Adopted by the Town of Charleston Selectboard on:
January 5, 2016

TOWN of CHARLESTON, Vermont
All-Hazards Mitigation Plan

Selectboard
5063 VT Route 105
Charleston, VT 05872
802-895-2814

Prepared by:

OPHC, NVDA and the
Town of Charleston, Vermont

CERTIFICATE OF LOCAL ADOPTION

Town of Charleston, Vermont

A Resolution Adopting the All-Hazards Mitigation Plan

WHEREAS, the Town of Charleston has worked with NVDA and OPH Consulting Services to identify hazards, analyze past and potential future losses due to natural and human-caused disasters, and identify strategies for mitigating future losses; and

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

WHEREAS, a meeting was held by the Town of Charleston Select Board to formally approve and adopt the Town of Charleston All Hazards Mitigation Plan.

NOW, THEREFORE BE IT RESOLVED that the Town of Charleston adopts this All-Hazards Mitigation Plan for the town.

January 5, 2016
Date

Dean Bennett
Dean Bennett, Select Board Chair

Meghann Carter, Selectperson

Larry Young, Selectperson

Teri L. Gray
Attested to by Town: Town Clerk, Teri L. Gray

Executive Summary

In the fall of 2014, the Northeastern Vermont Development Associated (NVDA) contracted with OPH Consulting Services (OPHC) to develop the Town of Charleston's Hazard Mitigation Plan. The results of this work are contained herein and represent the collaborative efforts of NVDA, OPHC, the Town of Charleston, the Hazard Mitigation Planning Team and associated residents, towns and agencies that contributed in the development of this plan.

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 Charleston.
- Prioritize hazards for mitigation planning.
- Recommend town-level goals and strategies to reduce losses from those hazards.
- Establish a coordinated process to implement the plan, taking advantage of a wide range of resources.

In order to become eligible to receive various forms of Federal hazard mitigation grants, an Orleans County municipality must formally adopt its Local All-Hazards Mitigation Plan.

This plan is organized into 5 Sections which are described below:

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

Section 2: Hazard Identification expands on the hazard identification in the Charleston Town Plan (2013) 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 Charleston are broken down in the grid below:

Severe winter storm	Power loss	Flooding
Telecommunications failure	Major transportation incident	Epidemic

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

Section 5: Mitigation Strategies begins with an overview of goals and policies in the **2013 Charleston Town Plan** that support hazard mitigation and utilizes the town's comprehensive **2014 Road Inventory and Capital Budget Plan**. This is followed by an analysis of existing municipal actions that support hazard mitigation, such as planning, emergency services and public works. The following all-hazards mitigation goals are summarized below:

1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
3) Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan and the Town Plan.
4) Recognize the relationship between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management.
5) Maintain existing municipal plans and programs, adherence to state standards and ordinances that directly or indirectly support hazard mitigation.
6) Consider formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5), as well as incorporation of proposed new mitigation actions into the municipality's operating procedures.
7) Consider formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans and infrastructure, utilities, highways and emergency services.

Section 5 also identifies and provides a detailed discussion of the following Mitigation Actions:

- Action #1: Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.
- Action #2: Maintain and improve capabilities of existing and potential public shelters.
- Action #3: Work to enhance response times of emergency medical services in areas of town where there is a known deficit.
- Action #4: Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident.
- Action #5: Ensure town and school emergency plans are fully coordinated.
- Action #6: Raise public awareness of hazards, hazard mitigation and disaster preparedness.
- Action #7: Continue fluvial geomorphology (in coordination with state recommendations and protocol) assessment and develop strategies in response to any identified risk

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

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SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

The purpose of this Local All-Hazards Mitigation Plan is to assist this municipality in identifying all hazards facing their community and in identifying strategies to begin to reduce the impacts of those hazards. The plan also seeks to better integrate and consolidate efforts of this municipality with those outlined in the Town Plan as well as efforts of NVDA, the Local Emergency Planning Committee and the State Hazard Mitigation Plan.

This document constitutes an All-Hazards Mitigation Plan for the Town of Charleston. Community planning can aid significantly in reducing the impact of expected, but unpredictable natural and human-caused events. The goal of this plan is provide hazard mitigation strategies to aid in creating disaster resistant communities throughout Orleans County.

1.2 Hazard Mitigation

The Vermont State All-Hazards Mitigation Plan of 2013 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. This plan aligns and/or benefits from the 5 goals accomplished as a State since 2010 and as referenced in Section 5 of the State's 2013 Hazard Mitigation Plan and as part of the newly created Emergency Relief Assistance Funding (ERAF) requirements. With enhanced emphasis on community resiliency and advancements in planning such as the Agency of Commerce and Community Development'

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

Hazard mitigation planning is the process that analyzes a community's risk from natural hazards, coordinates available resources, and implements actions to reduce risks. According to 44 CFR Part 201, Hazard Mitigation Planning, this planning process establishes criteria for State and local hazard mitigation planning authorized by Section 322 of the Stafford Act as amended by Section 104 of the *Disaster Mitigation Act of 2000*. Effective November 1, 2003, local governments now 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:

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

1.4 Benefits

Adoption and maintenance of this Hazard Mitigation Plan will:

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

1.5 All-Hazards Mitigation Plan Goals

This All-Hazards Mitigation Plan establishes the following general goals for the town as a whole and its residents:

1) Recognize the characteristics that make the Town of Charleston unique within Orleans County and incorporate these findings into the hazard mitigation planning process.
2) Promote awareness of the relationship between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses, when applicable.
3) Ensure that mitigation measures are consistent with municipal plans and the capacity of the town to implement them.
4) Encourage Charleston to formally incorporate their individual Local All-Hazards Mitigation Plan into their municipal plan as described in 24 VSA, Section 4403(5).
5) Encourage Charleston to formally incorporate elements of their Local All-Hazards Mitigation Plan, particularly their recommended mitigation strategies, into their municipal operating and capital plans & programs, especially, but not limited to, as they relate to public facilities and infrastructure, utilities, highways and emergency services.

6) Educate regional entities on the damage to public infrastructure resulting from all hazards and work to incorporate hazard mitigation planning into regional land use and transportation planning conducted by NVDA.

7) Maintain existing mechanisms or develop additional processes to enhance regional cooperation in hazard mitigation and emergency planning.

1.6 Town of Charleston: Population and Housing Characteristics

Population:
The Town of Charleston covers 24,662 contiguous acres. The 2010 U.S. Census reports a total population of 1023 residents, 51% male and 49% female, indicating a population density of about 1 person per 26 acres. The Town's population has shown slow to moderate growth over the past 50 years—a rate that has increased somewhat over the past decade. About 22% of the population is younger than 20 years, about 20% is between 20 and 40 years of age, about 31% is between 40 and 60 years, and 27% is aged 60 or older. The median age is 49 years.

Table 1-1 Town of Charleston, selected population characteristics, 2010 Census

Category	Number	%
Total Population	1023	100
Median Age	49	--
Population age 60 years and over	276	27
Population under 20 years old	225	22
Population between 20 and 40	205	20
Population between 40 and 60	317	31

Housing:
The entire population of Charleston is housed, with more than half living in traditional nuclear families, a third living in non-family households, and about one-quarter living alone. The average family size is 2.7 and the average household size is 2.2. About 63% of Town residents are in the civilian labor force and 37% are not, with an unemployment rate of 5%, that is lower than state and national unemployment rates. About 30% of households have annual incomes below $25,000, about 40% between $25,000 and $50,000, 12% between $50,000 and $75,000, and 18% above $75,000. The average annual household income is about $45,000.
About one-third of the Town's housing stock was built before 1950. Almost half was built between 1960 and 1990. About 12% has been built since 2000. About half of the housing is valued between $50,000 and $150,000, with another half valued between $150,000 and $300,000. More than 80% of the housing is owner-occupied, with about 20% rented. Rental costs range from $500 to $1500 per month.

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

Table1-2 Town of Charleston, selected housing unit data, 2010 Census Block Group 2

Category	Number	%
Total Housing Units	672	--
Occupied housing units	447	66.5
Vacant housing units	225	33.5
Owner-Occupied	363	54
Renter Occupied	84	12.5
Population in Renter-occupied	201	19.6
Households with individuals under 18	110	10.8

1.7 Summary of Planning Process

1.7.1 Planning and Development of the 2014 All-Hazards Mitigation Plan

In July, 2014, NVDA selected OPH Consulting Services (OPHCS) to draft the plan for the town. An initial meeting between NVDA, OPHCS and Charleston select board Chair, Tom Jenson was held to discuss the planning process and development of a planning team. On July 24th, 2014, OPHCS attended the select board meeting to explain the planning process and goals. A survey was drafted asking for community input and made available on the town's website along with an outline and spreadsheet concerning the importance and informational needs of a HMP and more town-specific concerns the public may have, respectively. This information was sent to 175 property owners in the town that had previously self-identified as being open to correspondence. While discussion and coordination of plan development remained ongoing from the onset with the individuals that would populate the planning team and the derived community surveys, the final roster was approved and adopted by the select board on November 13th, 2014. This meeting was warned with special notice inviting public comment on the draft Hazard Identification and Mitigation Strategies developed up to that date. Notices were posted at the Town Clerk's, Charleston School, East Charleston & West Charleston Post Offices, and on the town website indicating that copies were available at the Town Clerk's Office. A PDF version was also made available on the town's website.

