storm (55)
- Fluvial Erosion (20)
- Severe Rainstorm (20)
- Flooding (20)

Technological Hazards

- Water pollution (28)
- Major Transportation Incident (28)
- Power Loss (28)

Societal Hazards

- Key Employer Loss (28)
- Epidemic (21)
- Economic Recession (21)

It should be noted that the highest-rated natural hazard on the list—severe winter storm—could be the cause of the highest-rated technological hazards, power loss and telecommunications failure. Winter storms are the highest rated hazard, due in large part to their widespread nature and frequent occurrence. Essex and Essex Junction have a combined Winter Operations Plan that is updated annually. This plan serves to lay out policy, train road crews and inform the public about plowing and other winter operations in the town and village.

The loss of GLOBAL FOUNDRIES as a key employer would have severe economic impacts for the community, as well as for the region and the state. GLOBAL FOUNDRIES also stores substantial quantities of fuels and extremely hazardous substances.

Since Essex has more developed urban areas than some other municipalities, its risk for major fire is correspondingly larger. Although it occurs infrequently, water service loss would impair firefighting capabilities.

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 Essex and Essex Junction: 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 Essex and the Village of Essex Junction have a higher vulnerability to:

- Flooding due to the presence of the Winooski River

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

Table 4-2 Essex and Essex Junction: 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 -temporary impacts to vulnerable individuals	-if extensive loss, 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 Essex and the Village of Essex Junction have a slightly higher vulnerability to:

- Water pollution due to the municipalities being MS-4 communities.
- Major Transportation Incident due to the transit of a railroad line

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 Essex & Essex Junction: 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	-budget impacts to police services

	-damage to public and private property	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 and Village are 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. Table 4-1 identifies critical facilities in Essex and Essex Junction. This list does not contain 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 Essex and Essex Junction

Facility Type	Number of Facilities
Veterinary Hospital / Clinic	4
Education Facility	8
College / University	1
EMS Station	1
Fire Station	2
Emergency Shelters	10
Emergency Operations Center	1
Energy	4
Government and Military	5
Information and Communications	2
Police Station	1
Mail and Shipping	2
Public Attractions and Landmark Buildings	1
Transportation Facilities	2

Source: VCGI

Two of these facilities in Essex Junction—both associated with Green Mountain Power—are located within the 100-year floodplain and the mapped River Corridor.

4.2 Infrastructure

4.2.1 Town Highways

The following is a statistical overview of roads in the Town of Essex and Village of Essex Junction. These tables show the range of road types within the municipalities, from state highways 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 Essex or Essex Junction.

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, Essex and Essex Junction

Municipality	Class 1	Class 2	Class 3	Class 4	State Hwy	Fed Hwy	Inter-state	Total 1, 2, 3, State Hwy
Essex Junction	4.009	1.906	27.740		1.961			35.289
Essex Town outside Village		10.83	63.785	3.400	22.312			96.927
Total	4.009	12.710	91.755	3.400	24.273			132.747

Source: Essex Junction and Essex Town data from Town and Village Depts. of Public Works

Table 4-6 Town highway mileage by surface type, Essex and Essex Junction

Municipality	Paved	Gravel	Soil or Graded	Unimproved	Impassable	Unknown	Total
Essex Junction	34.367	0	0	0	0	0	34.367
Essex Town outside Village	72.957	19.42	1.07	1.95	0.88	0.57	96.847
Total	107.324	19.42	1.07	1.95	0.88	0.57	131.218

Municipality	Total Known	Total Unpaved	%Paved	%Unpaved
Essex Junction	34.367	0	100%	0%*
Essex Town outside Village	96.277	23.32	75.8%	24.2%
Total	130.644	23.32	82.2%	17.8%

Source: TransRDS GIS data – surface class and AOTmiles

* Essex Junction Public Works officials indicate that no unpaved roads remain in the Village.

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 municipalities. The following bridges are contained in an inventory maintained by VCGI, VTrans and the CCRPC. A GIS intersection was performed to determine which bridges are located in the designated flood hazard area (aka Special Flood Hazard Area or 100-year floodplain.) and /or the River Corridor Protection Area (aka Fluvial Erosion Hazard Area).

Table 4-7 Bridges located in SFHA and RCPA, Essex and Essex Junction

# of Structures in RCPA (FEH)	# of Insufficient Structures in RCPA	# of Structures in River Corridor	# of Insufficient Structures in RC	# of Structures in SFHA	# of Insufficient Structures in SFHA
29	14	28	11	33	13
A structures could be a bridge, culvert or arch. Data came from ANR DMS. A structure is insufficient if its % bankfull width is 50% or less.					

