TOWN OF CHARLOTTE, Vermont
2017 All-Hazards Mitigation Plan

Annex 4
to the
2017 Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan

Prepared by:

The Chittenden County Regional Planning Commission

and the

Town of Charlotte, Vermont

Adopted by the Town of Charlotte Selectboard on December 11, 2017

Approved by FEMA on December 28, 2017

U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

DEC 2 8 2017

Lauren Oates
State Hazard Mitigation Officer
Vermont Department of Public Safety
45 State Drive
Waterbury, Vermont 05671-1300

Dear Ms. Oates:

We would like to acknowledge the participating jurisdictions and the State of Vermont for their dedication and commitment to mitigation planning. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I Mitigation Planning Team has completed its review of the 2017 Chittenden County, Vermont Multi-Jurisdictional All-Hazards Mitigation Plan and determined it meets the requirements of 44 C.F.R. Pt. 201. This plan approval includes the following participating jurisdictions that provided a copy of their resolution adopting the plan. The newly approved jurisdiction is highlighted in **bold.**

Bolton	Buel's Gore	Burlington	**Charlotte**
Colchester	Essex Town	Essex Junction Village	Hinesburg
Huntington	Jericho	Milton	Richmond
Saint George	Shelburne	South Burlington	Underhill
Westford	Williston	Winooski	

With this plan approval, the communities above are eligible to apply to the Vermont Division of Emergency Management & Homeland Security for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at http://www.fema.gov/national-flood-insurance-program-community-rating-system, or through your local floodplain administrator.

DEC 2 8 2017

The 2017 Chittenden County, Vermont Multi-Jurisdictional All-Hazards Mitigation Plan must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of March 6, 2017** in order to maintain eligibility for mitigation grant funding. We encourage Chittenden County Regional Planning Commission communities to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Josiah "Jay" Neiderbach at (617) 832-4926.

Sincerely,

Mark F. Gallagher for

Paul F. Ford
Acting Regional Administrator

PFF: jn

cc: Ben Rose, Recovery and Mitigation Section Chief, VT DEMHS
Stephanie Smith, Hazard Mitigation Planner, VT DEMHS

Enclosure

CERTIFICATE OF ADOPTION
Date: 12/11/17

TOWN OF CHARLOTTE VERMONT SELECTBOARD
A RESOLUTION ADOPTING THE 2017 Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan and Annex #4, the 2017 Town of Charlotte All-Hazards Mitigation Plan (Plan).

WHEREAS, the Town of Charlotte has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **2017 Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan and Annex #4, the 2017 Town of Charlotte All-Hazards Mitigation Plan** which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Charlotte has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for **the 2017 Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan and Annex #4, the Town of Charlotte All-Hazards Mitigation Plan (Plan)** under the requirements of *44 CFR 201.6;* and

WHEREAS, the **Plan** specifically addresses hazard mitigation strategies, and Plan maintenance procedures for the Town of Charlotte; and

WHEREAS, the **Plan** recommends several hazard mitigation actions (projects) that will provide mitigation for specific natural hazards that impact the Town of Charlotte with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this **Plan** will make the Town of Charlotte eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Town of Charlotte Selectboard:

1. The **2017 Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan and Annex #4, the 2017 Town of Charlotte All-Hazards Mitigation Plan (Plan)** is hereby adopted as an official plan of the Town of Charlotte;

2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;

3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution; and

4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Charlotte this 12 day of DEC 2017.

Selectboard Chair

Selectboard Member

ATTEST Mary A. Mead
Town Clerk

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 Charlotte;
- 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 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 most significant identified hazards for Charlotte are:

The top three Hazards by type with the most risk in Charlotte are:

Natural Hazards:	Severe Winter Storm, Flooding, Fluvial Erosion, High winds
Technological Hazards	Pollution, Hazardous Materials Incident, Power Loss
Societal Hazards	Economic Crisis, Terrorism, Epidemic

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 2017 Charlotte Town Plan that support hazard mitigation. This is followed by an analysis of existing municipal actions that support hazard mitigation, such as planning and zoning, and public works. This section presents the following municipal all-hazards mitigation goals:

1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
3) Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan and as identified generally in the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan.
4) Recognize the benefits and efficiencies of inter-town hazard mitigation planning, data collection and actions.
5) 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.
6) Maintain existing municipal plans, programs, regulations, bylaws and ordinances that directly or indirectly support hazard mitigation.
7) 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.
8) 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.
9) Work with partners and neighboring towns on hazard mitigation planning, education and improvement measures.

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

Category A: Improve Existing Road and Stormwater Management Infrastructure to mitigate against Severe Rainstorms and Fluvial Erosion

- Action A-1: Culvert and Stormwater Infrastructure Upgrades
- Action A-2: Improve road drainage

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

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

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

Table of Contents

Executive Summary ..... **i**

List of Tables ..... **iv**

List of Figures ..... **vi**

SECTION 1: INTRODUCTION AND PURPOSE **1**

1.1 Purpose and Scope of this Plan **1**

1.2 Hazard Mitigation **1**

1.3 Hazard Mitigation Planning Required by the Federal Disaster Mitigation Act of 2000 ..... **1**

1.4 Benefits **2**

1.5 All-Hazards Mitigation Plan Goals **2**

1.6 Town of Charlotte: Demographics and Development Characteristics **3**

1.7 Summary of Planning Process **5**

1.7.1 Planning and Development of the 2017 Charlotte All-Hazards Mitigation Plan 5
1.7.2 Opportunities for involvement in the planning process and formal public review and governing body approval 6
1.7.3 Submission of drafts to VDEMHS and FEMA for Review and final adoption process 7
1.7.4. Monitoring, Evaluation and Updating of the Plan 8

SECTION 2: HAZARD IDENTIFICATION **9**

2.1.1 Profiled Hazards 9

SECTION 3: RISK ASSESSMENT **15**

3.1 Mapped Hazard Areas **15**

3.1.1 Flood Hazard Areas 15
3.1.2 Fluvial Erosion Hazard and River Corridor Areas 16
3.1.3 Repetitive Loss Properties and National Flood Insurance Program 17

3.2 Other Information **18**

3.2.1 1998 Ice Storm Damage 18
3.2.2 Severe Rainstorms 18
3.2.3 High Crash Locations 18
3.2.4 Road Infrastructure Failure 19
3.2.5 Hazardous Substances 19
3.2.6 Rail Incident 20
3.2.7 Ice Jams 20

3.3 Previous FEMA-Declared Natural Disasters and Snow Emergencies **20**

3.3.1 Public Assistance 20
3.3.2 Individual Assistance Funds 21

3.4 Future Events 22

3.4.1 Natural Hazards 23
3.4.2 Technological Hazards 25
3.4.3 Societal Hazards 26
3.4.4 Hazard Summary 29

SECTION 4: VULNERABILITY ASSESSMENT 30

4.1 Critical Facilities 33

4.2 Infrastructure 33

4.2.1 Town Highways 33
4.2.2 Bridges, Culverts, and Dams 35
4.2.3 Water, Wastewater and Natural Gas Service Areas 38
4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines 38

4.3 Estimating Potential Losses in Designated Hazard Areas. 38

4.4 Vulnerable Populations 38

4.5 Land Use and Development Trends Related to Mitigation 39

4.5.1 Conserved or Undevelopable Parcels 40
4.5.2 Recent and Future Development 41

SECTION 5: MITIGATION STRATEGY 42

5.1 Existing 2016 Charlotte Town Plan Policies That Support Hazard Mitigation 42

5.2 Existing Town of Charlotte Actions that Support Hazard Mitigation 46

5.3 Town of Charlotte All-Hazards Mitigation Goals 48

5.4 Mitigation Actions 49

5.4.1 Current Capabilities and Need for Mitigation Actions 53
5.4.2 Specific Mitigation Actions 57
5.4.3 Prioritization of Mitigation Strategies 58

5.5 Implementation and Monitoring of Mitigation Strategies 60

List of Tables

Table 1-1 Town of Charlotte, selected population characteristics, 2010 3

Table 1-2 Town of Charlotte, selected housing unit data, 2010 Census 4

Table 1-3 Town of Charlotte, Historic Population Trends 4

Table 3-1 High Crash Locations 18

Table 3-2 Town of Charlotte, hazardous material or fuel storage sites 19

Table 3-3 Town of Charlotte, FEMA-declared disasters and snow emergencies, 1990-2016. 20

Table 3-4 Town of Charlotte, location of individual assistance claims, 2011 disasters 21

Table 3-5 Natural hazards risk estimation matrix, Charlotte 24

Table 3-6 Technological hazards risk estimation matrix, Charlotte 26

Table 3-7 Societal hazards risk estimation matrix, Charlotte 28

Table 4-1 Town of Charlotte: Natural Hazards and typical vulnerabilities 30

Table 4-2 Town of Charlotte: Technological Hazards and typical vulnerabilities 31

Table 4-3 Town of Charlotte: Societal Hazards and typical vulnerabilities 32

Table 4-4 Critical facilities in the Town of Charlotte 33

Table 4-5 Town highway mileage by class, Town of Charlotte 34

Table 4-6 Town highway mileage by surface type, Town of Charlotte 34

Table 4-7 Bridges located in SFHA and RCPA 35

Table 4-9 Culverts with a geomorphic compatibility rating of "Mostly Incompatible" or "Incompatible" 37

Table 4-10 Dams located in the Town of Charlotte 37

Table 4-11 Vulnerable populations, Charlotte 39

Table 4-12 Structures compared to zoning, Town of Charlotte 40

Table 4-13 Conserved Land, Town of Charlotte 41

Table 5-1 Existing municipal actions that support hazard mitigation, Town of Charlotte . 46

Table 5-2 Existing municipal emergency services & plans, Town of Charlotte 48

Table 5-3 Charlotte All-Hazards Mitigation Plan, Progress on 2011 Strategies 50

Table 5-4 Town of Charlotte: Capabilities to address vulnerabilities from natural hazards 53

Table 5-5 Town of Charlotte: Capabilities to address vulnerabilities from technological hazards 54

Table 5-6 Town of Charlotte: Capabilities to address vulnerabilities from societal hazards 55

Table 5-7 Charlotte action evaluation and prioritization matrix 60

Table 5-8 Town of Charlotte Mitigation Actions: Implementation Monitoring Worksheet 60

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

List of Figures

Figure 1.1 Geography, Town of Charlotte……...Appendix

Figure 1.2 Housing and Employment, Town of Charlotte ……..……Appendix

Figure 1.3 Future Land Use, Town of Charlotte ……...……...Appendix

Figure 1.4 Critical Facilities, Town of Charlotte …….…….Appendix

Figure 2.1 River Corridors and Floodplains, Town of Charlotte ……..…..Appendix

Figure 3.1 FEMA Public Assistance Projects, Town of Charlotte ……....Appendix

Figure 3.1.1 FEMA Individual Assistance locations, Town of Charlotte.……...Appendix

Figure 3.2 Stormwater Management, Town of Charlotte …….……..Appendix

Figure 3.3 Lake Champlain daily water levels at Burlington, VT 1907-2015……..16

Figure 4.1 Vulnerable Populations, Town of Charlotte ……...……...Appendix

Figure 4.2 Land Development Trends, Town of Charlotte …….....Appendix

SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

The purpose of this Local All-Hazards Mitigation Plan is to assist the Town of Charlotte 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 Charlotte. Community planning can aid in significantly reducing the impact of potential 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 *2007 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, Response and Recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where they are, where they are most severe and to identify actions that can 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 Federal 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 must have an approved local mitigation plan prior to the approval of a local mitigation project funded through federal Pre-Disaster Mitigation funds. Furthermore, the State of Vermont is required to adopt a State Pre-Disaster Mitigation Plan 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. PDM funding can be used for projects that reduce risk from hazards to people, structures, and infrastructure.
- 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% - 12.5% of the total cost. (cf. http://floodready.vermont.gov/find_funding/emergency_relief_assistance)

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.
- Facilitate the receipt and effective use 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 the Town's fiscal 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 businesses 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 prospective damage to public infrastructure resulting from all hazards and work to incorporate hazard mitigation planning into regional land use and transportation planning program conducted by the Chittenden County Regional Planning Commission.
7) Maintain existing mechanisms or develop additional processes to foster regional cooperation in hazard mitigation, specifically, and emergency management planning, generally.