1.7.2 Development of the 2014 Charleston Hazard Mitigation Plan

Following FEMA guidance in Local Mitigation Plan Review Tool Regulation Checklist, the plan was written using data sources that included:

- Surveys collecting public comment:

The survey sought updated information for Table 5-1, as well as information on the progress, logical next steps, and continued relevance of the mitigation strategies laid out in the 2005 plan draft. Additionally, the following municipal plans and reports were reviewed and used:

- 2013 Charleston Town Plan
- 2014 Charleston Capitol Budget and Road Plan

Based on information obtained and input from town officials, OPHCS and NVDA staff drafted the plan, building on new data, town plans and community input. OPHCS engaged in outreach with the following town staff and community organizations to provide an inclusive and strategic mitigation plan (**Names in bold indicate Planning Team Members**):

- **Tom Jensen, Charleston Selectboard Chair**
- **Bernie Pepin, Charleston Road Foreman**
- **Larry Young, Charleston Selectboard**
- **Dean Bennett, Charleston Selectboard**
- Bill Rodgers, Director of Operations, Great Bay Hydro Corporation
- Chris Herrick, HAZMAT Chief, State of Vermont
- Richard Colburn, Treasurer, Charleston Historical Society
- **Pat Austin, School Board, Charleston Elementary School**
- Tom Wagner, President of Echo Lake Protective Association
- **Jason Benoit - Director, NorthWoods Stewardship Center**
- **Jamie LeClair, Newport City Fire Chief and LEPC 10 Chair**
- **Duane Moulton, Charleston Fire Chief and local business owner**
- **John Kellogg, Charleston Planning Commission**
- **Colleen Kellogg, Charleston Assistant Town Clerk**
- **Bruce Melendy, Emergency Planner NVDA**

Additionally, in the town's ongoing efforts to engage and include surrounded towns, the regional LEPC chair, Jamie LeClair was a member of the planning team. Mr. LeClair is also the current fire chief in Newport, VT and was able to provide valuable insight on potential considerations unique to Charleston and its relationship to surrounding municipalities. NVDA's role in assisting the entire region with all facets of planning provided crucial information and NVDA's Emergency Management Planning representative was a project lead as well as a member of the planning team. While the LEPC provides the best platform to engage representatives from various towns and agencies, all bordering towns to Charleston (Morgan, Derby, Brighton, Brownington and Coventry) were contacted with planning objectives and asked to provide any concerns or suggestions in addition to receiving a draft plan with opportunity to comment. State agency involvement included the State EMS office with points of contact including both Ray Walker and Deputy Director Mike Leydon. Vermont's Department of Emergency Management and Homeland Security (DEMHS) also provided valuable guidance during the development of the plan. DEMHS also has representation at the LEPC meetings and will continue to provide input and guidance as the town moves forward with the annual mitigation plan-specific LEPC meetings. The Great Bay Hydro Corporation was also involved in addressing the risk posed by area dams and point of contact, William Rodgers, Director of Operations assisted in the planning

process by sharing the Corporation's emergency notification procedures and overall Emergency Response Plan.

The draft plan was revised based on input and presented to the town select board in November 2014. The revised draft sections related to Hazards and Mitigation Strategies was posted on the Charleston website for public review in November, 2014.

The revised final draft was resubmitted to DEMHS and FEMA for formal review and approval pending municipal adoption. OPHCS and NVDA staff made minor revisions to the plan in response to comments from the State Mitigation Office. This version of the plan was resubmitted to the Federal Emergency Management Agency Region 1 for approval pending adoption. Upon approval pending adoption, the final draft was sent to select board members and the town clerk. NVDA staff also provided draft language for a resolution of adoption to be discussed at a regularly scheduled and properly warned select board meeting in December, 2014.

SECTION 2: HAZARD IDENTIFICATION

The following is a discussion of existing and potential hazards in Charleston. The definitions of each hazard, along with historical occurrence and impact, are described. Hazards have been grouped into three broad categories:

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

- **Technological Hazards:** utility failure (telecommunications failure, loss of electrical service, loss of sewer service, loss of water service, loss of gas service), hazardous substances (hazardous material storage and release, hazardous waste sites, military ordnance, pollution events), and transportation incident.

- **Societal Hazards:** crime, civil disturbance, terrorism, epidemic / mass casualty, food supply crisis, economic downturn, and key employer loss.

2.1 Natural Hazards

The following discussion on natural hazards is based upon information from several sources. General descriptions are based upon the *2013 Vermont State Hazard Mitigation Plan*. Due to rural nature of Northeast Kingdom, there is little historical data available for presentation.

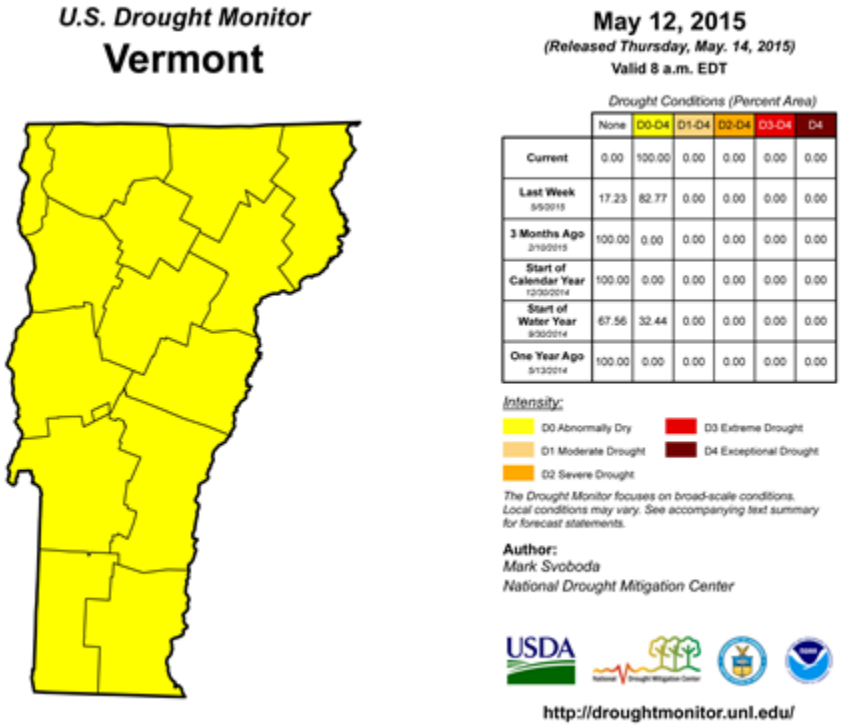
2.1.1 Weather / Climate Hazards

Drought

Severe droughts are rare in Vermont. Summer is potentially a dry period, but local thunderstorms and moisture from tropical air masses generally prevent serious drought. A severe drought during

1930-36 affected the entire State. In the northern part of the State, the drought was moderate and had recurrence intervals that ranged from 10 to 25 years among gaging stations. Drought conditions in the rest of the State had recurrence intervals greater than 25 years. This drought coincided with severe drought conditions present in large parts of the central and eastern United States. Drought conditions in Vermont during 1939-43 were moderate. Only in the extreme southwestern area of the State did recurrence intervals exceed 25 years. During the 1947-51 drought, the northern area experienced the most severe conditions in the State. Drought recurrence intervals were greater than 25 years. Conditions were moderate in central areas, and drought recurrence intervals were less than 10 years in the south. The drought of 1960-69 affected the entire State and was the most severe of this century in Vermont. The recurrence interval of the drought was greater than 50 years. This drought was regional in scope, encompassing most of the northeastern United States. Precipitation in the State was less than normal every year during 1960-68, which was the longest continuous spell of deficient precipitation since 1895. Streamflow deficiency was greatest during 1965. In 1969, the drought ended abruptly. A drought affected Vermont during 1979-80; drought conditions were moderate throughout much of the State during the summer of 1980. In the northwestern area, however, the situation was sufficiently severe that State and local officials offered drought assistance to dairy farmers. Water was trucked in to provide relief to drought-stricken dairy herds. Below is the most recent drought monitor for the entire state. Spring can bring abnormally dry conditions as is evident in early 2015 and Charleston expects the extent of drought to remain as brief periods of abnormally dry conditions in the spring and occasionally, summer months. Table 2-1 below provides recent drought conditions and an explanation of the rating scale used. Data was not available specific to Charleston.

Table 2-1: 2014-2015 Vermont Drought Monitor



Tornadoes, Hurricanes and Tropical Storms

Tornado damage is classified by the Enhanced Fujita scale, ranging from relatively little damage (ef0) to catastrophic damage (ef5). Violent tornadoes (ef3 or greater) are capable of great destruction and loss of life. Objects as sticks, glass, and lawn furniture become deadly missiles when driven by tornadic winds. The number of days with thunderstorms across Vermont and northern New York ranges from 20 to 30 days, with nearly a third of these days experiencing severe weather. According to the National Weather Service (NWS), severe thunderstorms can produce damaging winds in excess of 58 mph, hail one inch in diameter or larger, or even a tornado. Heavy rain and deadly lightning are also likely hazard. The Tornado Project has recorded a total of five tornadoes in Orleans County during the period from May 1962 through May 2012. Tornado damage tends to be localized. The town received no significant damage from any tornado event. No formal hurricane events are recorded for the town.

Table 2-2: Tornado Events and Fujita Scale (F-Scale) for Orleans County, Vermont

ID	Date	Event Num	Time	Dead	Inj	F-Scale	Beg Coor	End Coor	County
183	MAY 20, 1962	2	11:30	0	0	1	44.90 -072.40	00.00 0	19
184	MAY 20, 1962	3	11:45	0	1	1	44.75 -072.37	44.87 -072.25	19
708	AUG 6, 1989	1	16:20	0	0	1	44.67 -072.28	00.00 0	19
1036	SEP 3, 1993	1	18:55	0	0	1	44.82 -072.03	44.83 -071.90	19,9
529	JUN 5, 2010	1	12:30	0	0	1	44.62 -072.42	44.61 -072.38	19
376759	MAY 29, 2012		13:25	0	0	0	44.70 -072.26	44.69 -072.26	19

Tropical cyclones (storms) are officially ranked on one of five tropical cyclone scales, according to their maximum sustained winds and which tropical cyclone basin are located. Only a few scales of classifications are used officially by the meteorological agencies monitoring the tropical cyclones, but some alternative scales also exist, such as Accumulated cyclone energy, the Power Dissipation Index, the Integrated Kinetic Energy Index, and Hurricane Severity Index. Of most recent importance for Vermont was Tropical Storm Irene in 2011. Irene first struck the U.S. as a Category 1 hurricane in eastern North Carolina, then moved northward along the Mid-Atlantic Coast. Wind damage in coastal North Carolina, Virginia, and Maryland was moderate, with considerable damage resulting from falling trees and power lines. Irene made its final landfall as a tropical storm in the New York City area and dropped torrential rainfall in the Northeast that caused widespread flooding. Irene resulted in the worst Vermont flooding in 83 years but Charleston, along with much of the surrounding towns were not of the hardest hit. During Irene (August 20th-29th, 2011) Charleston received 3'' of rain (NOAA). By comparison, the following chart shows the three highest recorded rain and wind events for Vermont towns during Irene.