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 regards to Essex and Essex Junction, studies identify specific stream reaches where fluvial erosion is a concern as well as where infrastructure, primarily culverts, as noted in the table below is at risk

Table 4-8 Culverts with a geomorphic compatibility rating of "Mostly Incompatible" or "Incompatible," Essex and Essex Junction

Bankfull Width	Compatibility Score	Location	Road Name	Stream Name
30.00	5	Just below M07/M08 reach break at Rt. 128 crossing.	RTE. 128	Alder Bk
26.67	6	.4 Miles NE Osgood Hill Rd.	HANLEY LN	Abbey Brook
34.31	7	Near Lowes and Rite Aid	SUSIE WILSON RD	Sunderland Brook
10.29	8	Near Warner Avenue and Rt. 15 intersection	WARNER AV	Sunderland Brook
52.94	8	.1 Mi From end of Rd.	SUSIE WILSON RD	Indian Brook
30.77	8	.2 Mi E VT-2A	LAMORE RD	Unnamed
41.74	9		SUSIE WILSON BYP	Indian Brook
43.89	9	Just after Essex corners	JERICHO RD	Alder Brook
53.33	9	Driveway of House #71 off Osgood Hill rd.	DW off Osgood Hill Rd	Unnamed
11.67	9	Driveway of House #178 off VT-128	DW off Browns River Rd	Unnamed
59.38	10		PINECREST DR	Indian Brook
54.55	10		BRICKYARD RD	Indian Brook
47.00	10		SUSIE WILSON RD	Indian Brook
26.67	10	Upper Access Road to parking area at Indian Brook Park	Upper Access Road at Indian Brook Park	Indian Brook
30.00	10	At Alder crossing of Rt. 15 in Essex Center	JERICHO RD	Alder Bk
30.77	10	.1 Miles S West Sleepy Hollow rd.	BROWNS RIVER RD	Unnamed
30.77	10	Junction with Osgood Hill Rd.	CATELLA RD	Unnamed
26.67	10	.1 Miles W Catella Rd.	OSGOOD HILL RD	Abbey Brook
36.36	10	Right before mailbox #15	GRAY WY	Unnamed
40.00	10		Fairgrounds Access Road	Indian Brook

Mostly incompatible $5 < GC < 10$

% Bankfull Width + Approach Angle scores < 2

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.

Fully incompatible $0 < GC < 5$

% Bankfull Width + Approach Angle scores < 2 AND Sediment Continuity + Erosion and Armoring scores < 2

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.

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 4-9 Dams under the jurisdiction of VT Department of Environmental Conservation

Dam Name	State ID	Location (Town)	Hazard Class	Owner
Indian Brook Reservoir	69.01	Essex	High	Town of Essex
IBM Lagoon	69.06	Essex	Low	Private
<i>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.</i>				

The National Dam Inventory shows seven dams located in the municipalities:

Table 4-10 National Dam Inventory Data

Name	Owner	River	Description	Maximum Storage (acre/feet)	Hazard Potential
Essex No. 19 (Essex Junction) Also known as Hubbell's Falls Dam.	Green Mountain Power Corp.	Winooski	Large concrete gravity dam, built in 1917 for, and currently used for, hydroelectric purposes.	10,500	High-Failure or a mistake in operation will probably cause loss of life.
Indian Brook Reservoir (Essex)	Town of Essex	Indian Brook	Concrete gravity dam built in 1957 for water supply, now used for recreation	1,157	Significant-no probable loss of human life but can cause significant economic or environmental damage and disrupt lifeline concerns. ¹
Essex-2	No data recorded.	Browns River	No data recorded.	No data recorded	Significant-no probable loss of human life but can cause significant economic or environmental damage and disrupt lifeline concerns.
Saxon Hill Reservoir (North)	No data recorded.	Winooski River	Used for water supply in the past. No other data recorded.	0	No hazard rating.
Saxon Hill Reservoir (South)	No data recorded.	Winooski River	No data recorded.	0	No hazard rating.
Essex Town Reservoir	No data recorded.	Winooski River	No data recorded.	0	No hazard rating.
Essex School Reservoir	No data recorded.		No data recorded.	0	No hazard rating.

Source: National Dam Inventory, 2005

¹ Town of Essex indicates that the hazard potential for this dam is High – failure will probably cause loss of life.

4.2.3 Water, Wastewater and Natural Gas Service Areas

Water service and wastewater service lines extend through all of Essex Junction and to most of the denser housing and commercial developments in Essex, through Essex Center and along VT

15 towards Jericho. Natural gas distribution covers most of the water service area but does not extend east of Irene Avenue along VT 128 or east of the Saxon Hill Road/VT15 intersection. Homes in the northern half of Essex and along its eastern border are serviced by private or community septic and well systems. Much of the western area of the Town is also served by onsite septic systems (cf. Figure 1.4)

4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines

Several VELCO high tension power transmission lines run through the jurisdictions (see Map 4-1). One line runs from west to east about ½ half-mile from, and paralleling, the Winooski River, while two others run south-north through both jurisdictions. Two substations are located in Essex Junction while one is located in Essex. Electrical distribution lines and telecommunication land lines are on elevated poles along the street grid. Most subdivisions built since the 1970's have buried power and telephone lines along the street grid (cf. Figure 1.4)

4.3 Estimating Potential Losses in Designated Hazard Areas.

A simple GIS intersection (cf. Figure 2.1) of esite (aka “E911 site location) data with the FIRM floodplain data indicates the following with regards to structures located in mapped flood hazard areas in Essex and Essex Junction:

- There are a total of 7,427 structures.
- There are 7 residences and 10 commercial/industrial structures are located within the 100-year floodplain.
- Assuming a 2014 median grand list value, the estimated potential loss due to a major flood event inundating the floodplain is \$14,112,204.