1.6 Town of Charlotte: Demographics and Development Characteristics

The Town of Charlotte *(cf. Figure-1.1*) is located in the southwestern corner of Chittenden County. Charlotte is bounded on the west by Lake Champlain, on the south by Ferrisburgh and Monkton (both in Addison County), on the east by Hinesburg and on the north by Shelburne. The town encompasses 41.36 square miles.

Based on U.S. Census data, the University of Vermont's Center for Rural Studies reports a municipal population of 3,754 people in 2010. Selected population characteristics are as follows:

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

Category	Number	%
Total Population	3,754	--
Median Age	44.8 years	--
Population age 65 years and over	438	11.7
Population (and %) under 10 years old	530	11.4
Population (and %) in group quarters*	0	0.0

U.S. Census Bureau, 2010 Census of Population and Housing, Population and Housing Unit Counts
** A group quarters is a place where people live or stay, in a group living arrangement, that is owned or managed by an entity or organization providing housing and/or services for the residents.*

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

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

Category	Number	%
Total Housing Units	1,706	--
Occupied housing units	1,419	83.2
Vacant housing units	287	16.8
Vacant housing units used for seasonal, recreational or occasional use	238	14
Detached 1-unit housing units	1,326	88.9
Housing units with 5 or more units in structure	0	0.0
Mobile homes	28	1.9
Housing structures built in 1939 or earlier	334	22.4

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

The concentration of residential and commercial development in Charlotte is shown in *(cf. Figure 1.2)*, The population is distributed relatively evenly throughout the town, with denser concentrations along Greenbush Road, Ferry Road, Church Hill Road, Mount Philo Road, Spear Street and Dorset Street. With the exception of limited commercial development and municipal buildings along Ferry Road, and smaller preexisting residential lots at the East and West Village locations, the predominant use of the landscape in Charlotte is for large-lot (5+ acres) residential development and agriculture. With regard to other land uses, town zoning is depicted in *Figure 1.3.*

Population trends for the town are as follows:

Table 1-3 Town of Charlotte, Historic Population Trends

Year	Population
1960	1271
1970	1802
1980	2561
1990	3148
2000	3569
2010	3754
2014	3856

April 1 census counts 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-Jurisditional 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 Planning and Development of the 2017 Charlotte All-Hazards Mitigation Plan

In September 2015, CCRPC staff met with Town Administrator Dean Bloch, Selectboard members Fritz Tegatz and Lane Morrison, Fire Chief/EMD Chris Davis, then-Town Planner Jeannine McCrumb, and Road Commissioner Hugh Lewis, Jr. to describe the overall process for updating this plan.

In November and December of 2015, CCRPC staff gathered updated data for the tables and in-text factual information. The availability of GIS data for updated maps was also assessed at this time.

In addition, the following materials were reviewed:

- 2016 Charlotte Town Plan
- Town of Charlotte Zoning Bylaw
- FEMA information on prior disasters
- Information from the Vermont Agency of Transportation on town roads, bridges, culverts, and high crash locations
- Information from the Vermont Department of Emergency Management and Homeland Security on prior disaster and hazardous materials reporting.
- Fluvial erosion hazard studies

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 staff to review for accuracy and conferred with these same staff regularly via phone and email. CCRPC staff produced new versions of the 2011 maps and also produced new maps desired in this 2017 update.

Based on information from the County plan, the updated tables, and input from town officials, CCRPC staff drafted an update to the text of the Charlotte annex in March 2017. All sections of the annex were updated. CCRPC staff contacted the following officials to fill in remaining data gaps:

- Dean Bloch, Town Administrator

- Hugh Lewis, Jr., Road Commissioner

A draft final Plan was submitted to Dean Bloch, the Town administrator on August 30, 2017 for distribution to relevant staff and Town board/commission members for comment.

Dan Albrecht, CCRPC Senior Planner presented this Plan at a public meeting of the Town's Planning Commission on September 7, 2017. Mr. Albrecht incorporated edits suggested by Commission members as well as others provided by Mr. Bloch and then circulated a draft back to him for distribution.

The draft Plan was reviewed and approved for submission by the Town of Charlotte Selectboard on September 25, 2017 and then submitted to VDEMHS and FEMA as noted in Section 1.7.3 below.

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

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

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

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

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

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

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

On June 3, 2016, the first draft of the Plan 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 and formal submissions to VDEMHS and FEMA then progressed as follows:

On September 27, 2017, the revised final draft annex was submitted to VDEMHS for review and forwarding to FEMA for formal review and approval pending municipal adoption

On November 9, 2017 FEMA Region One issued a notice that the Town of Charlotte's AHMP was approved pending adoption by the relevant municipal governing body.

On November 17, 2017 CCRPC staff provided the final versions of the Multi-Jurisdictional Plan and this Municipal Annex to the Town Administrator for distribution to the Town of Charlotte Selectboard members and also provided draft language for a resolution of adoption to be discussed at a regularly scheduled and properly warned Town of Charlotte Selectboard meeting

On December 11, 2017 the revised annex was adopted by the Selectboard and a copy of the resolution sent to VDEMHS and FEMA Region One on December 18, 2017.

On December 28, 2017 FEMA issued a letter that the Town of Charlotte's Plan was formally 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 Charlotte will:

- in the fall of 2017 and each fall thereafter, the municipal departments as noted in Section 5.5 at the conclusion of this document shall respond to CCRPC's questionnaire seeking information on the status (progress, problems if any, etc.) of each identified mitigation strategy detailed in Section 5;
- in the fall of 2018 and the fall of 2020, provide information to aid CCRPC in its more comprehensive review of the Multi-Jurisdictional AHMP and this local AHMP which will address issues such as goals, risks, resources, implementation problems, and partners; in partnership with the municipalities, the CCRPC will make the public aware of the availability of these review documents (via press releases, posting on the CCRPC website, electronic newsletters, one formal announcement in a paper of general circulation in the County, and other mechanisms) and provide detailed instructions on how to provide comment on these reviews;
- provide at least one representative of the municipality to participate as a member of the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan Update and Review Committee which, after the current Plan update process is completed, to resume meeting in 2018; and
- participate in the Plan update process assumed to commence in 2020 and conclude by early 2022.

Finally, it should be reemphasized that the Town of Charlotte 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 five-year life cycle of their single jurisdiction plan.

SECTION 2: HAZARD IDENTIFICATION

Detailed descriptions of the natural, technological, and societal hazards affecting the municipalities of Chittenden County are included in Section 2 of the Multi-Jurisdictional All-Hazards Mitigation Plan (MJAHMP). 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*. A few of the hazards identified in the multi-jurisdictional AHMP are presented in more detail in this municipal annex.

2.1.1 Profiled Hazards

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

Hazard (Section of MJAHMP 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 U.S. Army Corps of Engineers for Lake Champlain. Consistent and long-term data on Lake Champlain water levels are maintained at Burlington. *See Figure 3.2 below*	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 in area. Likewise, while there are likely other systematic point-specific records being collected by individuals, business or organizations these data do not appear to be easily accessible. Finally, even if such data were accessible, only if the data was collected by mutually compatible means would it be useful.*

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

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

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

Hazard (section of MJAHMP where discussed)	**Are Location data Available?**	**Are Extent data available?**	**Are Impact data available?**
Water Pollution	Impaired streams that lack adequate biota are identified.	Phosphorus-loading for general locations is known but non-point sources are varied and dispersed. A road erosion inventory was performed in 2017 but data analysis is not yet complete and projects have not yet been prioritized or scoped.	Annual budgetary impacts to individual municipalities are significant but vary depending upon location and whether they are designated community subject to the requirements of a Vermont DEC issued Municipal Separate Storm Sewer permit. Charlotte is not an MS-4 permit. However, the municipality is subject to the requirements of DEC's Municipal Roads General Permit scheduled to be issued in late 2017
Hazardous Materials Incident (2.2.2)	Storage locations are known. Incidents occurring during transportation could occur anywhere.	Rough estimates of spill amounts are recorded.	No formal data readily available on cleanup costs.
Power Loss (2.2.3)	Outage locations not mapped	During an actual outage, some data is recorded on duration although typically this is stated as "x,000 customers within the power company's service area".	Outage data is broad and refers to total customers within a county.
Invasive Species (2.2.4)	Several species known to but no systematic mapping	No formal damage has been documented to date	No formal damage has been documented to date

	has taken place.		
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)	There are public water systems in some areas, but no municipal systems; all areas use private wells or lake water.	Data not formally collated across agencies	Data not formally collated across agencies
Sewer Service Loss (2.2.8)	The Town has two small municipal systems, one serving seasonal residences camps at Thompson Point, and the other serving the Tow office and library on Ferry Road.Private businesses and homesuse private septic systems.	Data not formally collated across agencies	Data not formally collated across agencies
Natural Gas Service Loss (2.2.9)	Natural gas service is not available in Charlotte at this time.	Not applicable	Not applicable.
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	No formal loss of service has been documented.	No formal damage has been documented to date

	mapped nor publicly available.		

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

According to the Charlotte Town Plan, portions of the shoreline of the following areas have been designated flood hazard areas, based upon the FEMA 100-year floodplain data: Lewis Creek. Flood inundation data are in the process of being updated, however, and designated flood hazard areas may change. In the current data, some of the town's flood hazard areas are not mapped, including the flood hazard area of the LaPlatte River. The update of the floodplain data does not address this problem. As a result, significant flood hazard risks may remain in areas that are currently not covered by the NFIP (National Flood Insurance Program). Steps may be taken on the municipal level to define flood hazard areas for the LaPlatte River. Individual residences are the most common building type located in the floodplain, particularly older homes and vacation "camps" built prior to the implementation of local zoning bylaws and the National Flood Insurance Program. The Town is participating in NFIP as of September 2017, and thus limits/regulates development in these hazard zones.

A simple GIS intersection analysis reveals that portions of town roads are located within the mapped 100-year floodplain associated with Lewis Creek, as are culverts, bridges, and utility poles. Unfortunately, this level of analysis does not take into account the additional risk of flooding due to fluvial geomorphology (volume, velocity, direction, etc.) nor, more importantly, does it factor in the elevation of the road relative to flood elevation. Analysis also reveals farmland located in the floodplain. Without accurate detailed studies, it is not currently possible to predict how many cubic yards of productive soils would potentially be lost during a flood event.

Figure 2.1 shows the current extent of the FEMA-FIRM flood hazard area in Charlotte, mostly near the mouth of Lewis Creek.