Tropical Storm Irene Rain and Wind Extremes	
Rainfall	Wind
Mendon, 11.23 inches	Burlington, 51 mph
Walden, 7.60 inches	Morrisville, 40 mph
Randolph Center, 7.15 inches	Springfield, 40 mph

Source: http://www.accuweather.com/en/weather-news/irenes-infamous-top-ten-1/54348

The state road to Island Pond from East Charleston (VT105) was closed due to damage from Tropical Storm Irene. While not classified as a Tropical Storm, the April, 2011 rain totals for the NEK reached nearly 7'' compared to the normal precipitation for the month at 3''. The heaviest rainfall event was associated with thunderstorms during the late afternoon of April 26th into the early morning hours of April 27th, 2011. These storms resulted in record and near record rainfall and flooding across portions of northern Vermont. Specific records for the town of Charleston regarding rainfall totals were not available but in using nearby Newport City (where the 7'' of rain was recorded), the town feels that this event can be used as a benchmark regarding extent.

High Winds

High wind events do occasionally cause damage for the town, normally in downed power lines. The last recorded high wind event as tracked by the National Weather Service was recorded on 17-18 January 2012. An 81 mph wind gust was measured atop Vermont's highest peak Mount Mansfield. These strong gusts caused numerous power outages across northern New York and parts of central and northern Vermont. At the peak of the event, over 10,000 people were without power across northern New York, including the Saint Lawrence Valley and over 2,500 people had no power in parts of Vermont. During this event, Orleans County had wind speeds of 30-40 mph. Specific data for Charleston was not available but town officials recall the 2012 event as being the most severe in memory. The following table describes the *Saffir–Simpson* hurricane wind scale.

Table 2-3: Saffir–Simpson hurricane wind scale

Category	Wind speeds
Five	≥70 m/s, ≥137 knots ≥157 mph, ≥252 km/h
Four	58–70 m/s, 113–136 knots 130–156 mph, 209–251 km/h
Three	50–58 m/s, 96–112 knots 111–129 mph, 178–208 km/h
Two	43–49 m/s, 83–95 knots 96–110 mph, 154–177 km/h
One	33–42 m/s, 64–82 knots 74–95 mph, 119–153 km/h
Related classifications	
Tropical storm	18–32 m/s, 34–63 knots 39–73 mph, 63–118 km/h

Tropical depression	≤17 m/s, ≤33 knots ≤38 mph, ≤62 km/h

Severe Winter Storm

Winter storm frequency and distribution varies from year to year depending on the climatological patterns. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are brought down by falling trees and branches. According to the *2013 Vermont State All-Hazards Mitigation Plan*:

> *"A winter storm can range from moderate snow to blizzard conditions. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period. A blizzard is a snowstorm with sustained winds of 40 miles per hour or more with heavy falling or blowing snow and temperatures of ten degrees Fahrenheit or colder. An ice storm involves rain, which freezes upon impact. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires, and similar objects and to produce widespread power outages."*

The winter of 2010-2011 was the third-snowiest on record with a total of 124.3 inches. The record of 145.4 inches was set in 1970-1971. The potential for a major snowstorm that exceeds the capabilities of town to handle exists every year but with the recent increase in snow fall totals and cold temperature duration, the town realizes the further consideration are required. NOAA's National Centers for Environmental Information is now producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. NCEI has analyzed and assigned RSI values to over 500 storms going as far back as 1900. New storms are added operationally. As such, RSI puts the regional impacts of snowstorms into a century-scale historical perspective. The index is useful for the media, emergency managers, the public and others who wish to compare regional impacts between different snowstorms. The RSI and Societal Impacts Section allows one to see the regional RSI values for particular storms as well as the area and population of snowfall for those storms. The area and population are cumulative values above regional specific thresholds. For example, the thresholds for the Southeast are 2", 5", 10", and 15" of snowfall while the thresholds for the Northeast are 4", 10", 20", and 30" of snowfall. 2010, 2012 and 2015 have some of the highest rankings for notable storms. These rankings are based, in part on the severity of the storm using the following system. Since 2000, there has only been one event that reached a category 4 in the Northeast, five reached Category 3, eight were "significant" and all others were notable. The winters of 1969-72 produced record snowfalls, and greater than normal precipitation was recorded in 8 of the 11 years during 1969-79. A record breaking continuous snowfall occurred from January 2nd -January 3rd, 2010 producing a historic 33.1 inches of snow

at Burlington, Vermont. Charleston received an excess of 12 inches (RSI of 4), the most on record during this storm. The December 9th- 12th, 2014 snow storm caused historic utility damage surpassing that of Irene and the 1998 Ice Storm. During this event, Charleston power outages reached the greatest level that the town can remember. While exact figures were not available, town officials recall the event being the worst outage event they had seen. The longest duration for a continuous outage in the town was less than eight days.

Table 2-4: NOAA's Regional Snowfall Index (RSI)

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

Ice Storm

Major Ice Storms occurred in January, 1998 and again in December, 2014. While both Morgan and Brownington received heavy damage to forest stands, Charleston did not sustain any significant damage in the 1998 event. Known as the North American Ice Storm of 1998 a series of surface low pressure systems passed in this atmospheric circulation between January 5 and January 10, 1998. For more than 80 hours, steady freezing rain and drizzle fell over an area of several thousand square miles of the Northeast, causing ice accumulation upwards of 2'' in some areas. Charleston and the surrounding area received .5 to 1 inch of ice. The ice storm that hit Vermont on Thursday, January 8, 1998 was one of the worst weather calamities in Vermont history. It took Green Mountain Power seven days, one hour, and 29 minutes to restore power to all its customers. The power company supplying Charleston during the 1998 Storm is no longer operating and the Vermont Electric Cooperative has been supplying the town for about 10 years. With a recent generator grant application, the town has captured a recent history of outages with the greatest duration lasting four days but not due to an ice event.

Lightning

The greatest concern associated with lightning is the impact on communications, especially communications between emergency responders, from lightning striking communications infrastructure. In the United States there are an estimated 25 million cloud to ground lightning flashes each year and each one is a potential threat to life and property. During the past 10 years there has been an annual average of 44 lightning fatalities in the United States. Vermont is ranked # 17th per capita in lightning related deaths (1959 – 2003). Due to the fact that many

residents of Charleston work outside, there is a greater chance of being struck but even with this increased potential, the likelihood is very small. The limited development in the town also reduces the risk associated with infrastructure and/or communication disruption. There was no known record of lightning data specific to Charleston with no known power outages or deaths resulting from lightning strikes. *(Source: http://www.nekweather.net/wxVtclimatology.php)*

Hail

The town does not consider hail a significant hazard, although hailstorms can have a devastating effect on local farmers. At present there is no historical data on hailstorms in Charleston. Hail storms tend to be very localized and the frequency is low. However, with the recent increases in extreme weather and evidenced by recent hail storms like the one occurring on September 11th, 2013, where record high temperatures were observed in the state, helping to produce a severe wind and hail storm in parts of the Northeast Kingdom, the potential for more frequent hail storms is certainly a possibility. The following excerpt is from a regional NEK paper concerning the event:

"ST. JOHNSBURY -- Storms rolled into the Northeast Kingdom Tuesday, delivering severe hail, a mudslide, at least one lighting strike, road damage, and tornado warnings. "That's been the biggest news around here, the tornado warning, I think" said meteorologist Lawrence Hayes at Fairbanks Museum & Planetarium in St. Johnsbury. Hayes heard no reports of tornado sightings. He thought chances for a twister by late Tuesday afternoon were slim. "But there will still be rain and some rumbles of thunder," Hayes said at about 5 p.m. The most extreme weather Tuesday hit areas like Lowell, where hail was reported at 1.25 inches in diameter, and Albany and Holland, which both saw hail at an inch in diameter."
(Source: http://orleanscountyrecord.com/Main.asp?SectionID=14&SubSectionID=113&ArticleID=24859)

Extreme Temperatures

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

- Highest: 105 degrees in Vernon, VT July 4th, 1911
- Lowest: -50 degrees in Bloomfield, VT December 30th, 1933

Cold temperatures are expected in the Northeast but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. Maintaining a safe living environment for livestock during extreme temperatures, especially cold extremes, is a real concern for farmers in Charleston and the rest of the state.

Climate Change

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

2.1.2 Flooding

Flood Vulnerability

Widespread, steady rainfall from frontal systems, tropical cyclones, or "northeasters" can result in flooding of large areas. Extensive and disastrous floods are rare but can result from intense spring rains combined with warm, humid winds that rapidly release water from the snowpack. Such was true for the devastating flood of March 11-12, 1936. During this flood, total rainfall and snowmelt ranged from 10 to 16 inches over the southeastern one-half of the State. Rainfall alone can cause disastrous flooding similar to that in November 1927. During that flood, rainfall totals of 5-9 inches were common, and much more occurred at higher altitudes. Intense rainfall caused extensive flooding on September 21, 1938, when the "great hurricane" reached landfall in the southern area of the State. Severe thundershowers more commonly cause localized street and cellar flooding. Flooding is the most common recurring hazard event in the state of Vermont. June, 2015 broke records across the state for the wettest on record. Montpelier had the wettest June on record with 9.05 inches of precipitation, beating the old record of 8.36 inches set in 2013, according the National Weather Service. Mount Mansfield also had record rain with 15.54 inches, topping the 15.28 inches that fell in 1998. During May of 2011, Charleston saw 7’’ of rain which is the most the town has seen in many years. Recent history, including the flooding events of 2011 and the records set in 2015 suggest that increases in total rain fall and severity in

terms of rainfall per given unit of time are to be expected along the lines seen with the records seen across the state recently.