A simple GIS intersection (cf. Figure 2.1) of esite data with the 2016 River Corridor Protection Area data indicates the following with regards to structures located in river corridor areas in Essex and Essex Junction:

- There are a total of 7,427 structures.
- There are 15 residences and 6 commercial/industrial structures within the RCPA.
- The estimated potential loss due to an event in a river corridor is \$7,802,563.

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 4-11 Vulnerable populations, Essex and Essex Junction

	Essex and Essex Junction	Chittenden County	Vermont	National
Percent Minority (non-white) ¹	4.8%	7.7%	4.8%	26.7%
Children <18 in poverty ¹	6.9%	11.1%	14.8%	21.6%
Families w/children in poverty ¹	7.8%	10.5%	13.4%	17.8%
Families w/ female householder, no husband present w/children in poverty ¹	18.3%	37.0%	37.4%	40%
Population, age 65+ in poverty ¹	3.4%	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 at the introduction of this appendix, land use in Essex Junction is heavily commercial and densely residential. Essex is primarily residential and commercial around Essex Center, with large lot rural and open land throughout the rest of the town. An analysis of GIS data shows the following percentages for land use and the percentages of land allocated to each zoning district for the two jurisdictions.

Table 4-12 Structures compared to zoning, Essex and Essex Junction

Essex and Essex Junction Structures		Essex and Essex Junction Zoning	
Residential	88.60%	Agriculture - Residential	31.50%
Commercial	6.02%	Center	0.60%
Industrial	0.90%	Conservation	23.37%
Institutional / Infrastructure	1.04%	Floodplain	11.57%
Mass Assembly	0.38%	Historic Preservation - Design Control	0.05%
Leisure / Recreation	0.04%	Industrial	4.30%
Natural Resources	0.44%	Low Density Residential	5.90%
		Medium Density Residential	12.48%
		High Density Residential	0.05%
		Mixed Use	0.31%
		Mixed Use - Planned Unit Development	2.16%
		Mixed Use Commercial	0.12%
		Open Recreation	4.02%
		Residential - Business	0.06%
		Resource Preservation District - Industrial	2.99%
		Retail - Business	0.51%

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 few conserved parcels in the municipalities. In Essex Junction, the Winooski Valley Park District (WVPD) owns land along the Winooski River overlook adjacent to Route 15 in both Essex and Essex Junction. Similarly, a closed State-owned nursery, known as the Tree Farm, is located near Route 2-A in both municipalities. The Tree Farm has been converted to open space recreational uses, primarily soccer fields. The Town of Essex manages a Town Forest near Route 15 in coordination with a developer. The Winooski Valley Park District and the Town of Essex protect several parcels surrounding the Indian Brook Reservoir. The Town of Essex owns and manages the Indian Brook Reservoir. The Town has an agricultural lands tax stabilization program. Neither the Town nor the Village collects dedicated tax revenue through an Open Space or Conservation fund.

Table 4-13 Conserved Land, Essex and Essex Junction

	Acres	Acres of Public Land	Percent Public	Acres of Conserved Land	Percent Conserved	Total Public & Conserved	Percent Conserved Land
Essex	22,255.79	962.71	4%	524.99	2%	1,487.74	7%
Essex Junction	2,973.90	79.70	3%	12.75	0%	92.47	3%

Source: VLT Data and ANR Public Lands

Additionally, as noted below in Table 5.1, Essex’s zoning bylaws include a Floodplain Overlay District and Essex Junction’s Land Development code contains a Flood Plain District, both of which preclude the construction of new homes or businesses and effectively act as conserved lands.

4.5.2 Recent and Future Development

At present and for the foreseeable future, the development pattern is expected to continue: steady growth of single family homes, apartments and condominiums within permitted subdivisions within the sewer and water service areas of the Essex and Essex Junction coupled with similar growth rates in the construction of randomly placed single-family homes on large lots in the outlying portions of Essex, outside the sewer core area.

At this time, the only way CCRPC has to predict future development is by analysis of municipal zoning bylaws. As Essex and Essex Junction both participate in the NFIP, zoning bylaws heavily regulate development in designated flood hazard areas. As a result, little to no development is likely to take place in hazard areas. These zoning requirements mitigate flood hazards to future structures. Additionally, the Town and Village also regulate 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 municipalities have seen 123 housing units (in single family and multi-family structures) and 23 new commercial/industrial buildings constructed. One housing unit was constructed in a River Corridor. Otherwise, none of these units or structures were constructed in the Special Flood Hazard Area nor in the River Corridor Protection Area.