The Base Flood Elevation of Lake Champlain established by FEMA is 102.0 feet while flood stage established by the National Weather Service is 100 ft. These stages are defined as follows:

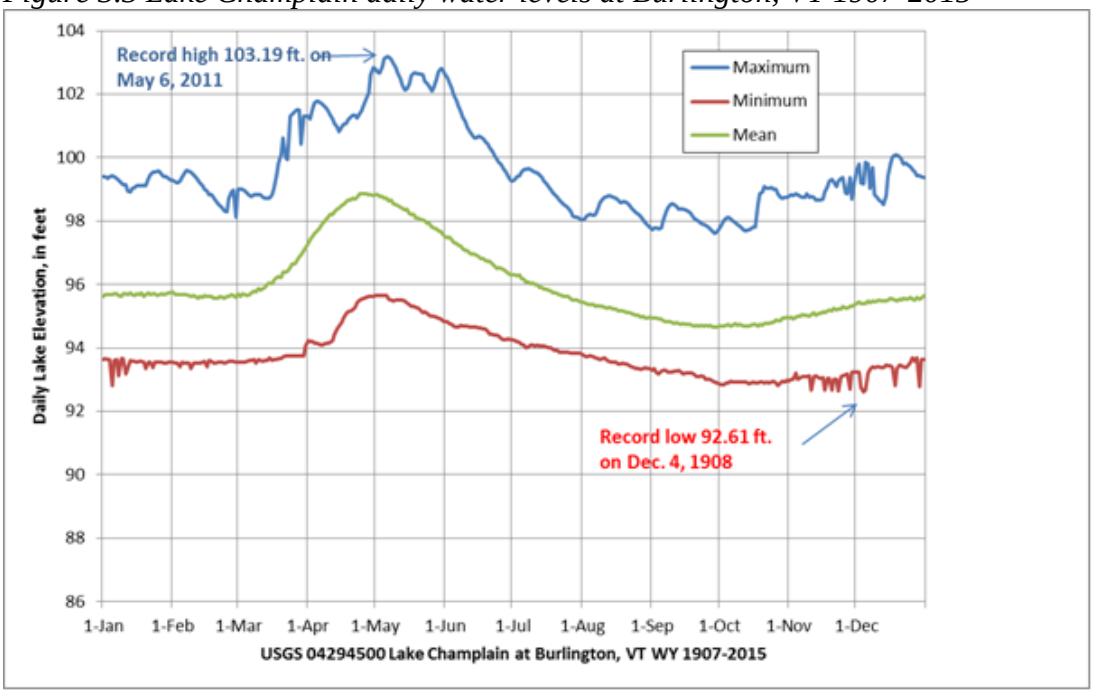
100 ft. Water begins to enter some lake front properties. Water also begins to threaten low lying roads, piers, and docks. Wave action can compound flooding on windward facing shorelines.

101. Flooding becomes serious, and wave erosion on windward shores becomes a problem. If lake ice is present, structural damage can occur.

102 ft. Severe flooding occurs, with widespread inundation of lake side properties, and closure of low lying roads.

The following graph shows the water levels measured along the Burlington waterfront over the last 100+ years.

Figure 3.3 Lake Champlain daily water levels at Burlington, VT 1907-2015



The winter of 2015-2016 experienced relatively little snowfall and the summer of 2016 (as of July 31, 2016) has been relatively dry in terms of rainfall. Water levels in Lake Champlain dropped quite low in the fall of 2016 almost matching the record low of 1908 with a peak trough of 93.26 ft. on both October 16th and October 17th before climbing back to 94 ft. on October 31st.

3.1.2 Fluvial Erosion Hazard and River Corridor Areas

During development and adoption of both the 2005 and 2011 Multi-Jurisdictional Plan and the County and 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 hazard. ANR now identifies and maps:

- *River Corridor* which is the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in 10 V.S.A. §1422, and for minimization of fluvial erosion hazards, as delineated by the Agency in accordance with the ANR Flood Hazard Area and River Corridor Protection Procedures.
- *River Corridor Protection Area* means the area within a delineated river corridor subject to fluvial erosion that may occur as a river establishes and maintains the dimensions, pattern, and profile associated with its dynamic equilibrium condition and that would represent a hazard to life, property, and infrastructure placed within the area. The river corridor protection area is the meander belt portion of the river corridor without an additional allowance for a riparian buffer to serve the functions of bank stability and slowing flood water velocities in the near-bank region.

Geomorphic assessments have been completed for most of the streams that run through Charlotte. Fluvial erosion hazard areas have been initially mapped for some of these waterways. Sections of the LaPlatte River, Mud Hollow Brook, Thorp Brook, Lewis Creek, Holmes Creek, Pringle Brook and Kimball Brook have been identified as having fluvial erosion hazard areas. Fluvial erosion data have been largely completed for the LaPlatte River and Lewis Creek, and River Corridor Management Plans have been created for these waterways. A previous Lewis Creek bank stabilization project is causing erosion hazards and potential safety issues near Covered Bridge #29, the Quinlan Bridge.

Town officials and community partners also note that there are areas along some streams where erosion hazards may impact residential dwellings and road infrastructure. *Figure 2.1* shows the identified fluvial erosion hazard areas (now termed River Corridor Protection Areas or River Corridors) in Charlotte. However, structures and infrastructure in the fluvial erosion hazard Areas along the LaPlatte River and Lewis Creek are identified in the River Corridor Plans for those waterways.

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, no such properties are located in the Town of Charlotte.

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

Initial Flood Hazard Boundary Map	Initial Flood Insurance Rate Map	Current effective Map Date	Date of joining Regular NFIP	Date of most recent Community Assistance Visit
01/03/75	09/03/80	07/18/11	09/03/80	12/03/91

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

3.2 Other Information

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

3.2.1 1998 Ice Storm Damage

Due to their aspect to Lake Champlain and the presence of forested cover, areas hardest hit during this event were Mt. Philo State Park, Mutton Hill, Lewis Creek Road, West Charlotte Village and Pease Mountain.

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 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, Fluvial Erosion Hazard Area, or River Corridor. This was the case in more recent FEMA-declared disasters in the summers of 2013 and 2015. Because of this new information, CCRPC has decided to add "Thunderstorm" to the 2016 Update to the County Plan and its annexed local AHMPs. While past damage locations can sometimes be mapped (depending upon the degree and accuracy of data collection efforts), they may or may not provide any degree of predictability of the potential locations for future events.

High Winds and Lightning Ridgeline and hilltop homes as well as homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. The Lake Champlain shoreline is also subject to high winds. According to the National Climatic Data Center, lightning has struck and damaged structures in Charlotte once since 1995, although local officials indicate that many more lightning incidents have occurred in that timeframe. Eight high wind events have been specifically identified as affecting Charlotte by the National Climatic Data Center since 1990, though, as with lightning, local officials indicate that there are numerous unrecorded high wind incidents.

3.2.3 High Crash Locations

Table 3-1 High Crash Locations

Road	Road Type	Section (miles)	Severity Index ($/crash)
US-7, FAS 0208, TOWN ROAD 0003	Principal Arterial (r)/Major Collector (r)	3.360 - 3.520	$31,982
US-7, FAS 0208, TOWN ROAD 0003	Principal Arterial (r)/Major Collector (r)	3.360 - 3.520	$22,559

Source: VTrans

Municipal officials have also expressed concern with the intersection at Hinesburg Road and Mt. Philo Road.

3.2.4 Road Infrastructure Failure

Of the three bridges inventoried by VTrans for Charlotte, none are rated Scour Critical with regards to fluvial undermining of bridge structure. *(A rating of Scour Critical can be assigned for the following reasons: a)bridge foundations determined to be unstable for calculated scour conditions; b) field review indicates that extensive scour has occurred at bridge foundations; c) field review indicates that failure of piers/abutments is imminent and d) bridge has failed and is closed to traffic.)* However, municipal officials indicate that some bridges, particularly those over Lewis Creek, are at risk to damage due to fluvial erosion and ice jams. Similarly, several sections of Roscoe Road along Lewis Creek are at risk to flooding and fluvial erosion damage. Details on the bridges in the town are found in *Table 4-4*.

Some of the most vulnerable infrastructure are road culverts. For a listing of culverts identified as "geomorphically-incompatible" either due to inadequate size or improper alignment, see Section 4.2.2.

3.2.5 Hazardous Substances

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

According to recent hazardous materials data obtained from VEM, the following sites in Charlotte stored either fuel in excess of 10,000 lbs or extremely hazardous substances (note that one site can be listed several times due to the nature of the electronic records available):

Table 3-2 Town of Charlotte, hazardous material or fuel storage sites

Owner / Facility	**Type of Substance**
Point Bay Marina	GASOLINE
Point Bay Marina	Diesel Fuel
RCC - CHARLOTTE ATC	LEAD ACID BATTERIES
RCC - CRABBE	LEAD ACID BATTERIES
RCC - CRABBE - USID102876	LEAD
S. B. Collins, Inc. - (Spears Store) -Charlotte	FUELS, GASOLINE
Steve Citgo (station now closed but tanks still present)	Diesel Fuel
Steve Citgo (station now closed but tanks still present)	Gasoline
VELCO CHARLOTTE SUBSTATION	BATTERY LEAD
VELCO CHARLOTTE SUBSTATION	MINERAL OIL
VELCO CHARLOTTE SUBSTATION	BATTERY ACID
VELCO CHARLOTTE SUBSTATION	SULFUR HEXAFLUORIDE
Verizon Wireless Charlotte, VT (ID:55223)	Sulfuric acid

Source: Vermont Emergency Management

3.2.6 Rail Incident

A rail line runs through Charlotte, where it crosses three town roads and numerous private and agricultural roads. Only one of the public road crossings is currently gated, and none of the private crossings have gates or signs. Since the 1960s, there have been at least three collisions between a car and a train at these crossings. Notably, the State is currently installing a gate on Town Line Road at the railroad crossing.

As of Fall 2017, municipal officials remained concerned about the possibility of a vehicle/train collision causing a derailment and potentially a hazardous materials incident. municipal officials are very concerned about hazardous materials transported by freight trains (or stored on the rail siding) along the rail line that runs through Charlotte. Given serious railway incidents that have occurred in recent years elsewhere in North America, as well as the proximity of the rail line to essential community facilities (Town Hall, Senior Center, Library, Fire Station, electrical substation, the Town's ability to respond to an emergency incident on the rail line may be seriously compromised). The magnitude of any such event would rapidly also overwhelm regional capacity to respond to, manage, and extinguish. Officials are also concerned about fuel storage on farms in close proximity to waterways.

This issue is also explored in Section 2.2.6 of the Chittenden County Multi-Jurisdictional All Hazards Mitigation Plan, as it is also of concern in other municipalities, not just in Charlotte.

3.2.7 Ice Jams

While Charlotte is not necessarily at greater risk for ice jams than other parts of the county, municipal officials and community partners are concerned about the effect of ice jams on bridges and other infrastructure, particularly along Lewis Creek. Inundation from ice jams can damage or destroy road or stormwater infrastructure in addition to jeopardizing structures. Officials are also concerned that the sheer volume of ice moving downstream in an ice jam could damage or destroy bridges, particularly some of the more vulnerable covered bridges in the municipality.

3.3 Previous FEMA-Declared Natural Disasters and Snow Emergencies

3.3.1 Public Assistance

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

Table 3-3 Town of Charlotte, FEMA-declared disasters and snow emergencies, 1990-2016.