There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash flooding and urban flooding. Flooding has also been known to occur as a result of ice jams in rivers adjoining developed towns and cities. These events may result in widespread damage in major rivers' floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private dams and beaver dams. Summer storms are the cause of most flooding in Charleston. Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation, and erosion damage to property and infrastructure. The *2013 Vermont State All-Hazards Mitigation Plan* discusses flooding extensively. While that plan is concerned with all of Vermont, the information on flooding is all relevant to Charleston in that:

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

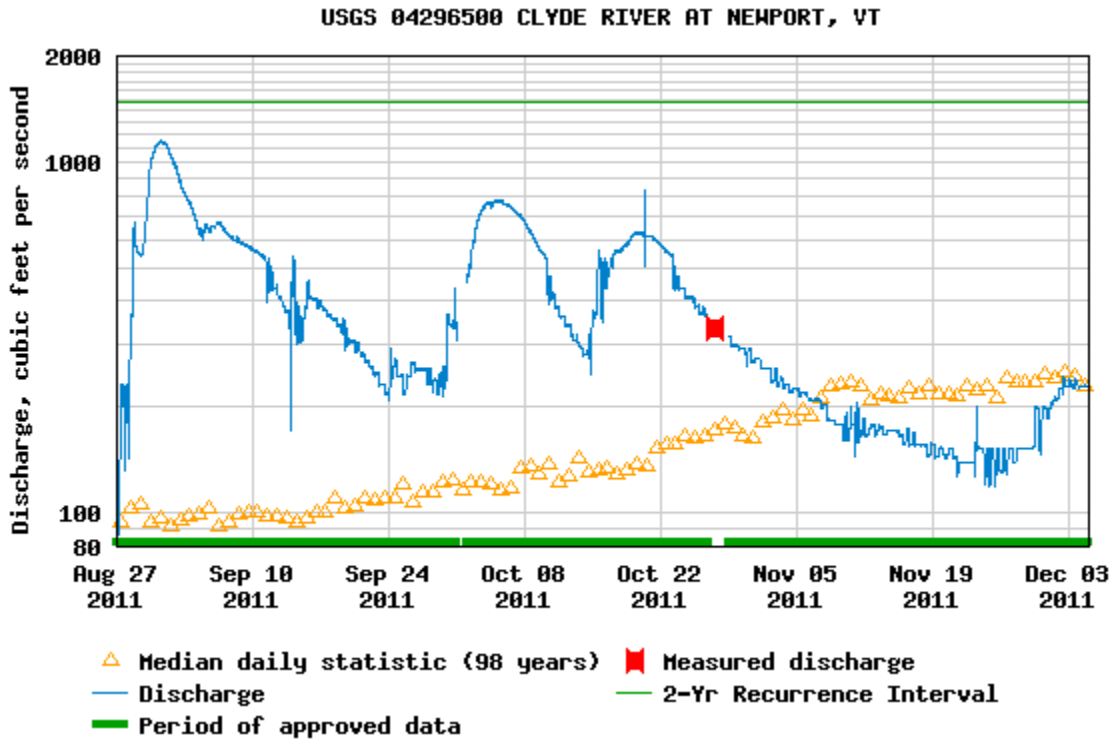
…Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are right for a significant localized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

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

cause flooding to basements and other low lying areas. Lakeshore property is highly desirable and valuable, making the development of lakeshore areas very likely, even with the high potential for flooding. Restrictions on lakeshore property development have significant negative economic and tax revenue impacts that must be carefully weighed against the gains in personal safety and protection of property."

Vermont experienced major floods long before Federal disaster assistance became available. But in November of 1927, Vermont experienced catastrophic flooding. In the month before the flood, rains in excess of 150% of normal precipitation fell after the ground had frozen. The flood itself was precipitated by 10 inches of rain falling over the course of a few days. The flood inundated parts of many towns and damaged or destroyed numerous bridges in the county. As the history of the flooding cited above bears out, the geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Numerous floods have resulted in Presidentially-declared disasters and an influx of federal disaster assistance. Of these disasters, the 1973 flood inflicted the most widespread damage, and the residual rains of Hurricane Belle in 1976 resulted in the second highest amount of federal disaster assistance in Vermont. The Clyde River and associated brooks did rise during both the May, 2011 storms (which is the time for record high levels for Lake Champlain at 103.27 feet on May 6th, 2011) and due to the extent of these storms, the town is confident that Irene produced the greatest rise an discharge rates in the river in recent history (see graphs below)
The discharge rate for the Clyde River during Irene was close to 1200 cubic feet per second compared to the average for that time of year at 100 cubic feet per second. While the data is for the portion of the Clyde River at Newport, it does indicate the magnitude of water resulting from the rains Irene produced.

Table 2-5: 2011 "Irene" Discharge Rates for Clyde River



Ice Jams

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

High Hazard Dams

According to the *2013 Vermont State All-Hazards Mitigation Plan*, "*The VT Agency of Natural Resources (ANR) Dam Safety Program maintains an inventory of 1205 dams (including 85 ANR owned dams) with impoundments greater than 500,000 cubic feet*". Failure of any of these dams could result in significant downstream flooding. There are 55 high hazard dams on the dam inventory, none of which are considered at significant risk for failure or located in the town.

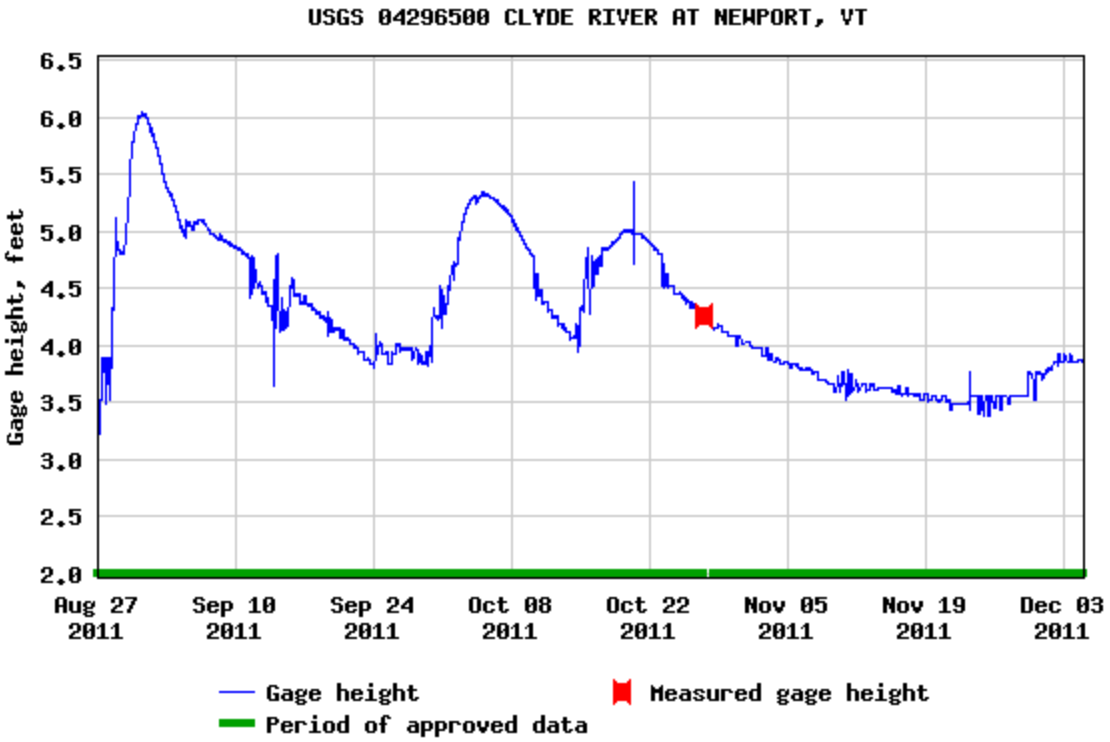
There have been no recent or historically relevant flooding events associated with the failure of any dam in Vermont. However, as stated in FEMA Guide P-956 "*Living with Dams: Know Your Risks*" (2013): "Although dam failures are infrequent, the impacts can be catastrophic, often far exceeding typical stream or river flood events."

Inundation and Floodplains
Regarding flood inundation issues, the *2013 Vermont State All-Hazards Mitigation Plan* states that:

> *"While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage is associated with the dynamic, and often times catastrophic, physical adjustment of stream channel dimensions and location during storm events due to bed and bank erosion, debris and ice jams, structural failures, flow diversion, or flow modification by man-made structures. Channel adjustments with devastating consequences have frequently been documented wherein such adjustments are linked to historic channel management activities, flood plain encroachments, adjacent land use practices and/or changes in watershed hydrology associated with conversion of land cover and drainage activities. The 100-year, or "base" floodplain is the national standard for floodplain management. The area is shown on town Flood Insurance Rate Maps (FIRMs) as issued by FEMA. The 100-year floodplain has one chance in a hundred of being flooded in any given year. The probability that a 100-year flood will occur is a statistical determination based on past flooding in an area. This is not to say that a flood of such magnitude cannot occur two years in a row or twice in the same year. The term only means that in any given year, the odds are 1% that the area will be flooded. The same logic holds true for defining a 500- year flood. In this case, a flood of the 500-year magnitude has a 0.2% chance of occurring in a year. Much flood damage in Vermont occurs along upland streams, damaging private property and infrastructure such as bridges, roads, and culverts. The failure of beaver dams, private ponds and public and private culvert crossings contributes to flood surges and often dramatically increased damage downstream. Homes and other private investments along these streams are generally not recognized as a flood area on FEMA maps of flood hazard zones and, thus, are not typically identified as being vulnerable to flooding or erosion. Town plans and zoning regulations have generally not identified these stream corridors as areas needing protective setbacks for development or zoning."*

Flooding is a significant hazard in Charleston, a fact that is unlikely to change. Protecting river systems as a preventative measure, protecting property, and protecting human health and safety remain priorities for flood-related hazard mitigation and response in the state and the town. The following graph shows the river gage data just before and during Irene and the months following. Irene caused near doubling of the gage height (3.2 to 6 ft.) and this data depicts the most recent benchmark on the potential level of increase in Charleston rivers and brooks.