As best can be ascertained based upon data maintained by the Chittenden County RPC and the Town of Essex and Village of Essex Junction, 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 2016 Essex Town Plan and Village of Essex Junction 2014 Comprehensive Plan Goals, Policies, Objectives and Tasks That Support Hazard Mitigation

These tasks are described in the 2014 Essex Junction Municipal Plan and the 2016 Essex Town Plan. The following selected excerpts illustrate how mitigation is formally promoted and supported through the Town Plan and Comprehensive Plan.

2016 Essex Town Plan

Economic Development

2c. Infrastructure, in the form of roads, bridges, trails, and sewer and water lines, is maintained and improved.

Action 2.3: Advocate for upgrades to VT Route 117

Transportation

Action 3.3: Design and construct a new signalized intersection at Sand Hill Road and VT Route 15

Action 3.4: Design and construct improved access at VT Route 2A/Susie Wilson Bypass and the Circumferential Highway off-ramp

Flood Resilience

6a. New development in floodplains, fluvial erosion hazard areas, and land adjacent to streams, wetlands, and upland forests is avoided.

6b. Flood damage and fluvial erosion are reduced by protecting and restoring vulnerable areas.

6c. Flood emergency preparedness and response is achieved.

General Policy 6: Land shall be conserved, and development avoided, in particularly vulnerable areas, such as floodplains and river corridors.

Action 6.1: Adopt updated Public Works Specifications

Action 6.2: Construct flow restoration improvements within the watersheds of Indian Brook and Sunderland Brook, which have impaired water quality

Action 6.3: Reduce erosion from existing road and development sources in the Alder Brook watershed between VT Route 15 and VT Route 117

Action 6.4: Evaluate standards in planning and zoning documents for steep slopes, wetlands, and highly erodible areas

Action 6.5: Stabilize stream banks, cultivate plants in buffers, and protect channels and road ditches in critical fluvial areas

Action 6.6: Re-evaluate elements of the draft Conservation Subdivision Regulations

Resource Protection: Natural, Scenic, Historic and Archeological

Action 7.1: Start a Conservation Fund

Action 7.2: Start an invasive species management program

Action 7.5: Continue to improve stormwater quality in accordance with mandated state and federal permits

Local Government Services

Action 9.15: Increase roster of paid on-call firefighters

Action 9.17: Replace tanker trucks with larger capacity pumper/tanker

Action 9.18: Replace AWD Reel Truck with AWD Engine for rural residences

Action 9.19: Add aerial truck to fleet to meet needs of the community

Action 9.21: Update ISO review for Town

Action 9.22: Renovate Fire Station to current National Fire Protection Association standards

Action 9.40: Prepare final design plans and specifications and fund water line improvements in the Susie Wilson Road Corridor and Fort Ethan Allen area to increase fire flow and pressure

Action 9.44: Implement Impaired Streams Flow Restoration Plans involving construction of new stormwater treatment facilities

Action 9.45: Resolution of all expired stormwater permits in the Town's impaired watersheds

Education

Action 10.10: Invest in school building projects that promote student safety and learning, community usage, and energy efficiency

Village of Essex Junction 2014 Comprehensive Plan

Priority Goals for the Next 5 Years

Objective 5.6: Consider reinstating funding to the land acquisition fund.

Open Space/Recreation/Environmental

Objective 4.1: Continue to enforce stormwater treatment standards in the Land Development code to improve water quality in impaired waters and to minimize non-point source water pollution from new development.

Objective 4.2: Require retention of vegetation or effective re-vegetation of areas vulnerable to erosion.

Goal 6: Avoid new development in floodplains, fluvial erosion hazard areas, and land adjacent to streams, wetlands, and upland forests; eliminate the exacerbation of flooding and

fluvial erosion; encourage protection and restoration of these areas; and plan for flood emergency preparedness and response.

Objective 6.1: Continue to enforce the flood plain regulations to protect flood prone areas and minimize fluvial erosion.

Objective 6.2: Monitor the fluvial erosion hazard area south of Cascade Street that is not currently regulated by the flood plain regulations to determine if additional protections area needed.

Objective 6.3: Monitor all of the fluvial erosion areas to see how best to accommodate fluvial equilibrium and natural erosion processes while minimizing undue damage to property.

Objective 6.4: Plan culvert replacements for any undersized culverts in conjunction with roadway improvement.

Objective 6.5: Review the Hazard Mitigation Plan on a regulation basis and follow-up on action steps.

Objective 6.6: Continue annual certification of the Emergency Operations Plan.

Utilities/Facilities

Goal 1: Provide a Village infrastructure system that adequately ensures the availability of potable water, disburses storm and ground water runoff and disposes of sanitary wastes in a manner which ensures community health and is environmentally sound.