Date (FEMA ID#)	Type of Event	Total Repair Estimates
April 1993 (DR 990)	flooding	$5,208
January 1996 (DR 1101)	windstorm	$7,647
January 1998 (DR 1201)	ice storm	$149,603
April 2001 (EM3167)	snow emergency	$11,500

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 Charlotte was reimbursed at a rate of 75 percent by FEMA for the estimated repair costs coupled with additional dollars from the State's Emergency Relief Assistance Fund (ERAF), typically averaging 12.5%. Funds provided in response to these natural disasters were used as follows:

- April 1993: General road repairs and gravel, especially along Roscoe Road and Spear Street Extension. Also, bank stabilization along Lewis Creek.
- January 1996: Debris removal and cleanup expenses from microburst windstorm that moved from west to east beginning at Thompson's Point and extending to Prindle Road.
- January 1998: Widespread debris removal from effects of ice storm.
- April 2001: Increased contractual costs for snow removal.

See *Figure* 3.1. to see locations where repairs funded in part with FEMA Public Assistance took place for disasters between 2001 and 2015. Note, however, that no formal Federally-declared disasters occurred in Charlotte for damage to municipal infrastructure during that time frame however some assistance was provided to the Vermont State Parks for damage at Mount Philo State Park

3.3.2 Individual Assistance Funds

As noted in Section 3.3 of the Multi-Jurisdictional Plan, due to privacy concerns, the individual homes or businesses which received Individual Assistance funds are not public information. However, the names of the streets of such homes or businesses from which claims are filed are available, as are the funds provided. With regard to the Town of Charlotte, the following properties are listed in the database, but no financial assistance was apparently needed nor provided.

Table 3-4 Town of Charlotte, location of individual assistance claims, 2011 disasters

Disaster Number	Damaged Address Street	Registrations	IHP Amount
4022	FERRY RD	1	$0.00
4022	LAKE RD	1	$0.00
4022	MUTTON HILL DR	1	$0.00
4022	SPEAR ST	1	$0.00
1995	CONVERSE BAY RD	1	$0.00
1995	MOON RD	1	$0.00
1995	N SHORE RD	1	$0.00
1995	THOMPSONS POINT RD	1	$0.00

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 early 2016. This analysis assigns numerical values to a hazard's affected area, expected consequences, and probability. This quantification allows direct comparison of very different kinds of hazards and their effect on the county, and serves as a rough method of identifying which hazards hold the greatest risk. CCRPC staff applied the following scoring system:

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

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

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

Probability of Occurrence (scored 1-5) estimates an anticipated frequency of occurrence.

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

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

Natural Hazards:

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

Technological Hazards:

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

Societal Hazards:

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

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

Natural Hazards: **Technological Hazards:** **Societal Hazards:**

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

3.4.1 Natural Hazards

According to the updated Hazard and Risk Estimation analysis for Charlotte, the following natural hazards received the highest risk ratings out of a possible high score of 80; see Table below:

- Severe Rainstorm (35)
- Severe Winter Storm (24)
- Fluvial Erosion (20)
- Flooding (20)

While flooding is likely to have a significant impact over a smaller area, both severe rainstorms and severe winter storms tend to affect the entire town and are more common, hence the higher rating. The risk of flooding includes risk of ice jams. Charlotte has areas with a high fluvial erosion hazard rating, and town officials are concerned about fluvial erosion issues.

Table 3-5 Natural hazards risk estimation matrix, Charlotte

		Severe Rainstorm	Severe Winter Storm	Fluvial Erosion	Flooding	Extreme Temperatures	Wildfire
Area Impacted							
Key:	0 = No developed area impacted						0
	1 = Less than 25% of developed area impacted		1		1	1	
	2 = Less than 50% of developed area impacted			2			
	3 = Less than 75% of developed area impacted	3					
	4 = Over 75% of developed area impacted						
Consequences							
Health & Safety Consequences							
Key:	0 = No health and safety impact			0	0		0
	1 = Few injuries or illnesses	1	1			1	
	2 = Few fatalities or illnesses						
	3 = Numerous Fatalities						
Property Damage							
Key:	0 = No property damage						
	1 = Few properties destroyed or damaged	1	1	1	1	1	1
	2 = Few destroyed but many damaged						
	2 = Few damaged and many destroyed						
	3 = Many properties destroyed and damaged						
Environmental Damage							
Key:	0 = Little or no environmental 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						
Economic Disruption							
Key:	0 = No economic impact						
	1 = Low direct and/or indirect costs	1		1	1	1	1
	2 = High direct and low indirect costs		2				
	2 = Low direct and high indirect costs						
	3 = High direct and high indirect costs						
Sum of Area & Consequences Scores		***7***	***6***	***5***	***5***	***4***	***3***
Probability of Occurrence							
Key:	1 = Unknown but rare occurrence						
	2 = Unknown but anticipate an occurrence						
	3 = 100 years or less occurrence						
	4 = 25 years or less occurrence		4	4	4	4	4
	5 = Once a year or more occurrence	5					
TOTAL RISK RATING							
	Total Risk Rating =	**35**	**24**	**20**	**20**	**16**	**12**
	Sum of Area & Consequences Scores						
	x Probability of Occurrence						

3.4.2 Technological Hazards

According to the updated Hazard Risk Estimation analysis for Charlotte, the following technological hazards received the highest risk ratings out of a possible high score of 80; see table below:

- Hazardous Materials Incident (40)
- Water Pollution (36)
- Power Loss (35)
- Multi Structure Fire (24)
- Major Transportation Incident (24)
- Telecommunications Failure (24)

As noted previously, there is grave concern about risk for a hazardous materials incident on the rail line, and the lack of local, regional, or state capacity to manage and contain such an incident as has occurred elsewhere on the continent. Transportation incident refers to accidents with a large number of vehicles or boats, rail incidents, or road infrastructure failure. Accidents involving few vehicles are a common occurrence, and tend not to rise to the level of hazard rated here. While large-scale road accidents are not a major concern in Charlotte, the presence of the Lake Champlain ferry and railroad in the town increases the risk of a transportation incident or hazardous materials incident. The town is also concerned that increased incidences of distracted motorists could trigger a major road incident on U.S. Route 7.

Charlotte has limited vulnerability to many technological hazards due to minimal technological infrastructure such as municipal water or sewer services. The town has no private utility gas lines and has a dispersed population, with the exception of the West Village and East Village areas. Water pollution in the form of increased phosphorus runoff into Lake Champlain is of growing concern to the Town due to the increased costs to comply with pending State permits.

Table 3-6 Technological hazards risk estimation matrix, Charlotte

		Hazardous Material Incident	Water Pollution	Power Loss	Multi-Structure Fire	Major Transportation Incident	Telecommunications Failure	Sewer Service Loss	Water Service Loss	Invasive Species	Other Fuel Service Loss	Gas Service Loss
Area Impacted												
Key:	0 = No developed area impacted								0	0		0
	1 = Less than 25% of developed area impacted				1	1		1			1	
	2 = Less than 50% of developed area impacted	2	2									
	3 = Less than 75% of developed area impacted			3			3					
	4 = Over 75% of developed area impacted											
Consequences												
Health & Safety Consequences												
Key:	0 = No health and safety impact											0
	1 = Few injuries or illnesses		1	1			1	1	1	1	1	
	2 = Few fatalities or illnesses	2			2	2						
	3 = Numerous Fatalities											
Property Damage												
Key:	0 = No property damage						0		0	0		0
	1 = Few properties destroyed or damaged	2		1	1	1		1			1	
	2 = Few destroyed but many damaged		2									
	3 = Few damaged and many destroyed											
	4 = Many properties destroyed and damaged											
Environmental Damage												
Key:	0 = Little or no environmental damage			0			0		0	0	0	0
	1 = Resources damaged with short-term recovery				1	1		1				
	2 = Resources damaged with long-term recovery	2	2									
	3 = Resources destroyed beyond recovery											
Economic Disruption												
Key:	0 = No economic impact											0
	1 = Low direct and/or indirect costs							1			1	
	2 = High direct and low indirect costs	2	2	2			2		2	2		
	2 = Low direct and high indirect costs				3	3						
	3= High direct and high indirect costs											
Sum of Area & Consequences Scores		***10***	***9***	***7***	***8***	***8***	***6***	***5***	***3***	***3***	***3***	***0***
Probability of Occurrence												
Key:	1 = Unknown but rare occurrence										1	1
	2 = Unknown but anticipate an occurrence							2	2	2		
	3 = 100 years or less occurrence				3	3						
	4 = 25 years or less occurrence	4					4					
	5 = Once a year or more occurrence		4	5								
TOTAL RISK RATING												
	Total Risk Rating =	**40**	**36**	**35**	**24**	**24**	**24**	**10**	**6**	**6**	**3**	**0**
	Sum of Area & Consequences Scores											
	x Probability of Occurrence											

3.4.3 Societal Hazards

According to the updated Hazard Risk Estimation analysis for Charlotte, the following societal hazards received the highest risk ratings out of a possible high score of 80; see Table below:

- Economic Crisis (20)
- Crime (20)
- Epidemic (18)

Economic recession is highly ranked for both its direct impacts and its secondary effects on health, safety, and the environment. In a recession, property owners may not be able to maintain their properties, which are then more vulnerable to natural hazards.

The likelihood of an epidemic is difficult to gauge, but its consequences could be severe. The community did experience an outbreak of TB in the elementary school in 2015, so this concern has its foundation in reality. Charlotte has limited vulnerability to other evaluated societal hazards, although crime has become a larger concern in recent years. The town has few developed areas and businesses that could be targets of crime, and is not reliant on a single employer or single industry for employment of a significant portion of residents.

Table 3-7 Societal hazards risk estimation matrix, Charlotte

		Economic Crisis	Crime	Epidemic	Key Employer Loss	Terrorism	Civil Disturbance
Area Impacted							
Key:	0 = No developed area impacted						
	1 = Less than 25% of developed area impacted		1		1	1	1
	2 = Less than 50% of developed area impacted	2		2			
	3 = Less than 75% of developed area impacted						
	4 = Over 75% of developed area impacted						
Consequences							
Health & Safety Consequences							
Key:	0 = No health and safety impact				0		
	1 = Few injuries or illnesses	1	1				1
	2 = Few fatalities or illnesses			2		2	
	3 = Numerous Fatalities						
Property Damage							
Key:	0 = No property damage	0		0	0		
	1 = Few properties destroyed or damaged		1			1	1
	2 = Few destroyed but many damaged						
	3 = Few damaged and many destroyed						
	4 = Many properties destroyed and damaged						
Environmental Damage							
Key:	0 = Little or no environmental damage		0	0	0	0	0
	1 = Resources damaged with short-term recovery	1					
	2 = Resources damaged with long-term recovery						
	3 = Resources destroyed beyond recovery						
Economic Disruption							
Key:	0 = No economic impact						
	1 = Low direct and/or indirect costs	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						
Sum of Area & Consequences Scores		***5***	***4***	***6***	***3***	***6***	***4***
Probability of Occurrence							
Key:	1 = Unknown but rare occurrence					1	1
	2 = Unknown but anticipate an occurrence						
	3 = 100 years or less occurrence			3			
	4 = 25 years or less occurrence	4			4		
	5 = Once a year or more occurrence		5				
TOTAL RISK RATING							
	Total Risk Rating =	**20**	**20**	**18**	**12**	**6**	**4**
	Sum of Area & Consequences Scores						
	x Probability of Occurrence						

3.4.4 Hazard Summary

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

Natural Hazards

- Severe Rainstorm (35)
- Severe Winter Storm (24)
- Fluvial Erosion (20)
- Flooding (20)

Technological Hazards

- Hazardous Materials Incident (40)
- Water Pollution (36)
- Power Loss (35)
- Multi Structure Fire (24)
- Major Transportation Incident (24)
- Telecommunications Failure (24)

Societal Hazards

- Economic Crisis (20)
- Crime (20)
- Epidemic (18)

It should be noted that the four natural hazards on the list—flooding, fluvial erosion, high winds and 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 for Charlotte, due in large part to their widespread nature and frequent occurrence.