Table 2-6: 2011 "Irene" Gage Height for Clyde River



Fluvial Erosion

Erosion occurs on a consistent, but small-scale, basis within the riparian corridor of the towns streams and rivers. This is a part of normal natural processes and as such is necessary for the proper functioning of the ecosystem of these waterways. However, fluvial erosion on a large scale can damage stream banks and undercut infrastructure such as roads, bridges and culverts as well as agricultural land and structures, causing severe damage. Fluvial erosion on a large scale can cause stream bank collapses, which are generally classified as landslides. Most flood damage is associated with fluvial erosion rather than inundation. The *2013 Vermont State All-Hazards Mitigation Plan* contains the following discussion of fluvial erosion:

"Vermont's landscape has historically contributed greatly to the widespread practice of the channelization of rivers and streams in order to maximize agricultural land uses and facilitate the development of transportation infrastructure. Channelization, in combination with widespread flood plain encroachment, has contributed significantly to the disconnection of as much as 70% of Vermont's streams from their flood plains. In this unsustainable condition and when energized by flood events, catastrophic adjustments of the channel frequently occur, usually with consequent fluvial erosion damage to adjacent or nearby human investments. All areas of the state suffer equally from fluvial erosion hazards. Some areas have suffered more than others simply because of the location of storm tracks. Transportation infrastructure and agricultural property are the most frequently endangered types of human investment affected by fluvial erosion hazards. Residential, commercial and other municipal properties are also frequently endangered. Changes in watershed hydrology that significantly influence fluvial stability are commonly associated with urbanization or with silvicultural practices. However, watershed scale hydrologic changes have been observed in Vermont as a localized phenomenon

either in small, highly urbanized watersheds or in small, rural sub watersheds where clear cutting of a large percentage of the watershed land area has recently occurred. Stream geomorphic assessments and a fluvial geomorphic database maintained by the Agency of Natural Resources have identified main stem rivers typically channelized from 60-95% of their lengths. When human investments and land use expectations include all the land in the valley up to the river banks, there results extreme public interest in maintaining this unsustainable morphological condition despite its great cost and resultant hazard to public safety."

The Vermont Agency of Transportation (VTrans) applies the term "scour critical" to stream crossing structures especially vulnerable to streambed scour—the undermining of bridge supports by water action and erosion. A spreadsheet database is maintained by VTrans and continually updated by the Bridge Inspection Program. Structures inspected are only those of 20 ft. or longer owned by a municipality or the state. The scour critical rating is based on the structure itself, and does not take into account debris jams, outflanking, channel change, or other issues commonly associated with fluvial erosion. Water supply source and distribution systems are also endangered by fluvial erosion. Many water distribution systems involve buried pipes that cross streams, which are vulnerable to fluvial erosion, however, the town does not have a municipal water supply. In December, 2014 the Vermont Department of Environmental Conservation (DEC) released the "Flood Hazard Area and River Corridor Protection Procedures" guide, outlining specific actions and considerations for all towns in the state. Charleston remains committed to enhancing awareness and incorporating recommendations in future planning and mitigation work. The Clyde River Stream Geomorphic Assessment is part of an on-going partnership between the Northwood's Stewardship Center and the State of Vermont to identify sources of nonpoint source pollution in the four main Vermont tributaries draining into Lake Memphremagog, a lake receiving high nutrient and sediment loads. Located in northeastern Vermont, the Clyde River Watershed encompasses 144 square miles of land noted for its remoteness and wildness. Although recognized for their natural beauty, relatively intact wetlands, and abundant recreational and fishing opportunities, the Clyde River, its tributaries, and associated lakes also face a number of water quality threats resulting from a variety of sources within the watershed. While it is important to address these threats, it is equally important to identify and prevent degradation of areas with excellent water quality. In streams, water quality is influenced by inputs from the watershed as well as the health of the stream itself. A stable stream with a healthy floodplain is less likely to contribute to nonpoint sources of sediment and nutrients than a stream undergoing rapid change and adjustments due to heavy channel or floodplain alterations. To identify areas of nonpoint source pollution, a Phase 1 Stream Geomorphic Assessments on 83 miles of the Clyde River and its tributaries has been completed; from these, 17.5 miles were chosen for more detailed Phase 2 Stream Geomorphic Assessments. The results of these assessments indicate that many streams in the Clyde River Watershed are in good or reference condition. However, there are areas in the watershed which have lost their protective riparian buffers, are receiving inputs of sediment and nutrients from urban and agricultural development, and are eroding and sending nutrients downstream. The Phase 2 reaches most profoundly affected by these stressors were rated in fair or poor condition and totaled 1.6 stream-miles. The Phase 2 assessments highlighted several potential stream restoration sites, including reaches in Newport (reach M01), West Charleston (reach M08), East

Charleston (reaches M15, M16 and an unnamed tributary to M15), and the lower reach of Cold Brook in Brighton (reach T4.01). These reaches contain areas of actively eroding streambanks and significant areas without riparian buffers. These reaches would benefit from buffer enhancement projects such as tree or shrub plantings. Dropping only 40 feet in elevation from its beginning at Island Pond (Reach M21) to Pensioner Pond (Reach M12), the Clyde River is a slow, low gradient river snaking its way through broad valleys, vast wetlands, and floodplain forests. The river receives inputs from numerous cold-water mountain tributaries during this 11.8 mile (16.5 river miles) stretch, most notably the Pherrins River (Reach T6), Oswegatchie Brook (T5), Cold Brook (T4), Webster Brook (not assessed), Mad Brook (T2), and outflows from Seymour and Echo Lakes (T1). Below Pensioner Pond and the Great Falls Dam above West Charleston, the river changes dramatically, cascading over several bedrock ledges before entering Charleston Pond. Below Charleston Dam, the Clyde becomes a whitewater river, encountering more small bedrock ledges, flowing over cobble and boulder stream beds, and finally leveling off downstream of West Charleston village. The river elevation drops 140 feet from Pensioner Pond (Reach M12) to West Charleston (Reach M09), a distance of only 0.68 river miles, excluding the pond lengths. After West Charleston village, the Clyde River transitions again to a low-gradient river, meandering through fields and forests before entering Little Salem Pond and Lake Salem (Reach M06). The river elevation drops 40 feet in these 1.7 miles (2.3 river miles). After exiting these lakes, the Clyde again changes to a fast-flowing and high-gradient river, traveling through a confined valley within the town of Derby and dropping 80 feet in 3.6 miles (3.9 river miles) between Lake Salem and Clyde Pond (Reach M03). Upon leaving Clyde Pond, the river passes over the Clyde Pond Hydroelectric Dam and becomes a fast and cascading stream, dropping 190 feet in only 1.1 miles before leveling off in Newport and entering Lake Memphremagog. The Clyde River flows through five lakes along its course. Its flows are affected by three man-made grade controls: Great Falls Dam below Pensioner Pond, Charleston Dam at Charleston Pond, and the Clyde Pond Dam in Newport. Salem Lake and Little Salem Pond are undammed, but all of these ponds and lakes capture sediment originating from upstream sources. Based on the intensity of channel and floodplain modifications, as well as the overall stream condition observed during the field assessments, reaches conditions were defined as reference, good, fair, and poor. Vermont ANR Stream Geomorphic Assessment Protocols describe these conditions below (State of Vermont 2007b):

In Regime: A stream reach in reference and good condition that is in dynamic equilibrium which may involve localized, insignificant to minimal change to its shape or location while maintaining the fluvial processes and functions of its watershed over time and within the range of natural variability.

In Adjustment: A stream reach in fair condition that has experienced major change in channel form and fluvial processes outside the expected range of natural variability; and may be poised for additional adjustment with future flooding or changes in watershed inputs that could change the stream type.

Active Adjustment and Stream Type Departure: A stream reach in poor condition that is experiencing extreme adjustment outside the expected range of natural variability for the reference stream type; likely exhibiting a new stream type; and is expected to continue to adjust, either evolving back to the historic reference stream type or to a new stream type consistent with

watershed inputs and boundary conditions. There are five stages in channel evolution. Streams in stable condition that are not out of balance due to in-stream or upstream stressors are in Stage I. These streams are in good to reference condition and have the ability to regularly flood in order to disperse sediment and energy. Reaches in fair or poor condition are currently evolving to regain balance; these streams will be in various stages of channel evolution. Streams in Stage II have eroded their beds and may have lost the ability to access their floodplains. These reaches have increased power, increased ability to erode, and decreased ability to store sediment within the reach. Instead, much of the sediment may be sent downstream to affect downstream reaches or lakes. In Stages III and IV, the stream is widening and migrating as it re-establishes meanders and a new floodplain at a lower elevation. Erosion may be severe at these stages as the stream attempts to establish its equilibrium. Finally, Stage V represents a new equilibrium and a reestablished floodplain at a lower elevation. Most assessed reaches in the Clyde River watershed were stable and in good to reference condition. Although some reaches rated in good condition contained areas of erosion and unstable banks, they lacked the widespread instability resulting from extensive modifications to the channel and watershed. Four reaches were in fair condition, and one reach was in poor condition. These reaches were unstable, have lost floodplain function, and may be responsible for sending large amounts of sediment and nutrients downstream. While this information provides a foundation for the town to understand erosion characteristics, continued analysis in conjunction with ANR and the Stewardship Center is needed. *(Source: Restoring Water Quality in the Lake Memphremagog Basin: Clyde River Phase I and II Stream Geomorphic Assessments, 2006). The 2011 flooding events did result in enhanced erosion, further data was not available to determine the extent of this erosion.*

2.1.3 Geological Hazards

Landslides

Landslides are sudden failures of steep slopes and can cause significant damage to streams, infrastructure, and property. Landslides can be caused by fluvial processes, as discussed above. Landslides can also be caused by slope steepening due to non-fluvial erosion, increased loading on the top of a slope, or pore-water issues. Landslides can destroy or damage structures and infrastructure that lie either above or below the slope. While the town has some steep sloped roads, there is no evidence to support concern over landslides. Further discussion of landslides in the *2013 Vermont State All-Hazard Mitigation Plan* contains the following:

> *"Overall, the state of Vermont has had a moderate to low incidence of landslides. The USGS defines susceptibility to landslides as the probable degree of response of rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation.*
> *The U.S. Geological Survey has produced a map entitled "Map showing slope failures and slope-movement-prone areas in Vermont" (Baskerville and Ohlmacher, 2001, 1:250,000 scale). This map identifies about 2.8% of the land area of Vermont as having evidence of slope movements. This corresponds to a moderate susceptibility as a low incidence is defined as less than 1.5% of the land area involved. The map serves to broadly identify some of the areas susceptible to landslides and the included text provides an excellent description of the types of slides found in the state, but the map is not detailed enough to meet current needs. The map*

generally does not identify slope failures in unconsolidated material in the valley bottoms….areas along Lake Champlain and the Green Mountains show a high susceptibility and moderate incidence. A moderate incidence is defined as 1.5%-15% of the area is involved. On the national map, none of the significant landslide events in the United States have occurred in Vermont."