Objective 1.1: Maintain Public Works Specifications utilizing prudent and reasonable technology to ensure adequate infrastructure systems. Include adequate designs to allow for peak usage and control peak flows.

Objective 1.2: Implement asset management plans through capital projects that upgrade existing water, stormwater and sanitary sewer systems to insure long term rate stability.

Objective 1.7: Continue to identify existing areas where deficiencies in the systems occur and could potentially have a detrimental effect on safety, health or the environment.

Objective 1.9: Implement stormwater discharge standards to be included in the Land Development Code revisions.

Goal 4: Continue to provide all Village segments with the best fire protection.

Objective 4.1: Actively recruit volunteers for the Fire Department, and consider the need for a new fire station to assist in recruitment and retention efforts.

Objective 4.2: Consider establishing a limited full-time Fire Department.

Transportation:

Objective 2.2: Review all development proposals to minimize traffic and pedestrian safety concerns.

5.2 Existing Essex and Essex Junction 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 address hazard mitigation, Essex and Essex Junction

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	Essex Public Works Department, Essex Junction Public Works Department	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Public Works Departments, through the strategies noted below are taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.
Highway Personnel	11.5 FTE field personnel (Essex) 5 FTE field personnel (Essex Jct.)	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Public Works Department, through the strategies noted below are taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.
Water / Sewer Department	Essex Public Works Department, Essex Junction Public Works Department	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Public Works Departments, through the strategies noted below are taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.
Water / Sewer Personnel	2.95 FTE water personnel (Essex) 2.95 FTE sewer personnel (Essex) 1.5 FTE water personnel (Essex Jct.) 1.5 FTE sanitation personnel (Essex Jct.) 4.5 FTE WWT personnel (Essex Jct.)	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	2 FTE planners (Essex) 1 FTE zoning administrator (Essex) 2FTE planning/zoning (Essex Jct.)	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 are more must be inspected and permitted by the Vermont Division of Fire Safety.
Town / Municipal Comprehensive Plan	2016 (Essex) 2014 (Essex Junction)	1) As noted at the start of Section 5, several elements of the municipal Comprehensive Plans promote Hazard Mitigation. 2) The Town is currently updating its Plan and will be referencing this 2017 AHMP accordingly.
Zoning Bylaws and Subdivision Regulations	2008 (Essex) 2007 (Essex Junction)	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 Plain, Open Space, Conservation, Open Recreation, Industrial	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 2011. The Town's Administrative Officer is responsible for assuring compliance by landowners with the NFIP in both municipalities. The Zoning Boards of Adjustment review and adjudicate applications for development within the floodplain. 2) No need, at this time, to expand upon NFIP participation.
Open Space Plans; Conservation Funds	None	1) The Town and Village may conserve land in the future

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

Table 5-2 Existing municipal emergency services & plans, Essex and Essex Junction

Type of Existing Protection	Description /Details/Comments
Emergency Services	Emergency response personnel may have overlapping responsibilities with other town response organizations.
Police Services	Essex Police Department, serves both Town and Village.
Police Department Personnel	26.2 Paid FTE Officers, 2 Paid FTE Admin, 4 FTE Dispatchers
Fire Services	Essex Town VFD Essex Junction VFD
Fire Department Personnel	40-45 Volunteers (Essex Junction VFD), 35 Volunteers (Essex VFD)
Fire Department Mutual Aid Agreements	Essex, Essex Junction, Westford
EMS Services	Essex Rescue
EMS Personnel	4 full-time employees; 5 part-time employees; 77 volunteers
EMS Mutual Aid Agreements	various through VT EMS District #3
Emergency Plans	
Local Emergency Operations Plan (LEOP)	2016
Primary Shelter	Essex Alliance Church
Replacement Power, backup generator	No
Secondary Shelter	Champlain Valley Exposition Fairgrounds, Essex High School
Replacement Power, backup generator	Champlain Valley has a generator

5.3 Essex and Essex Junction All-Hazards Mitigation Goals

The following goals were first approved by the Town and Village in their 2005 and 2011 AHMPs and approved by Town and Village 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 regards to a more formal process by which the Town and Village will integrate the requirements of this mitigation plan into the Town and Village Comprehensive Plans, as required by Vermont law, municipalities must update their Comprehensive Plans every eight years. During any update process undertaken while this Plan is in effect, the Town and Village 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 Village will be required to update its Plan in 2019 and the Town will be required to update its plan in 2024.