SECTION 4: VULNERABILITY ASSESSMENT

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

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

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

Table 4-1 Town of Charlotte: 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 Charlotte has a higher vulnerability to:

- Severe Rainstorms and Fluvial Erosion due to high amount of gravel roads and road culverts
- Flooding of low-lying lands along the Lake Champlain shoreline.

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

Table 4-2 Town of Charlotte: 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, bridges, and facilities during cleanup.	-if large event, potential high cleanup costs. -injuries to persons
Water Service Loss	-temporary loss of service -temporary impacts to vulnerable individuals -limited vulnerability due to no municipal or centralized service	-if extensive loss, potential budget impacts to service providers.
Gas Service Loss	-no vulnerability as no service in Charlotte	n/a
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	-if extensive loss,

	-temporary impacts to vulnerable individuals -limited vulnerability due to limited municipal or centralized service	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 Charlotte has a slightly higher vulnerability to:

- Hazardous Materials Incident/Major Transportation Incident due to the traffic along U.S. RT 7, as well as materials transported along the rail line or stored on rail sidings in Town.

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

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

Hazard	**Typical vulnerabilities**	**Occasional additional vulnerability**
Crime	-increased demands on police services and social services	-injuries -deaths
Epidemic	-temporary closures of schools, businesses, places of assembly -increased demand on medical services	-if an epidemic is widespread and long-lasting, impact could be severe
Key Employer Loss	-loss of economic activity -loss of portion of tax base -increased demands on social services	-effects increased if employer is of significant size
Economic Recession	-loss of economic activity -increased demands on social services -some loss of tax revenue	-effects increased if event is of extended duration
Civil Disturbance	-injuries to persons -damage to public and private property	-budget impacts to police services depending upon severity of event -deaths
Terrorism	-injuries to persons	-budget impacts to

	-damage to public and private property	police services depending upon severity of event -deaths

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

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

4.1 Critical Facilities

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

Table 4-4 Critical facilities in the Town of Charlotte

Facility Type	Number of Facilities
Education Facility	1
Fire Station	1
Emergency Shelters	1
Emergency Operations Center	1
Energy	1
Government and Military	1
Mail and Shipping	1
Transportation Facilities	2

Source: VCGI, Charlotte Town staff

None of these facilities are located in the 100-year floodplain, nor in mapped River Corridors or River Protection Areas.

4.2 Infrastructure

4.2.1 Town Highways

The following is a statistical overview of roads in the Town of Charlotte. These tables show the range of road types within the town, from US Route 7 to unimproved unpaved roads. The different road types have different hazard vulnerabilities. Unpaved roads are more vulnerable to

being washed out in a flood or heavy storm, while traffic incidents are more likely to occur on large, arterial roads.

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

The Vermont Agency of Transportation divides municipal highways into various classes:

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. Generally speaking, these are 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, minimally maintained, and almost exclusively dirt or gravel.

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

Class 1	Class 2	Class 3	Class 4	State Hwy	Fed Hwy	Interstate	Total 1, 2, 3, State Hwy
	31.790	42.610	0.370		6.550		74.400

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

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

Paved	Gravel	Soil or Graded	Unimproved	Impassable	Unknown	Total
47.141	28.992	4.657	0	0.2	0.46	81.45

Total Known	Total Unpaved	% Paved	% Unpaved
80.99	33.647	41.79%	58.21.0%

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

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

4.2.2 Bridges, Culverts, and Dams

There are a variety of bridges, culverts and dams located in the municipality. 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. This analysis does not take into account the fluvial geomorphology or the elevation of the bridge above the floodplain. The Lewis Creek Association (LCA) notes that bridges and culverts in the fluvial erosion hazard areas are identified in the River Corridor Plans for Lewis Creek and the LaPlatte River, and will be included in future updates of this All-Hazards Mitigation Plan, when fluvial erosion hazard area delineations are finalized. The LCA also notes that some bridges in the town are undersized with regards to stream stability needs. Less data are available for the Town Short bridges.

Table 4-7 Bridges located in SFHA and RCPA

BridgeType / Number	Location	Mile-point	Route Name	Year Built	SFHA ?	RCPA ?	Stream
ROLLED BEAM	0.2 MI TO JCT W CL3 TH12	008061	C2001	1957	No	Yes	LaPlatte RMPSFEH 050610
TIED ARCH COV BR	0.2 MI TO JCT W CL3 TH43	000000	C3009	1898	Yes	No	
ARCH/KINGPOST COV BR	0.01 MI TO JCT W C3 TH28	000000	C3039	1849	Yes	Yes	Lewis Creek RMPSFEH 031912
GAL ROLLED BM/COV BR	0.01 MI TO JCT W CL2 TH1	000000	C3036	1849	Yes	Yes	Lewis Creek RMPSFEH 031912
ROLLED BEAM	0.52 MI TO JCT W CL2 TH1	000000	C3014	1956	No	Yes	LaPlatte RMPSFEH 050610
ROLLED BM/FLR BEAM	0.2 MI TO JCT W CL3 TH14	000000	C2009	1939	No	Yes	LaPlatte RMPSFEH 050610
RC BOX CULVERT	6.5 MI N JCT VT 22A	000651	US7	1929	No	Yes	Direct Drainage RMPSFEH 032509

As noted in the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan*, CCRPC has conducted an inventory of culverts in the county's municipalities, including Charlotte in _____. The inventory collected data on the location, material, diameter, and length of each culvert. It also made qualitative judgments on the condition of the culvert. This data is updated by the town annually. The current data is shown in Table 4-8. The inventory data do not enable a vulnerability assessment to be conducted on this infrastructure in relation to natural water and sediment flow regimes.

Table 4-8 Culvert Inventory, data as of Sept. 2017

Total Number of Driveway Culverts	429
Number of Driveway Culverts in Poor or Worse Condition	20
Number of Driveway Culverts in Unknown Condition	0
Total Number of Public Culverts	549
Number of Public Culverts in Poor or Worse Condition	22
Number of Public Culverts in Unknown Condition	5
Total Number of Culverts with Unknown Type	1
Number of Culverts with Unknown Type in Poor or Worse Condition	0
Number of Culverts with Unknown Type in Unknown Condition	0
Total Number of Charlotte Culverts	979

As noted in Section 4 of the County Plan, a large portion of the County's stream have had detailed Phase II Stream Geomorphic Assessments conducted. With regard to Charlotte, 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 4-9 Culverts with a geomorphic compatibility rating of "Mostly Incompatible" or "Incompatible"

Bankfull Width	Compatibility Score	Location	GIS Road Name	Stream Name
22.14	7	.3 Mi E Greenbush Rd.	EAST THOMPSONS POINT RD	Thorp Brook
40.00	9		ROSCOE RD	Unnamed

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.

DELETING THIS OLD TABLE

Officials from the Lewis Creek Association (LCA) note that many bridges, culverts, and other stormwater infrastructure in and near fluvial erosion hazard areas lack geomorphic compatibility and may be too small to accommodate predicted water and sediment flow from Charlotte streams. Geomorphic and aquatic organism passage compatibility data results are available through the LCA or VT DEC River Management Program.

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, maintained by the U.S. Army Corps of Engineers.

There are no 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.

The National Dam Inventory shows two dams located in the municipality as follows:

Table 4-10 Dams located in the Town of Charlotte

Name	Owner	River	Description	Maximum Storage (acre/feet)	Hazard Potential
Charlotte-1	unknown	Holmes Creek	no detailed data available in Vermont ANR database	Unknown	Unknown
Scott Pond	T. Dinnan & M. Illick (private)	Lewis Creek	Concrete Gravity dam, construction date unknown, originally built for mill power, current purposes is recreation in that it is maintained by ANR/Dept. of Fish & Wildlife as a lamprey eel barrier control dam. Rebuilding costs would be significant if breached.	Unknown	Low

Source: National Dam Inventory

4.2.3 Water, Wastewater and Natural Gas Service Areas

The town operates a community wastewater treatment plant that serves 100+ summer only residences at Thompson's Point. A small town-owned septic system also serves the Town offices, library, senior center and fire & rescue building. There are four public community water systems, four non-transient non-community public water systems and five transient public water systems in Charlotte. The town contains no natural gas distribution facilities. (cf. *Figure 1.4*).

Most residents and businesses in the town receive water from wells and the lake and dispose of wastewater through individual septic systems. Homes in some subdivisions utilize a shared well and/or septic system.

4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines

A 115kV high-tension power transmission line, operated by VELCO, runs from south to north through Charlotte paralleling the railroad track, with a substation located on Ferry Road *(cf. Figure 1.4).* At present, newly constructed homes in Charlotte must have their power and telecommunications lines buried between the state or municipal road and the new house.

4.3 Estimating Potential Losses in Designated Hazard Areas.

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

- 35 residential structure and 3 commercial/industrial structures are located within the 100-year floodplain. Based on the 2014 median grand list values, the estimated potential loss due to a major flood event inundating the floodplain is $22,751,280.
- These estimates only take structures into account. It does not account for personal property or business losses.

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

- There are 6 residential structures and 0 commercial/industrial structures located in the RCPA. Based on the 2014 median grant list values, the estimated potential loss due to an event in the river corridor is $2,576,211.

At this time, a more detailed analysis of potential losses to structures, infrastructure, and agricultural lands due to flooding cannot be made. Such an analysis would require individual site visits and analyses 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 are 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, Charlotte

	Charlotte	Chittenden County	Vermont	National
Percent Minority (non-white)[1]	3.2%	7.7%	4.8%	26.7%
Children <18 in poverty[1]	4%	11.1%	14.8%	21.6%
Families w/children in poverty[1]	2.9%	10.5%	13.4%	17.8%
Families w/ female householder, no husband present w/children in poverty[1]	0.0%	37.0%	37.4%	40%
Population, age 65+ in poverty[1]	4.6%	6.5%	7.5%	13.4%

[1]*US Census Bureau, 2010-2015 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 *(see definition in Table 1-1).* The measures are combined to create relative vulnerability index. For every vulnerability measure, census tracts above the 90th percentile, or the most vulnerable 10%, are assigned a flag. The vulnerability index is created by counting the total number of flags in each census tract. It is important to remember that this Social Vulnerability Index is just a first
step in screening for populations that may be more or less vulnerable to a variety of hazard. Depending on the situation, different measures could be more or less important and should be looked at more closely. These data are NOT saying that one census tract is more vulnerable than another. Rather it is saying that there is a higher concentration of various vulnerable populations living within a tract and seeks to identify the conditions that make a population vulnerable.