The most common types of landslides in Vermont are slides, which take two general forms; rotational slumps and translational slides. The translational slides occur on a wide variety of unstable slopes underlain by weathered, dense till, as well as slopes underlain by sandy to clayey lacustrine deposits, whereas the rotational slumps are more common on unstable slopes underlain by sandy to clayey lacustrine deposits. Both rotational and translational failures imply that the material has internal cohesion; otherwise the material would disintegrate into some sort of flow. An active landslide is one that has moved within the last year. The sides and upper margin of such a landslide are generally sharp and any exposed slide surfaces are bare of vegetation or have only the beginnings of pioneer vegetation on them. An inactive landslide has not moved within the last year, but it is in a setting in which it could be reactivated. One that has been inactive for several years may be largely revegetated, at least with pioneer vegetation. Inactive landslides are common near actively migrating stream meander bends where the site of landslide activity has shifted downstream as the stream meander has shifted downstream. The inactive slides may very well be reactivated if another meander bend migrates down from upstream. We define a relict slide as one where there is no evidence of movement for many years and the likely causative agent is no longer present. An example would be a former stream cut bank formed by stream erosion in early Holocene time. If the stream has since cut down vertically and moved away in such a fashion that it is now trapped by bedrock and would be unable to move back to the old cut bank, that cut bank could be considered relict. Such a feature is generally completely revegetated and the edges have been softened by erosion. The Vermont Geological Society has developed a Protocol for Identification of Areas Sensitive to Landslide Hazards in Vermont (2012). This protocol was used in Chittenden County, Vermont with inclusion into the State Hazard Mitigation Plan. Fourteen potential parameters were considered as to their effect on landslide hazard. These included location with respect to the marine limit of the Champlain Sea, aspect, distance to stream, elevation, hydrologic group, NDVI, profile curvature, roughness, slope angle, slope height, soil type, stream power index, surficial geology, and topographic wetness index. The protocol is applicable to areas in Charleston but currently, there is no data for the town. However, following tropical storm Irene in 2011, the magnitude of rain caused widespread damage, including significant scouring of riverbanks and stream channels *(source: http://www.anr.state.vt.us/dec/geo/pdfdocs/TechReports/LandslideProtocol2012.pdf)*

Earthquake

The risk of earthquake is quite low in Vermont. The risk is low enough, however, that it is not prudent to invest in mitigation for earthquakes. The most recent earthquake felt in Charleston occurred in April 2002. This magnitude 5.2 quake occurred 87.4 miles away from town. Information provided by the Vermont Geological Survey, Department of Environmental Conservation, and the Agency of Natural Resources can be helpful in estimated the impact of an earthquake and for Charleston, the risks are quite low.

Radiation (Naturally Occurring)
Radon gas, a naturally occurring radioactive substance that can build up in homes and can cause health problems, is enough of a concern for Vermont that health officials recommend home testing. Charleston has the average predicted level of radon (between 2-4 pCi/L). The most common strategy for dealing with a radon problem is venting of basement areas. The Vermont Department of Health recommends mitigation steps be taken based on the type of radiation.

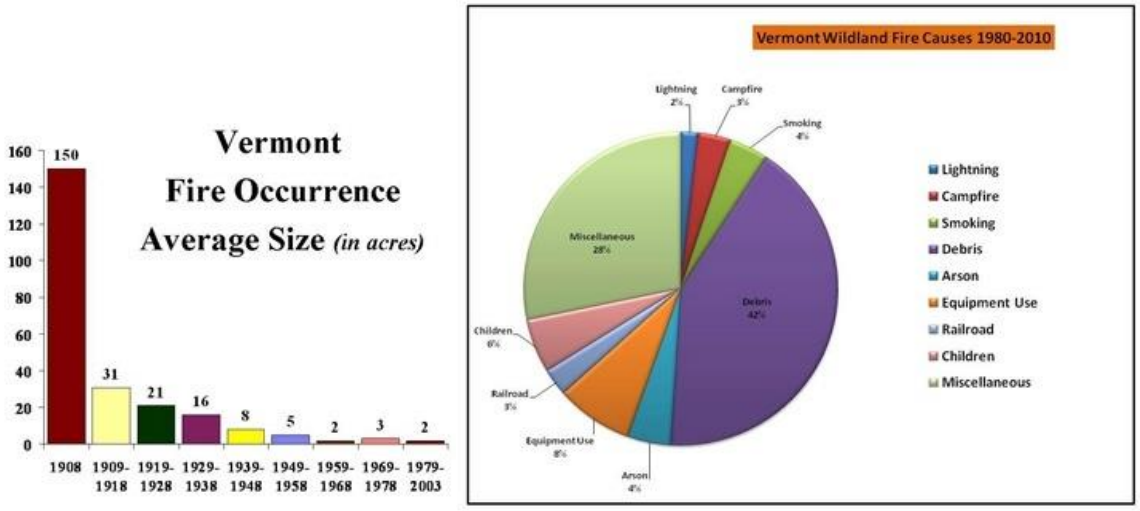
2.1.4 Fire Hazards

Major Fire – Urban
While structure fires have been removed from the 2013 *Vermont State All-Hazards Mitigation Plan*, the impact on the most urban area in Charleston to a fire is substantial as all buildings are in close proximity to another and a fire in one is likely to spread to the next. Vermont has one of the highest per capita death rates from fire in the nation. This is the deadliest form of disaster throughout the state. In 2000, there were 831 structural fires in the state, 12 of which resulted in 22 civilian deaths. 20 of those deaths occurred at residences. Although there have been requirements for smoke detectors in rental housing for over 20 years, and requirements for smoke detectors in single family dwellings since 1994, only one building involved in the fatal fires in 2000 had working smoke alarms. For some remote locations, access to water for emergency vehicles has been a factor in controlling an outbreak of fire.

Major Fire –non-developed
Due to its climate and primary vegetation types, Vermont is not considered to be at serious risk for large-scale wildfires. Despite not having had a major wildfire in the last 50 years, fire suppression systems are in place at the local level. These involve burn permits, burn restrictions, prevention, and detection of fires. Isolated homes with single access roads are more vulnerable to wildfires than more heavily populated areas, and the threat is increased during dry periods, especially in the late summer and fall. The primary forms of 'wildfire' fire in Charleston are brush and grass fires accidentally started by persons burning trash, leaves or brush. The town has not seen a significant fire in the last decade. The National Institute of Standards and Technology (NIST) Wildland Urban Interface (WUI) Hazard Scale rates wildfires on a range from E1 to E4 - with E4 being a location's highest exposure to fire, be it from grasslands to a forest in a remote mountain canyon. The WUI Hazard Scale is designed to consistently measure the expected risks from fire and embers during a WUI fire event for individual locations within a community, taking into account the ever-changing nature of those hazards. Traditionally, the State of Vermont has not had a high occurrence of large fires although individual fires of several thousand acres have burned in the past. On the average, Vermont has 200-400 fires per year with an average size of 1.5 – 2 acres. Nearly fifty percent of these fires are started by debris burning that is failed to be contained. A particularly devastating fire season in 1903 prompted the Vermont legislature to create the town forest fire warden system the following year. The initial intent of the warden system was to eliminate the destruction to the forests from fire by providing forest fire control at the local level. The 1904 law authorized the first selectmen in each town to be appointed as the fire warden. Below are charts showing average fire size (in acres) in

Vermont and causes. Since 1959, an average wildfire in Vermont has been less than 3 acres and this area is the extent that Charleston expects to see in the event of a wildfire. Charleston has not experienced a wild land fire to the extent that data as captured in terms of duration or acreage.

Table 2-7: Vermont Fires: Size and Causes



Source: northeastwildfire.org

2.1.5. Summary of Major Weather Events

The National Weather Service Maintains a "Recent Weather Event Summaries" list on their website. The following table provides the most recent list of major events by type. Further information can be obtained by going to the website and clicking on an event. While not all of the events listed impacted Charleston, they do give indication of the magnitude and frequency that any Vermont community can anticipate for their area.

Table 2-2: National Weather Service Weather Event Summaries Table (Source: http://www.weather.gov/btv/recentwx)

Severe Thunderstorms
The Widespread Damaging Wind Event on 8 July 2014 across Northern New York and Most of Vermont
The 27 May 2014 Isolated Supercell across Addison and Rutland Counties of Vermont
Golf Ball Hail and Damaging Wind Event on 11 September 2013
Widespread Severe Thunderstorm Damaging Wind Event on 19 July 2013
The Damaging Wind and Large Hail Event on 2 June 2013
The Large Hail and Damaging Wind Event of 23 July 2012
The Independence Day 2012 Severe Weather Event
Heavy Precipitation Supercells of 29 May 2012
Summary of the Severe Wx Event of August 21, 2011
The 2011 Pre-Memorial Day Severe Weather Outbreak and Flash Flood Event across the North