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 regards to a more formal process by which the Town and Village will integrate the requirements of this mitigation plan while developing the Town and Village annual capital improvement plans/budgets, from 2016-2021, the Town and Village 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 table below records the strategies from the 2011 Plan and progress on their implementation. This table also encapsulates the Town and Village'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 Essex and Essex Junction All-Hazards Mitigation Plan

Action Primary Responsible Entity	Task	Brief Description	Progress since 2011 and recommendations for 2017 Plan
#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.	A River Corridor Management Plan has been completed for the Browns River. Project identification is available for Indian Brook. Additionally, a Flow Restoration Plan is in place for the Indian and Sunderland Brooks. COMPLETED, REMOVE FROM 2017 PLAN.
Town Manager, Planners	Fluvial Erosion Hazard Mitigation Implementation	Implement strategies from above referenced Corridor Management Plan to mitigate losses from identified fluvial erosion hazards.	Essex: <ul style="list-style-type: none"> Near Margaret Street, a failed storm drain system draining into Alder Brook was replaced to minimize erosion from the outfall The town is working to address erosion on a small tributary to Alder Brook near Fern Hollow Road INCLUDE ALDER BROOK TRIBUTARY WORK IN 2017 PLAN.
Town Manager, Town Planner	Flood Insurance Rating Map Updates	Review draft FIRM data. Develop strategies to mitigate losses from identified flood hazards.	The FIRM data have been reviewed. A project was implemented on Woods End Road to reduce the risk for flooding. Essex Junction has joined NFIP. COMPLETED, REMOVE FROM 2017 PLAN.
#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.	Essex developed a 2014 Highway Transportation Improvement Plan to identify road problems and prioritize repairs. Essex also repaired failed portions of its municipal storm drainage system on Londonderry Lane in 2016. Essex Junction has been involved in creating a long-term maintenance and upgrade plan for all underground water, sewer and stormwater infrastructure. A catch basin was removed from Hillcrest Road and nature drainage was restored. <u>ASSESSMENT IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN</u>
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.	Development is now prohibited on steep slopes in Essex and Essex Junction. Limited analysis has been completed in the Alder Brook and Browns River watersheds. After a FEMA-declared disaster in 2103, repairs occurred in the Browns River watershed. <u>ASSESSMENT IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN</u>

Road Foreman	Culvert Upgrades	Upgrade culverts and ditching along roads to mitigate against repeated damages from stormwater or spring snowmelt.	Essex annually replaces 15 to 20 failing metal culverts. Projects undertaken in Essex include: <ul style="list-style-type: none"> •Box culvert south of Doubleday Lane was replaced with a system to enhance stormwater infiltration •Monitoring is ongoing for the Dual culverts on a tributary to the Browns River near Old Stage Road •On Weed Road, a culvert was upsized, nearby embankments were strengthened and upstream ditches were stone lined in responses to flooding in 2013 •A culvert on Indian Brook under Lost Nation Road was replaced in 2016 CONTINUE FOR 2017 PLAN
Road Foreman	Continued Monitoring of Vulnerable Infrastructure	Monitor bridges and culverts with erosion and scouring concerns.	Monitoring is ongoing. Projects undertaken in Essex include: <ul style="list-style-type: none"> •Monitoring is ongoing for the Dual culverts on a tributary to the Browns River near Old Stage Road MONITORING IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN
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.	The Town of Essex Selectboard has a long-standing public works specification that all new roads shall be paved and a policy not to pave any existing gravel roads. As roads are repaired or new paved roads are built, necessary drainage improvements are completed. 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.	The Foster Road Municipal Park erosion mitigation project has been completed. A significant eroded area has been restored and the topography has been revised to reduce the potential for further erosion. On Osgood Hill, Essex used 2013 FEMA disaster money and a Vermont Rural Roads Grant to stone line the ditch and upsize some culverts. The ditch erosion has been fixed. RENAME AS DRAINAGE IMPROVEMENTS FOR 2017 PLAN

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 in effect.

Table 5-4 Town of Essex and Village of Essex Junction: Capabilities to address vulnerabilities from natural hazards

Hazard	Adequacy of Municipal Capabilities to address associated vulnerabilities (Excellent, Good, Average, Below Average)	Additional expansion or improvement in policies & programs needed to address hazard given long-term vulnerability
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 Essex and Village of Essex Junction: 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 Essex and Village of Essex Junction: 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:

- Both municipalities’ 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 and Village plan to conduct the following mitigation actions during the 5 year period this Plan is in effect.

CATEGORY A: 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 and Village Public Works Department

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

Timeframe: **Month 2017** through March 5, 2022 **Update after final FEMA approval**

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 A-1: Stormwater Management

Essex is putting a proposal out for bid to replace failed portions of the municipal storm drainage system on Londonderry Lane. The pipes will be upsized. The highway department is working with the town's GIS staff to map and assess all culverts, and a comprehensive town wide hydraulic analysis on all culverts will be completed to comply with new state road requirements.

Action A-2: Plan for Repair of Vulnerable Infrastructure

Seek funds to develop cost estimates, plans and ideally construction funds to address various bridges and culvert locations that have erosion and scouring concerns. In Essex, Lamore Road segments are still being monitored and are an ongoing unaddressed concern. Culverts must continue to be monitored and possibly replaced on Osgood Hill. The town plans a major culvert replacement on Indian Brook under Lost Nation Road. The town plans to continue annually replacing 15 to 20 failing metal culverts and the Village anticipates at least 5 culverts annually.