4.5 Land Use and Development Trends Related to Mitigation

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

Table 4-12 Structures compared to zoning, Town of Charlotte

Charlotte Structures	Esite Count	Percent		Charlotte Zoning	Area (mi^2)	Percent
Residential	1758	81.46%		Commercial	0.185162	0.45%
Commercial	45	2.09%		Conservation	3.532369	8.53%
Industrial	3	0.14%		East Charlotte Village	0.315479	0.76%
Institutional / Infrastructure	13	0.60%		Rural	35.11919	84.78%
Mass Assembly	10	0.46%		Shoreland	1.610257	3.89%
Leisure / Recreation	1	0.05%		Shoreland Seasonal Home Management	0.100519	0.24%
Natural Resources	14	0.65%		Village Commercial	0.223445	0.54%
Total:	1844	85.45%		West Charlotte	0.337279	0.81%
Total Esites:	2158			Total Area:	41.4237	

Source: 2015 e911 Data and Town of Charlotte 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 significant number of conserved or undevelopable parcels in Charlotte. Most parcels have been conserved for their scenic, agricultural, and natural public value. It is likely that the number and extent of conserved parcels in Charlotte will continue to grow. The Town of Charlotte allocates a fewcents of its municipal tax rate every year toward land conservation and also provides operational funding to the Charlotte Land Trust. As of fall 2017, there is a healty balance of approximately $500,000 available in this land conservation fund. The Town also works in partnership with regional land conservation entities such as the Vermont Land Trust, Vermont Housing and Conservation Board, The Nature Conservancy, Lewis Creek Association, and Trust for Public Land. The Charlotte Town Plan is a natural resource based plan that values protection of natural systems, farming and forestry-based economies and rural community lifestyles. The Town Plan also states that land conservation measures should be achieved in part through non-regulatory methods.

Table 4-13 Conserved Land, Town of Charlotte

Acres	Acres of Public Land	Percent Public	Acres of Conserved Land	Percent Conserved	Total Public & Conserved	Percent Conserved Land
26,505.21	987.80	4%	7,883.33	30%	8,871.16	33%
347,804.53	**40,014.01**	**12%**	**26,789.23**	**8%**	**66,805.63**	**19%**
					57708.78	**17%**

Source: Conserved Land Data from CCRPC ECOS MapViewer, www.ccrpcvt.org

4.5.2 Recent and Future Development

At this time, the primary method CCRPC has to predict future development is by analysis of municipal zoning bylaws. As the municipality participates in the NFIP, zoning bylaws heavily regulate development in designated flood hazard areas. Additionally, the Town also regulates development near other waterbodies and wetlands. As a result, little or 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 mitigate flood hazards to future structures. Further, with a five-acre minimum lot size for residential structures, and with nearly 1/3 of the land base in some form of conservation protection, these also serve to limit the amount of new development that can occur.

From 2011 through 2014, the municipality has seen 41 housing units (in single family and multi-family structures) and 1 new commercial/industrial building constructed. None of these units or structures were constructed in the Special Flood Hazard Area; three housing structures (five dwellings total) were built in the River Corridor Protection Area. As this is not a regulatory distinction at this time, no special techniques were used in location or elevation.

As best can be ascertained based upon data maintained by the Chittenden County RPC and the Town of Charlotte, since the adoption of the last municipal AHMP in 2011, development activity in the Town has not increased vulnerability. Additionally, through at least 2022, 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 Charlotte Town Plan* Policies That Support Hazard Mitigation

The following selected excerpts illustrate how mitigation planning and activities are formally promoted and supported through the Town's Comprehensive Plan.

> *To maintain and enhance the integrity and continued viability of natural and cultural features with high public value, including prime and statewide agricultural soils, steep slopes, surface and groundwater resources, shoreland buffers, wildlife habitat and other ecologically important natural areas, scenic views and vistas, historic districts, sites and structures, land in active agriculture, and conserved land*
>
> *Restrict development in areas where it may create hazards to public health and safety.*
>
> *Limit development in areas of the Town where significant environmental resources or other features with high public value are located, by directing development away from those areas.*
>
> *Flood Hazard Areas*
> *Flood hazard areas are areas that are likely to be inundated by flood once every 100 years. Portions of the shoreline of Lewis Creek, Lake Champlain (on McNeil's Cove, Converse Bay, and Holmes Creek, and the mouth of Thorp Brook are designated flood hazard areas, based on the 100-year flood maps prepared by the federal government and approved by the Town of Charlotte under its Flood Hazard Area Zoning Regulations. The rest of the Town's flood hazard areas are currently being inventoried and mapped. The Town has requested the Federal Energy Management Authority to map the flood hazard area of the LaPlatte River. Additional flood hazard mapping should be coordinated with wetlands mapping.*
> *If a flood hazard area is improperly used and unprotected, a flood can create a serious threat to the public; private investments can be destroyed; and significant natural resources can be damaged. The Town of Charlotte does not allow development within known flood hazard areas. Wetlands are areas that are inundated by surface or ground water for two weeks or more during the growing season and at a frequency significant enough to support vegetation conducive to living in anaerobic condition. Wetlands may include marshes, swamps (in some cases with trees), bogs, wet meadows, river and lake overflows, and ponds. Wetlands are particularly important and fragile areas.*
>
> *They are important because they:*
>
> *1. Provide temporary water storage for flood waters;*

2. Play a key role in maintaining the quantity and quality of surface and ground water through physical and chemical actions;
3. Mitigate effects of erosion and runoff;
4. Provide especially rich wildlife habitat for plant, animal, bird and aquatic species;
5. Provide resources for education and research in natural sciences; provide recreational opportunities; and
6. Contribute to community open space and scenic beauty.

Major potential sources of water contamination exist in Charlotte. The Town's former landfill, private dumps and leaking underground petroleum storage tanks can easily contaminate large areas of groundwater in serious and long term ways. Other potential sources of groundwater contamination include: salt storage piles, treated sand storage piles, manure storage areas, onsite sewage disposal systems, runoff from impervious surfaces such as parking areas, chemical fertilizer and pesticides used on farms and lawns, and uncontrolled dumping of waste, chemical cleaning products, and petroleum. These present a threat to both surface water and groundwater quality. Current Town regulations contain no specific language on the protection of the identified aquifer recharge areas.

Streams in Charlotte face threats from human activity including:
Bacterial contamination from improperly functioning septic systems, manure spread too close to streams, and animal grazing too close to streams;
Chemical contamination from landfills, road salt and sand, herbicides, illegal dumping along stream banks, parking lot runoff, and agricultural and lawn chemicals;
Erosion and siltation from improper controls at construction sites, improper forestry practices, loss of vegetation on stream banks, improper use of culverts and diversions at road crossings of streams; and
Increases in biological oxygen demand from leaking septic systems, runoff containing fertilizers and manure.

Presently all lands within 100 feet of named streams are in a Conservation District under the Town Land Use Regulations. This land may not be developed but may be counted for density purposes [Table 2.8 of the Land Use Regulations]. In addition, the Land Use Regulations require setbacks of 150 feet from the Lake Champlain shoreline, 100 feet from edge of named streams and 50 feet from the edge of unnamed streams. Some lands along Lewis Creek and at the mouth of Thorp Brook are classified as flood hazard areas and are also regulated under Table 2.10 of the Land Use Regulations. All surface waters within the Town have a state water quality classification (of) "B". Class B waters are to be managed to achieve water of a quality which consistently exhibits good aesthetic value and provides high quality habitat for aquatic biota, fish, and wildlife. Class B waters may be used for public water supply with filtration and disinfection, irrigation and other agricultural uses, swimming and recreation.

5. Alien Species.
Introduction of invasive alien species to either land or water can have serious adverse impacts on native biodiversity. Landowners are urged to use native Northeastern species in any roadside planting or reforestation. Anglers are urged not to introduce invasive alien species into our waterways. Where alien invasives have taken strong hold (e.g. purple loosestrife or buckthorn) landowners are encouraged to control or eradicate them since they are displacing our native species. Maintaining our wild and agricultural biodiversity helps keep our terrestrial and aquatic ecosystems healthy and resilient. These ecosystems provide an impressive array of tangible and intangible benefits. Biological diversity is not only useful in terms of economic benefit, but there are strong aesthetic and ethical imperatives for its conservation.

Sufficient water supply in Charlotte must be considered not only for drinking and personal and business use, but also for fire protection. The Town adopted a Fire Protection Water Supply Plan for the entire Town in April 1997. In summary, the plan was prepared to ensure that sufficient

water supply is available for fire protection. A map of water supply sites is shown on Map 10 [of the Town Plan].

It has been a policy of the Town of Charlotte for many years to maintain Route 7 as a major arterial through the Town. In part, this policy reflects a concern that any major relocations, bypasses, or circumferential highways could have an adverse impact on the Town. To implement this policy the Town has strictly limited land uses along the highway. The Town has also instituted controls on curb cuts in the Land Use Regulations. To date, these actions have been effective in maintaining the corridor as only a functioning major arterial and not as an access to numerous business and residences as is the case to the north and south.

River Management
River corridor management plans are being developed for both Lewis Creek and the LaPlatte River. Lewis Creek Association and the LaPlatte Watershed Partnership are working with Hinesburg, Monkton, Charlotte and other towns to develop these plans.

Sharing of Rescue Services
Representatives from the towns of Charlotte, Shelburne and Hinesburg have discussed sharing rescue services and vehicles, as discussed above in Section 4.6.3 [of the Town Plan]. The Town of Ferrisburgh may also be interested in discussing the potential for sharing rescue coverage, as well.

Water Quality Strategies
1.The Town will implement a monitoring protocol to sample shoreline sites for evidence of sewage contamination, identify pollutant sources, and require corrective action by owners. Runoff will be monitored and controlled in accordance with State policies and regulations. The Town will request assistance of the State of Vermont on this issue.
2. The Town will continue to monitor, preserve, and restore water quality and stream equilibrium Conditions throughout the Town on an as needed basis to maintain lake water quality.
3. Low impact development (LID) methods of stormwater management should be considered during development review, and potentially required if site circumstances warrant.
4. Stormwater management "best practices" should be applied to all development, regardless of whether a state stormwater permit is required.

Public Safety Strategies
1.As appropriate, the Town will sponsor traffic studies for the purpose of establishing speed limits. If speed limits are enacted, the Town will arrange for their enforcement.
2.The Town will study the need for a Fire-Rescue sub-station for the east side of Town, and shall investigate the acquisition of property for this purpose.
3.The Town will explore strategies for adding fire ponds strategically located to assist in fire protection.
4.The Town will encourage a program to share fire and rescue resources with neighboring towns.
5.The Town will work to address issues cited in the Town's All Hazard Mitigation Plan.

Utility Lines Policies
1.New or replacement electrical, telephone, cable and other utility lines, shall be located underground. In particular,the Town seeks to protect public roads with high scenic value by placing utility transmission and distribution lines underground. Placing transmission and distribution lines underground reduces their negative impacts to the landscape, increases reliability, and potentially reduces long term maintenance costs.
2.The Town supports improvements to the power grid to adequately support existing uses and planned future growth. Such improvements must be compatible with other goals of this Town Pan, and existing uses and planned future growth must first be designed and constructed to maximize energy efficiency.
3.The Town strongly encourages the co-location of utility lines and infrastructure in existing rights of way, in order to reduce long-term costs and impacts to scenery. New utility transmission and

distribution line infrastructure must be located within existing rights of way, unless the greater public good is better served by placing them elsewhere.
4.The Town requires underground utility lines feeding and within subdivisions.
5.Height of utility poles will not be increased if not necessitated by technical requirements, such as to avoid interference.