Country
The July 21, 2010 Severe Weather Event across Vermont and Northern New York
"Route 7 Runner": The May 26, 2010 Severe Weather Event Across the Champlain Valley
July 16th, 2009 ~ Severe Storms Summary
May 9th, 2009 ~ Severe Storms & Washington Tornado Summary
July 18th, 2008 ~ Severe Storms & North Cambridge Tornado Summary
June 10th, 2008 ~ Severe Storms Summary
August 16th, 2007 ~ Supercell Thunderstorms
July 9th-11th, 2007 ~ Severe Weather & Flash Floods Across Northern New York & Vermont
July 1st, 2004 ~ Large Hail Across Northern New York & Vermont
June 9th, 2004 ~ Thunderstorm Wind Damage & Large Hail Across Northern New York & Vermont ~ Including 2 F0 Tornadoes in St. Lawrence County, New York
May 18th, 2004 ~ Straight-line Wind Damage in Rutland County, Vermont
June 29th, 2003 ~ Thunderstorm Wind Damage & Large Hail Across Northern New York & Vermont
Flash Flooding
Heavy Rainfall and Associated Flooding on May 23, 2013
Preliminary Hurricane/Tropical Storm Irene Summary for the North Country
26-27 April 2011 Flash Flood Event
Heavy Rainfall and Flooding of 2-4 August 2010
August 6th, 2008 ~ Flash Flooding in Southern Addison County, Vermont
June 29th, 2005 ~ Flash Flooding in Williston, Vermont
Winter Events
A Summary of the Pre-Thanksgiving Day Snowstorm of 2014
The Localized Upslope Snow Event on 28 December 2011
A Review of the 6-7 March 2011 Snowstorm Across Vermont and Northern New York**
**(2nd Greatest Snow Storm Total at Burlington Intl. Airport)
Champlain Powder: The Historic Burlington Vermont Snowfall of 2-3 January 2010**
**(The Greatest Snow Storm Total at Burlington Intl. Airport)
March 2nd, 2009 Winter Storm Case Review
December 11-12th, 2008 Winter Storm Case Review
October 27-28th, 2008 Snowstorm Case Review
February 26-27th, 2008 Winter Storm ~ Summary & Images
February 6-7th, 2008 Winter Storms ~ Summary & Images
February 1st, 2008 Mixed Precipitation ~ Summary & Images
Summary of the Record Breaking January Thaw of 2008
January 1st, 2008 ~ Summary & Images
December 31st, 2007 ~ Summary & Images
December 16th & 17th, 2007 ~ Summary & Images
April 4th & 5th, 2007 ~ Summary & Images
March 17th, 2007 ~ Summary of St. Patrick's Day Storm
February 14th, 2007 ~ Summary of Valentine's Day Storm**
**(3rd Greatest Snow Storm Total at Burlington Intl. Airport)
Miscellaneous Events
▪ High Wind Event on January 18, 2012
▪ The May 31, 2010 Memorial Day Smoke Out

▪ Lake Champlain Waterspouts - January 15th, 2009
Historical Events
▪ Top Weather Events of 2014 Across the North Country
▪ Historic March Warmth of 2012
▪ Top 5 Weather Events of 2011 across the North Country
▪ Preliminary Hurricane/Tropical Storm Irene Summary for the North Country
▪ WFO BTV Top 10 Weather Events of 2000 to 2009
▪ Northeast Ice Storm of 1998
▪ The December 1989 Arctic Outbreak across the North Country
▪ Montgomery Flash Flood of 1997
▪ Flood of 1927

2.2 Technological Hazards

The following discussion on technological hazards is based upon information from several sources. However, the town lacks any significant investment in utilities.

2.2.1 Utilities

Telecommunications System Failure

Land-line telecommunications services in town are largely provided by Fairpoint Communications. Fairpoint is responsible for operation, maintenance and repair of telecommunications facilities. While service outages do occur, the frequency and magnitude remains slight. Distribution of phone lines generally follows the same corridor as roads. Weather or other problems interrupting services outside of the town or even outside the State of Vermont have the potential to disrupt service in the town. Service outages that affect emergency communications are of concern to local officials. Cellular phone service remains lacking in the town due to the varying terrain and proximity to reception towers. The concern over the prospect of a computer virus that could propagate and shut down computer systems, public and private, across the county could certainly impact the town but the likelihood of such an occurrence has not been evaluated. Charleston, due to its rural nature and relative lack of heavy reliance may, in fact, be less vulnerable than a more urban area.

Loss of Electrical Service

Energy resources are available to Charleston in sufficient supply. Vermont Electric Cooperative, Barton Electric, and Citizens Energy supply electricity. Wood, heating oil, and propane gas are all available through local distribution. Gasoline and diesel fuel are available in adjacent towns and through local fuel suppliers. The most significant disruptions to electrical services are events which cause outages lasting more than a day and those which affect a wide area. Along with the upgrade of the transmissions system, efforts are being made in the county to reduce peak electricity use through energy efficiency measures.

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2.2.2 Hazardous Substances

Hazardous Material Storage and Release

A major Superfund Amendments and Reauthorization Act (SARA) provision is Title III, also referred to as or SARA Title III or the Emergency Planning and Community Right-to-Know Act (EPCRA). EPCRA establishes guidelines for Federal, State and local governments and industry regarding emergency planning and providing communities with information on hazardous chemicals within their jurisdiction. The State of Vermont's implementation of its SARA requirements was approved by the Legislature in 1994. Orleans County was designated as an emergency planning district and DEMHS established a Local Emergency Planning Committee, known as LEPC #10, for the county. The function of the LEPC is to carry out duties proscribed in SARA Title III. In addition, Vermont statute dictates that the LEPC shall insure that the local emergency response plan has been implemented upon notification of a release of hazardous chemical or substance, consult and coordinate with municipal emergency service providers, DEMHS and the managers of all HAZMAT facilities within Orleans County regarding the facility plan, and review and evaluate requests for funding. Farmers are not required to report agricultural chemicals stored on their properties, but they do not typically store and keep large amounts of these chemicals. Hazardous material release is a concern for the town of Charleston. According to the Charleston Fire Department, a collection source for facility tier II reports, only the school submitted a 2014 Tier II report. With this, there are minimal reported hazardous material storage sites in Charleston. Sites that contain large amounts of fuel or store what DEMHS calls Extremely Hazardous Substances are the most likely to cause significant problems in a hazardous materials incident and the town is free from such areas. The Town has two diesel fuel tanks in code-compliant spill containment shrouds. Farms and businesses have smaller fuel tanks for diesel and gas. There are various sized propane tanks all around town. Garages have various automotive products, such as oil, grease and antifreeze. While any site can be the source of a spill, history remarks positively to the responsible actions of business owners and farms in the town as there have been no significant chemical spills in the town.

According to the 2014 hazardous materials data obtained, the following sites in Charleston are required to file a Tier II report.

Table 2-3 Town of Charleston, Tier II Reporting Facilities

Owner / Facility	Type of Substance
CHARLESTON ELEMENTARY SCHOOL	HEATING OIL

Pollution Events

No data was available or obtained beyond the hazardous materials release data. This data shows that nearly all such hazardous materials spill incidents consist of accidental discharges of gasoline, diesel or fuel oil when customers or delivery personnel are pumping these products. The majority of spills were in quantities of less than 5 gallons. DEC's *Local Planning and Zoning Options for Water Quality Protection* supports efforts that could increase water quality protection by addressing issues such as: development setbacks from ponds, lakes, rivers and streams; requiring vegetation in watercourse buffer zones; keeping thorough inventories of water bodies; and protecting and maintaining water quality through wetland protection regulations.

Water resources often cross town, county, state, and national borders. A watershed's water quality can only be protected or enhanced through the cooperation of the municipalities and landowners that live, work, and play in the watershed.

2.2.3 Transportation Incidents

The most common form of transportation incident or accident is an automotive accident. The following is an overview of Charleston Roads from the 2013 Charleston Town Plan:

> *"Charleston depends on the 60 miles of local and state roads within our borders and road maintenance is a top priority. Charleston has 10.15 miles of Class 2 roads, 30.51 miles of Class 3 roads, 9.01 miles of Class 4 roads, and 5.85 miles of legal trails. The state highways account for another 13.88 miles of road. Vermont Route 105 runs through the Town, roughly parallel to the Clyde River, connecting the Town to Island Pond and Derby. Route 5A runs perpendicular to Route 105 in West Charleston, connecting to Brownington. Various classes of roads connect residents to Island Pond, Morgan, Derby, Brownington, and Westmore, and to each other. Ninety percent of the Town's workforce travels to work by car, truck or van—with almost half on the road before 7:00 am."* *–2013 Charleston Town Plan*

The town is concerned about transportation-related chemical accidents. Namely on the state highway, Route 5A and Route 105. In collaboration with LEPC 10, emergency managers from NVDA, the select board and Fire Department, exploring the benefits of a HMEP-grant funded study to better understand what is being transported through the town is a future goal.

<u>High Accident Locations</u>

VTrans has not identified any high-accident locations in Charleston.

<u>Road Infrastructure Failure</u>

Only bridge 5 on Hudson Rd is functionally deficient. This bridge is also scour critical. The bridges and culverts on the Twin Bridge Rd and the road itself cross the Clyde River floodplain. This road is subject to frequent washouts or wash-overs. Part of the town's five year plan is to pursue grants to address this problem. Mad Brook has been subject to repeated washouts outs on the roads and bridges throughout its watershed. The town has been approved for a Hazard Mitigation Grant from FEMA to replace a twin culvert that has washed completely out three time in the past 8 years on Cole Rd. This grant is waiting on the approval of this Hazard Mitigation Plan by FEMA. The Mad Brook Bridge was washed completely away in 1978, and has been seriously undermined in subsequent FEMA declared events. The Westmore Rd. Bridge has washed out tearing half of the deck away during Irene in Sept 2011. The town is planning to address these locations with repair and will pursue funding to do so.

2.3 Societal Hazards

The following discussion of societal hazards is based upon qualitative information from discussions with law enforcement professionals as well as quantitative data from the State of Vermont. The 2013 Vermont State All-Hazards Mitigation Plan is also referenced.

2.3.1 Crime

Vermont crime statistics indicate a total downward trend in crime based on data from 13 year prior when violent crime was increasing and property crime was decreasing. Overall, the total crime rate for 2015 is expected to be lower than 2012. Vermont remains lower on every statistical crime scale in comparison to the country as a whole. The town of Charleston does not feel that crime is a major issue currently.