Action A-3: Erosion Mitigation

Both municipalities should undertake erosion mitigation projects at various locations where municipal roads regularly incur damage from adjacent rivers/streams. Specific locations for projects in the future include those listed above.

Action A-4: Fluvial Erosion Hazard Mitigation Implementation

Essex is working to address erosion on a small tributary to Alder Brook near Fern Hollow Road.

CATEGORY B: Operate an effective Stormwater Management System

Hazards Addressed: Severe Rainstorm, Water Pollution

Vulnerabilities Addressed: Damage to public infrastructure; Temporary road and bridge closure and Budgetary impacts

Status: Ongoing

Primary Responsible Entity: Essex Public Works Director and Stormwater Coordinator; Essex Junction Public Works Department

Timeframe: Month 2017 through March 5, 2022 Update after final FEMA approval

Funding Requirements and Sources: FEMA or other hazard mitigation grants; FHWA grants; VTrans grants; Municipal Operating and Capital budgets only if sufficient

Rationale / Cost-Benefit Review: Operation of municipal stormwater management systems and implementation of the Indian Brook Flow Restoration Plan and the Sunderland Brook Flow Restoration Plan will assure that the Town remains in compliance with its MS4 permit and that various programs and projects will be implemented to better detain, infiltrate and treat runoff during severe rainstorm events. This will act to reduce overall water levels and velocity. The project will also reduce pollutant and phosphorus loads into local streams and Lake Champlain.

Specific Identified Actions:

Action B-1: Mitigate impacts of runoff such as excessive flow, sediment load and excessive phosphorus discharge.

The Town will conduct the following projects on an annual basis:

- street sweeping;
- catch basin cleaning;
- ditch improvements;
- review of land development proposals to assure proper stormwater management, and the Town and Village may also update their Low Impact Development bylaws

Action B-2: Begin implementation of Flow Restoration Plan for Indian Brook and Sunderland Brook.

Flow Restoration Plans were filed in late 2016 with the State's Agency of Natural Resources. These plans are part of the town's obligations under its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Stormwater Sewer Systems (MS4) permit. In keeping with the details of the Plan, the town will seek to implement the Best Management Practices (i.e., new projects and retrofits) identified in detail in the Plan such as bump-outs, green gutters, pond retrofits, infiltration basins. The projects will be completed over the next 20 years. At this time it is not known which exact projects will be implemented in the next five years.

Grants were just secured (Jan. 2017) for the following projects and will be implemented in 2017 and 2018:

Indian Brook FRP:

Village (2): Brickyard/Mansfield gravel wetlands retrofit; Main Street / Fairview Drive gravel wetlands retrofit;

Town (1): Sydney Drive infiltration basin

Action B-3: Develop Phosphorus Control Plan

Develop and begin to implement plans to reduce overall loading of phosphorus from within municipal boundaries that is eventually discharged into Lake Champlain. The exact nature and scope of these plans are not known at this time but MS4 permitted municipalities will be required to develop these plans as part of new revisions to their permits triggered by issuance of the new Lake Champlain Total Maximum Daily Load

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 Section 5.4.2 and in Table 5-3 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 and the Village 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 and Village 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 Essex and Essex Junction 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: Improve capabilities of existing road and stormwater management infrastructure										
Action A-1: Stormwater Management	5	5	5	5	4	5	5	5	5	44
Action A-2: Plan for Repair of Vulnerable Infrastructure	4	3	5	3	4	4	3	3	5	34
Action A-3: Erosion Mitigation	5	3	5	3	4	5	4	5	5	39
Action A-4: Fluvial Erosion Hazard Mitigation Implementation	3	3	5	3	4	4	3	3	5	33
CATEGORY B: Implement Flow Restoration Projects										
Action B-1: Mitigate impacts of runoff such as excessive flow, sediment load and excessive	4	4	5	4	5	5	5	4	5	41
Action B-2: Begin implementation of Flow Restoration Plans for Indian Brook and Sunderland Brook.	4	4	4	4	5	5	5	4	5	40
Action B-3: Develop Phosphorus Control Plan	4	3	3	4	4	5	4	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 Essex and Village of Essex Junction Mitigation Actions: Implementation Monitoring Worksheet

<p>CATEGORY A: Improve capabilities of existing road and stormwater management infrastructure to 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: Stormwater Management</u> (Town and Village Public Works)</p>	<p>-note any grants or funding source investigated -note any grants applied for/obtained -note progress on stormwater management projects</p>
<p><u>Action A-2: Plan for Repair of Vulnerable Infrastructure</u> (Town and Village Public Works)</p>	<p>-note progress on repairs and upgrades</p>
<p><u>Action A-3: Erosion Mitigation</u> (Town and Village Public Works)</p>	<p>-note progress on erosion mitigation projects</p>
<p><u>Action A-4: Fluvial Erosion Hazard Mitigation Implementation</u> (Town and Village Public Works, DEC)</p>	<p>-note progress of FEH mitigation projects</p>
<p>CATEGORY B: Operate an effective Stormwater Management System to mitigate Severe Rainstorm 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 	
<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 B-1: Mitigate impacts of runoff such as excessive flow, sediment load and excessive phosphorus discharge.</u> (Town & Village Public Works)</p>	<p>-annual # basins cleaned -annual # street miles swept -note any progress on improvements to zoning bylaws to reduce excess flow, sediment loading or excess phosphorus discharge</p>