Transportation Policies
1. The function of Route 7 as the main north-south corridor in the Town and a regional arterial highway should be protected through the limitation of access points and the control of land use along the highway. The Route 7 corridor shall be protected as a scenic travel corridor.
2.Expansion of Route 7 to increase its capacity by the addition of new lanes shall only occur when the need has been clearly demonstrated, when all reasonable alternatives have been carefully examined, and when such improvements have been prepared within the context of the Chittenden County Long Range Transportation Plan for the Route 7 Corridor. Any improvements to the corridor shall make provisions to enable safe bicycle and pedestrian travel and crossings, including bicycle lanes on Route 7 itself.
……...
6. Improvements to the intersection of Route 7 and F5 are the responsibility of the State of Vermont. Though major improvements have been implemented, the Town, with the help of the State, will monitor this intersection to insure that safety problems are rectified. In addition, the Town will control land development in the vicinity to minimize traffic congestion and safety problems at this location. Pedestrian and bicycle safety will be given special attention when improvements are considered for this intersection.
……..
10. Railroad crossings on public roads in Town will be gated crossings with bicycle safe surfaces to ensure traffic, pedestrian and bicycle safety, and will include adequate mitigation of other adverse impacts from railroad activity.
……..
16. The Town prohibits the long-term storage of rail cars in Town, as this diminishes the scenic value of the rural character of the Town, creates safety hazards from the potential exposure of hazardous chemicals, and can invite vandalism, trespassing, and unlawful conduct.

General Strategies
1.The Town will review road and driveway standards and update as needed within the next year. All new or redeveloped development roads and driveways will be required to meet these standards. The standards will consider safety, accessibility for emergency vehicles, winter maintenance, community character, impact to existing resources, impact to visual quality, and provisions for bicyclists, pedestrians and equestrians.
……...
3. The Selectboard will review the need for a Capital Budget and Program every year, which could include transportation and stormwater control facilities, as well as structures and capital equipment.
4. The Town will work with the Vermont Agency of Transportation, the Chittenden County Regional Planning Commission, and adjoining municipalities on studies of the Route 7 corridor to insure Town concerns are met and proposed improvements are consistent with the Town Plan.
5. The Town will improve pedestrian, bicycle and auto traffic safety throughout the Town, with specific attention in the West Village on Greenbush Road and Ferry Road. In the next year, accommodations for pedestrians will be made along Ferry Road between the Library and Greenbush Road
……..
7. The Town will develop plans to address erosion - prone town roads, such as Spear Street near the covered bridge, and along Mud Hollow Brook north of Carpenter Road.

5.2 Existing Town of Charlotte 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 actions that support hazard mitigation, Town of Charlotte

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	Contract through Lewis Excavating, which is the annual elected Road Commissioner	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Road Commissioner, through the strategies noted below is taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.
Highway personnel	1 FTE field personnel, two part-time (via Lewis Excavating)	1) Generally adequate with regards to mitigating the impacts of common hazards. 2) However, the Road Commissioner, through the strategies noted below is taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution.\
Water / Sewer Department	None. Contractual for Thompson's Pt. wastewater treatment plant, municipal offices septic system and Charlotte Central School septic system.	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	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	1) As noted at the start of Section 5, several elements of the municipal Comprehensive Plan promote Hazard Mitigation. 2) The Town will reference this 2017 AHMP in the next update to the Town Plan.
Zoning Bylaws and Subdivision Regulations	Most recent updates in 2016	1) Generally adequate with regard 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.)	Shoreland District, Conservation District; Flood Hazard Overlay District; Steep Slopes	1) Generally adequate with regard to mitigating the impacts of common hazards. 2) No need at this time to expand upon current flood hazard bylaws.
Participation in National Flood Insurance Program (NFIP) and Floodplain/Flood Hazard Area Ordinance	Yes/Yes	The Town Zoning Administrator and the Town's Zoning Board of AdjustmentZoning Board of Adjustment (DRB) monitor compliance with the National Flood Insurance Program. The DRB reviews and adjudicates applications for development within the floodplain. 2) No need at this time to expand upon NFIP participation
Open Space Plans; Conservation Funds	Conservation fund since 2004. Donations only; Selectboard has final say over expenditures based upon recommendations from Conservation Commission.	Nearly 1/3 of the town is protected or conserved in some form.

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

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

Type of Existing Protection	Description /Details/Comments
Emergency Services	**Emergency response personnel may have overlapping responsibilities with other town response organizations.**
Police Services	Vermont State Police plus ad hoc contracts for additional patrol time
Police Department Personnel	n/a
Fire Services	Charlotte Fire & Rescue Services
Fire Department Personnel	~23 active members
Fire Department Mutual Aid Agreements	
EMS Services	Charlotte Fire & Rescue Services
EMS Personnel	~23 active members
EMS Mutual Aid Agreements	Yes, via VT EMT District #3
Emergency Plans	
Local Emergency Operations Plan (LEOP)	Yes, 2017.
Primary Shelter	Charlotte Senior Center, Charlotte Congregational Church, Charlotte Central School
Replacement Power, backup generator	No. Generator for backup power much more achievable at Senior Center.
Secondary Shelter	None formally designated.
Replacement Power, backup generator	No.

5.3 Town of Charlotte All-Hazards Mitigation Goals

The following goals were first approved by the Town in its 2005 and 2011 AHMPs and approved by Town of Charlotte 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 benefits and efficiencies of inter-town hazard mitigation planning, data collection and actions.

5) 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.
6) Maintain existing municipal plans, programs, regulations, bylaws and ordinances that directly or indirectly support hazard mitigation.
7) 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.
8) 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.
9) Work with partners and neighboring towns on hazard mitigation planning, education and improvement measures.

With regard to a more formal process by which the Town will integrate the requirements of this mitigation plan into the Town's Comprehensive Plan, as required by Vermont law, municipalities must update their Comprehensive Plans every eight years. During any update process undertaken while this Plan document is in effect, the Town will review the recommended Actions detailed below to see if formal incorporation within the Comprehensive Plan (or any Plan implementation tasks) is warranted. Note that the Town will be updating its Comprehensive Plan in 2018.

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

With regard to a more formal process by which the Town will integrate the requirements of this mitigation plan while developing the Town's annual capital improvement plans/budgets, for the period 2017-2022, the Town will review the recommended Actions detailed below to see if formal incorporation within these annual capital plans is warranted prior to annual review and voting by Town residents. Additionally, CCRPC staff can assist the town with drafting grant applications to fund mitigation projects.

5.4 Mitigation Actions

The table below records the strategies from the 2011 Plan and progress on their implementation. This table also encapsulates the Town's decision making with regard 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 Charlotte All-Hazards Mitigation Plan, Progress on 2011 Strategies

Action Primary Responsible Entity	Task	Brief Description	Progress since 2011 and recommendations for 2017 Plan
#1 Evaluate capabilities of existing and potential public shelters and school and town emergency plans.			
Charlotte Selectboard, American Red Cross	Existing Shelters	Maintain relationships with existing designated American Red Cross Shelters. Evaluate heating capabilities in event of power outage.	The Senior Center, Congregational Church, and Central School are the designated shelters in the 2017 LEOP. NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Charlotte Selectboard	Secondary Shelter	Confirm capabilities at Charlotte Senior Center and consider designation as secondary shelter.	NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Charlotte Selectboard	Alternate Shelters	Investigate capabilities of "Old Lantern" on Greenbush Road, Charlotte Congregational Church on Church Hill Road and Mt. Carmel Catholic Church on Spear Street.	NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Charlotte Selectboard	Generator Installation	Seek funding for installation of generators and/or electrical transfer panels to facilitate emergency power generation at shelters.	It is clear that the Senior Center is the most likely candidate for installation of a backup generator. NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Charlotte Selectboard	Evacuation and Sheltering Plans	Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual accident.	NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Charlotte Selectboard, School Principal, Fire Chief	Town and School Emergency Plans	Ensure that town and school emergency plans are fully planned and feasible.	NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN

Action Primary Responsible Entity	Task	Brief Description	Progress since 2011 and recommendations for 2017 Plan
#2 Evaluate and improve existing road and stormwater management infrastructure.			
Charlotte Selectboard, Road Commissioner, Lewis Creek Association.	Infrastructure Assessment for Fluvial Erosion and Stormwater Vulnerability	Assess the vulnerability of municipal-owned roads, culverts and other stormwater management infrastructure to seasonal runoff, fluvial erosion and landslide events. Develop a prioritized improvement plan. Inform infrastructure maintenance programs with results of stream geomorphic and landslide assessments. Maintain an updated bridge and culvert database.	Assessment not considered a Mitigation Action. REMOVE FROM 2017 PLAN.

		Consider a 100-year flood event when evaluating capabilities during replacement/upgrade of infrastructure.	
Charlotte Selectboard, Road Commissioner	Culvert and Stormwater Infrastructure Upgrades	Upgrade culvert size and replace corrugated metal with corrugated high-density polyethylene. Upgrade culverts, culvert wings and ditching along the following roads to mitigate against repeated damages from stormwater: Lime Kiln Rd. at Route 7 (first four cross-culverts), Greenbush Rd. (underpass culvert)	Various upgrades were made since 2011 at select locations. CONTINUE SELECTED ELEMENTS IN 2017 PLAN.
Charlotte Selectboard, Road Commissioner	Stormwater Sediment Reduction	Consider catchment basins or other diversion techniques to prevent imbalance of stream sediment to water flow at vulnerable locations.	While desirable, this is not considered to be a priority for the Town. REMOVE FROM 2017 PLAN.
Charlotte Selectboard, Road Commissioner	Infrastructure Erosion and Flood Mitigation	Implement strategies for areas prone to erosion due to flood events, including steep gravel roads in the eastern portion of town, such as Lewis Creek, Roscoe, Converse Bay, Prindle Rd and Dorset St. -Undertake erosion mitigation projects where municipal roads may incur damage from streams, such as Cedar Beach Rd., Garen Rd., Spear St., Lime Kiln Rd., Roscoe Rd., Lewis Creek Rd., Hills Point Rd, Prindle Rd. -Maintain vegetated cover of floodplains and lands adjacent to stream corridors. Use geomorphic results to guide river corridor management strategies. -Consider opportunities to move or alter roadways to accommodate buffers that would prevent stream sedimentation, channel instability and threats to town infrastructure. -Construct roadside ditches at select locations with stone lining. -Continue rebuilding town-owned gravel roads, including dead-end roads, to improve drainage and stormwater issues.	-Moved Roscoe Road -Added rip rap @ Holmes Bridge on Lake Road -Rail underpass on Greenbush Road needs another culvert to help with drainage in intense rainstorms. It is a regular occurrence, but little or no damage occurs as this is a paved road. -Ice jams continue to occur at select stream culverts perhaps once/year on average. CONTINUE ROADSIDE DITCHING AND ROAD REBUILDING IN 2017 PLAN.