<u>Action B-2: Begin implementation of Flow Restoration Plans for Indian Brook and Sunderland Brook</u> (Essex Public Works Director)	-project types and locations and year constructed/installed
<u>Action B-3: Develop Phosphorus Control Plan</u> (Town & Village Public Works)	-progress on development of plan and filing to 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 Essex and Village of Essex Junction 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 table below records the strategies from the 2011 Plan and progress that has been made towards them.

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

Action Primary Responsible Entity	Task	Brief Description	Progress
#1 Maintain Sufficient Emergency Service Capabilities to Address Likely Terrorism Threats			
Police Chief; Essex Junction and Essex Volunteer Fire Chiefs	Maintain and Improve Capabilities	Maintain adequate levels of planning, staffing, training and equipment to mitigate against terrorism threats. Coordinate planning and training activities with State resources and with those of other Chittenden County municipalities.	Maintaining a sufficient number of volunteers is a challenge for both departments, especially for calls during business hours. The Essex Junction Fire Department feels prepared for such an issue, but the Essex Fire Department is concerned about their ability to act as first responders. The Essex Fire Department is also concerned about having the correct equipment and an adequate water supply to meet the needs of the growing number of larger and taller buildings in the town. The Essex Police Chief feels that there are sufficient levels of planning and personnel to address a terrorist threat. The department hopes to hire more officers.
Police Chief; Essex Junction and Essex Volunteer Fire Chiefs	Maintain Data and Mobile Technology	Continue to review and update data, and continue to implement mobile technology so that data can be readily accessed in the field in the case of an emergency.	The Essex Junction Fire Department received a grant from the VDEMHS to provide all personnel with digital portable radios. The Department recently bought 4 iPads equipped with cellular data capabilities so that personnel can quickly look up data and pre-plans when responding to calls.

			<p>The Essex Fire Department recently upgraded to a cloud system for their data and files. They do not have mobile access at this time, but could easily convert to mobile access.</p> <p>All police vehicles are now equipped with GPS units with current position information available to dispatchers and supervisors.</p> <p>Carrier service is available to Essex and Essex Junction municipal personnel during emergencies, with radio backup. However, coverage is not consistent and data service is not available in all parts of Essex Town. Narrow radio banding requirements can also cause radio deficiencies.</p> <p>In 2014 the Essex Police Department updated their devices for accessing mobile data.</p>
#2 Maintain and improve capabilities of existing and potential public shelters			
Emergency Management Director	Confirm Existing Shelter Capability	Confirm capabilities of existing shelters, maintain and improve upon if needed.	The Essex Alliance Church serves as the primary shelter, but does not have a generator. The church is moving to a new building in Williston, and it is unclear whether their current building will stay as a shelter. If the church is no longer available as the primary shelter, that role will be assumed by either the Champlain Valley Expo or the Essex High School. However, while personnel at the Alliance Church have received Red Cross training, personnel at the school and expo have not. This would need to be remedied.
Emergency Management Director	Investigate Alternate Shelters	Investigate capabilities of other buildings sufficient to serve as smaller shelters.	The Essex Junction Village Office, local schools and the Champlain Valley Expo are all available for use as secondary shelters, depending on their event schedules. None of the possible secondary shelters have generators.
#3 Ensure town and school emergency plans are fully coordinated; maintain operation of a School Safety Committee.			
Essex Fire Chief; Essex Junction Fire Chief, Emergency Management Director	Joint Study of Staffing Needs	Conduct a joint study of the firefighting staff needed to maintain adequate service in the growing communities.	Both departments evaluate their staffing needs often and express the need for more members. Any discussion of staff changes will involve the Town and Village Manager. There are no plans for more full-time staff in the Essex Junction or Essex Fire Departments due to budgetary constraints.
#4 Examine current and future staffing needs for fire departments to ensure adequate fire protection in the Town and Village.			
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.

#5 Raise public awareness of hazards, hazard mitigation and disaster preparedness

<p>Police Department Chief; Essex Fire Chief, Essex Junction Fire Chief</p>	<p>School Programs</p>	<p>Continue school programs to raise student awareness of hazards, safety, preparedness and prevention.</p>	<p>Both departments make annual presentations to elementary school students about fire safety. Fire extinguisher training is available for students at the Essex Center for Technology. The Essex Fire Department also holds a student art contest for their Fire Safety Calendar.</p> <p>The Essex Police Department gives school safety presentations, especially focused on preventing substance abuse.</p>
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