Action Primary Responsible Entity	Task	Brief Description	Progress
#3 Complete fluvial geomorphology assessment and develop strategies in response to identified risk.			
CCRPC, VT ANR, Lewis Creek Association	Fluvial Geomorphic Assessments	Complete Phase I and Phase II fluvial geomorphic assessments on streams and waterways in Charlotte.	Completed. REMOVE FROM 2017 PLAN
CCRPC, VT ANR	Fluvial Erosion Hazard Mapping	Rate the fluvial erosion hazard for each assessed reach and develop a fluvial erosion hazard map for the waterway using SGAT. Create map of all assessed reaches. Submit to VT ANR for QA/QC.	Completed. REMOVE FROM 2017 PLAN
Lewis Creek Association, VT ANR	River Corridor Management Plans	Where Phase I and II assessments are complete, develop a River Corridor Management Plan.	Completed. REMOVE FROM 2017 PLAN
Charlotte Selectboard	Fluvial Erosion Hazard Mitigation Implementation	Develop strategies to mitigate losses from identified fluvial erosion hazards.	STRATEGIES CARRIED OVER TO ROAD & STORMWATER INFRASTRUCTURE AND ROADS STORMWATER MANAGEMENT PLAN ACTIONS
Charlotte Selectboard	Flood Insurance Rating Map Updates	Review draft FIRM data. Develop strategies to mitigate losses from identified flood hazards, including adoption of the new flood hazard rating map.	Completed. REMOVE FROM 2017 PLAN
#4 Raise public awareness of hazards, hazard mitigation and disaster preparedness			
Charlotte Selectboard	Town Plan Update	Update town plan to include hazard mitigation improvement policies, goals and strategies.	Ongoing maintenance level activity not warranted for inclusion as formal mitigation action. REMOVE FROM 2017 PLAN
Fire Chief	School Programs	Continue school programs to raise student awareness of hazards, safety, preparedness and prevention.	NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Fire Chief	Family Programs	Continue family programs to raise family awareness of hazards, safety, preparedness and prevention.	NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Fire Chief	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.	NOT A MITIGATION ACTION, REMOVE FROM 2017 PLAN
Charlotte Selectboard; Fire Chief	Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate.	Insufficient municipal resources to implement on a consistent basis. REMOVE FROM 2017 PLAN

5.4.1 Current Capabilities and Need for Mitigation Actions

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

Table 5-4 Town of Charlotte: 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. The Town regards its current hazard mitigation efforts carried out by the Road Commissioner and Fire Department as adequate to address winter storm impacts to local roads. U.S. Route 7 is maintained by the State. Winter storms are often the cause of power loss and telecommunications failure.
Flooding	Excellent	No, however existing structures in the floodplain are at risk. The Town's zoning restricts new development in the designated flood hazard areas as well as near small streams that may not be considered part of the Special Flood Hazard Area. Efforts addressing Fluvial Erosion and Severe Rainstorm can indirectly mitigate Flooding.
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 Charlotte: 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. The Town considers the efforts of the Road Commissioner sufficient to maintaining safe roads and bridges. The private company which operates the Charlotte Ferry is responsible for maintaining safe conditions at the ferry crossing. The Fire and Rescue Departments maintain preparedness for transportation incidents, including rail and water. Long bridges in the town are maintained by VTrans. Short bridges are maintained by the Town at significant expense
Power Loss	Average. Private utilities are primarily responsible	No given that events are limited in duration and vulnerabilities are short-lived. The electric utility that serves the town is responsible for restoring service. Tree trimming and vegetation management, coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation. Underground installation of lines, required for new buildings and subdivisions, is also a means of mitigation.
Hazardous Materials Incident	Average + State agencies provide support	No, rare occurrence and extent, impact & vulnerabilities are limited. That said, the Town's major concern remains rail safety, pertaining to shipments of crude oil and other hazardous materials. Any accident or incident would likely overwhelm local and regional emergency response capabilities. In that regard, the Town continues to question rail safety plans prepared by Vermont Railway and the State. As noted in the discussion in Section 3.2.6, the Town has little authority to regulate rail operations.

		Therefore, for the purposes of this plan, the primary mechanism to address this concern of railcar accident is through improved Preparedness & Response capabilities of local emergency service providers.
Water Service Loss	Private services are primarily responsible.	No, rare occurrence and extent, impact & vulnerabilities are limited.
Gas Service Loss	Not applicable. No service in Town.	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. The landline and cellular service providers are responsible for restoring service. Tree trimming and vegetation management, coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation. Underground installation of lines, required for all new construction, is also a means of mitigation.
Other Fuel Service Loss	Private businesses are primarily responsible	No, rare occurrence and extent, impact & vulnerabilities are limited.
Sewer Service Loss	Excellent. Town maintains small, decentralized systems.	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 Charlotte: 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 supportive of the goal of economic diversification, which can

		serve to mitigate the impacts of a recession. Many residents work at home. The Town is attempting to address issues of affordable housing, and has an energy task force on efficiency, both of which might have a positive impact on residents affected by an economic recession.
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,employers are primarily in other municipalities.

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

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

Therefore, the reader will note that the proposed Mitigation Actions for the next five years represent a much more focused and achievable list of actions focused on those hazards (e.g. Severe Rainstorm, Flooding, Fluvial Erosion, Water Pollution, etc.) that cause more frequent if less dramatic damages. It is these more mundane damages of erosion along road beds, damaged small culverts and the ongoing struggle to maintain and improve water quality (which cost the municipality and its taxpayers both time and money) that deserve the most attention rather than hazards that could hypothetically cause damage but which are rare and

wherein the benefit-to-cost ratio for potential mitigation actions is weak (e.g. Major Transportation Incident, Hazardous Material Incident, Terrorism). No new discrete action is recommended with regard 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

CATEGORY A: Improve existing road and stormwater management infrastructure.

Hazards Addressed: Severe Rainstorm, Fluvial Erosion

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

Status: Ongoing

Primary Responsible Entity: Town of Charlotte Road Commissioner & Selectboard

Potential Partner Entities: Vermont Agency of Natural Resources, Vermont Agency of Transportation, CCRPC; Lewis Creek Association;

Timeframe: Month 2017 through March 5, 2022 (update after FEMA approval date)

Funding Requirements and Sources: Various Federal and State grants; municipal operating funds only if sufficient

Rationale/Cost-Benefit Review: Some portions of municipal roads 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. Upgrades to infrastructure and improved road drainage will accommodate the increased water flow during Fluvial Erosion and Severe Rainstorm events.

Specific Identified Actions

Action A-1: Culvert and Stormwater Infrastructure Upgrades

- When feasible, upgrade size of culverts and change out corrugated metal to corrugated high-density polyethylene
- Improve culvert wings to mitigate against repeated damages

Action A-2: Improve road drainage

- Construct roadside ditches at select locations (especially with high slope and gradient) with stone lining to address persistent erosion.
- Continue rebuilding town-owned gravel roads, including dead-end roads, to improve drainage.

CATEGORY B: Implement Roads Stormwater Management Plan

Hazards Addressed: Water Pollution, Fluvial Erosion, Severe Rainstorm,
Vulnerabilities Addressed: damage to public infrastructure especially roads and culverts; impairment of local waterways and Lake Champlain, budgetary impacts

Status: Ongoing

Lead Responsible Entities: Town of Charlotte Road Commissioner & Selectboard

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

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

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

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

Specific Identified Actions:

Action B-1 Develop Roads Stormwater Management Plan

In the summer of 2017, the CCRPC completed an Inventory of Priority Road Segments (PRS)[aka "hydrologically-connected" road segments] both currently meeting and not meeting MRGP standards in the Town. Starting in late 2017, the CCRPC will work with the Town to begin to develop cost estimates for various erosion-reduction projects. The Town will then apply for MRGP coverage starting in July 2018. After issuance of the permit by the State, the Town will then work to use this information to develop a formal Roads Stormwater Management Plan for submission to the VT-DEC in 2019. The Plan will include a remediation plan (capital budget) and implementation schedule for each site not currently meeting standards.

Action B-2 Begin Roads Stormwater Management Plan implementation

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

5.4.3 Prioritization of Mitigation Strategies

The above mitigation actions were listed in order of priority. Descriptions of specific projects, where available, are listed in 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 were rated according to a numeric score of "1" (poor), "2" (below average or unknown), "3" (good), "4" (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?

These rankings are 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 analyses in order to determine whether the benefits justify the costs of any project. Also, all proposed FEMA mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

Based on feedback from FEMA, CCRPC Staff have concluded that several strategies previously identified in 2011 by the Town of Charlotte as mitigation strategies are more accurately classified as preparedness, response, and recovery strategies. These are not intended to mitigate against the hazards identified in Section 3, and should not be evaluated as such. Therefore, these strategies are not included in the prioritization matrix below.

Other than the reclassification of some of these as non-mitigation strategies, there have not been significant changes in the prioritization of strategies between 2011 and now, with one notable exception. CCRPC staff, in consultation with FEMA, have concluded that landslides are not a discrete threat in Chittenden County, and are captured adequately in the plan's discussion of fluvial erosion. Additionally, further work on 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 projects that address different hazards.

Table 5-7 Charlotte action evaluation and prioritization matrix

Mitigation Category & Actions	Responds to significant (likely or high risk) hazard	Likelihood of funding	Protect threatened infra-structure	Implemented quickly	Socially / Politically acceptable	Technically Feasible	Administra-tively Realistic	Reasonable cost to benefit	Environmen-tally sound	TOTAL SCORE
CATEGORY A: Improve existing road and stormwater management infrastructure.										
Action A-1: Culvert and Stormwater Infrastructure Upgrades	5	4	5	4	5	5	4	5	5	**42**
Action A-2: Improve road drainage	5	4	5	4	4	5	4	4	5	**40**
CATEGORY B: Implement Roads Stormwater Management Plan										
Action B-1: Develop Roads Stormwater Management Plan	4	4	4	3	5	4	4	5	5	**38**
Action B-2: Begin Roads Stormwater Management Plan implementation	3	4	4	3	5	5	4	4	5	**37**
5 = Excellent; 4=Good; 3=Average; 2=BelowAverage or Uknown; 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 Charlotte Mitigation Actions: Implementation Monitoring Worksheet

Category A: Improve existing road and stormwater management infrastructure to mitigate Severe Rainstorm and Fluvial Erosion and their associated vulnerabilities of: • Damage to new/existing public infrastructure and buildings • Temporary road and bridge closure • Budgetary impacts • Temporary loss of power and/or telecommunications • Temporary isolation of vulnerable individuals	
Action **(Primary Responsible Entity)**	**Report on Progress since Plan adoption** *See Section 5.4 for details on locations identified during Plan development.*
Action A-1: Culvert and Stormwater Infrastructure Upgrades (Town Road Commissioner)	-Note month, year and location of any upgrade to size or material composition of culverts -Note month, year and location of improvements to culvert wings
Action A-2: Improve road drainage (Town Road Commissioner)	-Note month, year and location of roadside ditching and/or road base rebuilding

CATEGORY B: Implement Roads Stormwater Management Plan to mitigate Severe Rainstorm, Fluvial Erosion and Water Pollution and their associated vulnerabilities of: • Damage to new/existing public infrastructure • Impairment of local waterways and Lake Champlain • Budgetary impacts	
Action **(Primary Responsible Entity)**	**Report on Progress since Plan adoption** *See Section 5.4 for details on locations identified during Plan development.*
Action B-1 Develop Roads Stormwater Management Plan (Town Road Commissioner)	-MRGP obtained from State? -note projects developed and scoped with costs -Roads Stormwater Management Plan filed with State
Action B-2 Begin Roads Stormwater Management Plan implementation (Town Road Commissioner)	-note which RSMP projects underway/completed -note annual MRGP reports filed with State