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2.3.2 Terrorism

Regarding terrorism in Vermont, the *2013 Vermont State All-Hazards Mitigation Plan* states:

> *"Terrorism and civil hazards include actions intentionally aimed at threatening lives and property. They may range from a single person on a shooting rampage to a cyber attack that harms computer systems, to the organized use of weapons of mass destruction (WMD). WMD events could involve chemical, biological, explosive or radioactive weapons. DEMHS and Vermont State Police conducted a risk/threat assessment of potential WMD attacks in 2000 that ranked potential targets by State Police district. At that time, no known or suspected terrorists have been identified as operating in Vermont. However, some in the U.S intelligence community believe that radical Islamist/extremist organizations may have small cells in Montreal and Toronto, not far from the US border. In this regard, Vermont is considered a potential transit point for terrorist organizations operating out of Canada who may travel through the state to reach points to the south….Vulnerability studies conducted at the state level have focused on dam security-"*

2.3.3 Epidemics and Mass Casualty Incidents

Fatal or serious contagious diseases are increasingly being considered as hazards. In the US, influenza kills an average of 36,000 people per year. An influenza epidemic on the scale of that which occurred in 1918 could potentially sicken up to 35% of the population, including over 200,000 people in Vermont (Vermont Department of Health, draft *Pandemic Influenza Preparedness and Response Plan*, 2006). Due to the process of manufacturing vaccines, sufficient supply might not be available in the event of a serious outbreak of influenza. Concerns about avian influenza in 2006 prompted the Vermont Department of Health to issue a report, the *Pandemic Preparedness and Response Plan*, outlining the state's response to an influenza epidemic. There is also concern over how to distribute supplies, enforce quarantines, keep critical personnel from becoming ill, and disseminate information in the case of an epidemic. Other health threats mentioned in the Vermont State All-Hazards Mitigation Plan are water or food supply contamination, bioterrorism, an epidemic affecting farm animals and poultry, and rabid animals.

2.3.4 Food Supply Crisis

Some state and local officials have become concerned with the ability of local and regional food systems to adequately feed the population in the event of a fuel shortage or other emergency that disrupts inter- and intra-state food supply chains. Given the rural nature of Charleston, a food supply issue remains a concern but less of one compared to a more densely populated area.

2.3.5 Economic Recession

The United States formally entered a recession in December 2007, which dramatically accelerated in September 2008. While Vermont is not among the states hardest hit by the recession, the state, including Charleston, has certainly felt the effects of the downturn. According to the Vermont Department of Labor, unemployment in Vermont increased by 2.6% to 6.7% between January 2008 and January 2010, and was above 7% for much of 2009. As of January 2010, the unemployment rate in Charleston was higher than the state average.

SECTION 3: RISK ASSESSMENT

3.1 Designated Hazard Areas

3.1.1 Flood Hazard Areas

According to the Charleston Town Plan, designated flood hazard areas exist in the town but most major infrastructure and roadways are out of harm's way. 12 residences are in the floodplain and no commercial property other than hay fields and a few hay barns exist with the 100-year floodplain. All culverts on Hudson rd. and Twin Bridge Rd. are, however, located in the floodplain.

3.1.2 Fluvial Erosion Hazard Areas

The town is relatively free of any concern related to stream bank scouring as there are no high-risk areas in terms of environmental or economic risk. While portions of the Mad Brook have some fluvial erosion potential, the town has not seen any major increase in erosion since 2011, when repeated flooding inundated much of the state. In light of this and the potential for more severe weather events, the town remains cautious and realizes that the situation can change quickly. In support, Vermont has seen a dramatic increase in agency collaboration in recent years. The results of this enhanced cohesion has resulted in several published resources for all towns to use to guide mitigation efforts and enhance resiliency. With the recent emphasis on climate change and subsequent weather-related disasters, the town remains committed to aligning with all applicable and logistically feasible recommendations and considerations resulting from the work of State agencies.

Issue 1: Climate Change

In line with the Vtrans mission statement, the town remains committed to:

- Ensure that there are viable alternative routes around vulnerable infrastructure such as bridges and roadways.

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

Sources:
http://vtransplanning.vermont.gov/sites/aot_policy/files/documents/planning/Climate%20Change%20Adaptation%20White%20Paper.pdf

http://www.anr.state.vt.us/anr/climatechange/Pubs/2013.0610.vtanr.NR_CC_Adaptation_Framework_ES.pdf

Issue 2: Fluvial Erosion

In line with DEC's best practices, the town will work to:

- **Slowing, Spreading, and Infiltrating Runoff (**The State Surface Water Management Strategy is found at http://www.watershedmanagement.vt.gov/swms.html and http://www.watershedmanagement.vt.gov/stormwater.htm)
- **Avoiding and Removing Encroachments.**
  http://www.watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm
  http://www.watershedmanagement.vt.gov/rivers/docs/rv_RiverCorridorEasementGuide.pdf
- **River and Riparian Management:** DEC has prepared a compendium of *Standard River Management Principles and Practices* to support more effective flood recovery implementation; improve the practice of river management;
  and codify best river management practices in Vermont. The document compiles

the most current river management practices based on the best available science and engineering methods to create consistent practice and language for risk reduction while maintaining river and floodplain function. Best practices are established to address common flood damages, including:

- Erosion of banks adjacent to houses and infrastructure
- Erosion of road embankments
- Channel movement across the river corridor
- River bed down-cutting that destabilizes banks, undermines structure foundations, exposes utility crossings, and vertically disconnects rivers from adjacent floodplains
- Bridge and culvert failure.

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

3.1.3 Repetitive Loss Properties

The town has no repetitive loss properties.

3.2 Non-designated Hazard Areas

3.2.1 1998 Ice Storm Damage

Impacts of the January 1998 ice storm in Charleston were minimal in comparison to other areas of the state.

3.2.2 High Winds and Lightning

Ridgeline and hilltop homes as well as homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. High tension line runs along VT RT 105 and the Vermont Agency of Transportation works to keep limbs trimmed.

3.3 Previous FEMA-Declared Natural Disasters, Non-declared Disasters and Snow Emergencies

Since 2007, the town has had $587,000 in road expenses resulting from washouts and flooding. Of this amount, $64,000 (10.9%) has been paid for by the town. The remainder has been paid for by FEMA and ERAF. In 2010, the town made a significant repair to Dane Hill Road. Beginning at Route 105, the first ¾ mile were completely rebuilt. The $78,000 project was paid for by the Vermont Department of Public Safety ($35,000), Better Back Roads ($12,000) and a Vermont Structures Grant ($27,000) with the remainder paid for by the town. This project was not caused by the result of a declared disaster but due to the volume of traffic and impact on the road resulting from being on such a steep slope. The resulting repair has substantially protected the town from future expenditures associated with minor repairs to this location. Charleston has received public assistance funding from FEMA for the following natural disasters:

Table 3-1 Town of Charleston, FEMA-declared disasters and snow emergencies, 2005-2014

Date (FEMA ID#)	Type of Event	Total Repair Estimates	Project Worksheet #
DR-1715	Flooding	$61,719.00	30, 31
DR-1995	Flooding	$213,712.00	064, 116, 119, 134, 135, 141, 142, 156, 162, 173, 174, 223, 308, 378, 379, 384, 385, 390, 391, 394, 410, 411
DR-4022	Flooding	$187,394.00	016, 310, 784, 851, 852, 854, 855, 858, 866
DR-4140	Flooding	$76,598.00	0095, 0134, 0135
DR-4178	Flooding	$18,851.00	4163

Sources: Town Records, Project Worksheets, financial report forms and award letters.

The Town of Charleston was reimbursed at a rate of 75 percent by FEMA for the estimated repair costs and 12.5% by the state. Funds provided in response to these natural disasters were used for gravel, ditching, road repair and additional secondary costs associated with these activities.

Future Events

Although estimating the risk of future events is far from an exact science, the Planning Team used best available data and best professional judgment to conduct an updated Hazards Risk Estimate analysis, which was subsequently reviewed and revised by town officials in 2014. 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 town, and serves as a method of identifying which hazards hold the greatest risk based on prior experience and best available data. The following scoring system was used in this assessment.

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

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

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

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

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

3.4.1 Natural Hazards

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

- Severe Winter Storm (28)
- Flooding (16)
- Fire (10)
- Wildfire (7)

While flooding is likely to have a significant impact over a smaller area, severe winter storms tend to affect the entire town and are more common, hence the higher rating. Charleston has minimal fluvial erosion hazard areas along stream banks.

Table 3-2 Natural hazards risk estimation matrix, Charleston

Hazard and Risk Analysis: Natural Hazards	Drought	Flooding	High Winds	Fluvial Erosion	Landslide	Lightning	Multi-Structure Urban Fire	Wildfire	Winter Storm	Radiological (Natural)
Area Impacted										
Key: 0 = No developed area impacted 1 = Less than 25% of developed area impacted 2 = Less than 50% of developed area impacted 3 = Less than 75% of developed area impacted 4 = Over 75% of developed area impacted	0	1	1	0	0	0	2	1	4	0
Consequences										
Health & Safety Consequences Key: 0 = No health and safety impact 1 = Few injuries or illnesses 2 = Few fatalities or illnesses 3 = Numerous Fatalities	0	1	0	0	0	0	2	1	1	0
Property Damage Key: 0 = No property damage 1 = Few properties destroyed or damaged 2 = Few destroyed but many damaged 2 = Few damaged and many destroyed 3 = Many properties destroyed and damaged	0	1	1	0	0	0	3	1	1	0
Environmental Damage Key: 0 = Little or no environmental damage 1 = Resources damaged with short-term recovery 2 = Resources damaged with long-term recovery 3 = Resources destroyed beyond recovery	0	0	0	0	0	0	0	2	0	0
Economic Disruption Key: 0 = No economic impact 1 = Low direct and/or indirect costs 2 = High direct and low indirect costs 2 = Low direct and high indirect costs 3 = High direct and high indirect costs	0	1	1	0	0	0	3	2	1	0
Sum of Area & Consequences Scores	0	4	3	0	0	0	10	7	7	0
Probability of Occurrence Key: 1 = Unknown but rare occurrence 2 = Unknown but anticipate an occurrence 3 = 100 years or less occurrence 4 = 25 years or less occurrence 5 = Once a year or more occurrence	1	4	1	0	0	0	1	1	4	0
TOTAL RISK RATING Total Risk Rating = Sum of Area & Consequences Scores x Probability of Occurrence	0	16	3	0	0	0	10	7	28	0

3.4.2 Technological Hazards

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

Power Loss (7)

Telecommunications Failure (36)

Hazardous Materials Incident (7)

Charleston is vulnerable to Power Loss and Telecommunications Failure because the population is dispersed and repairing utility infrastructure in rural areas can take more time.

Table 3-3 Technological hazards risk estimation matrix, Charleston

Hazard and Risk Analysis: Technological Hazards	Gas Service Loss	Hazardous Materials Incident	Power Loss	Radiological Incident	Sewer Service Loss	Telecommunications Failure	Water Service Loss	Major Transportation Incident	Military Ordnance Incident
Area Impacted									
Key: 0 = No developed area impacted									
1 = Less than 25% of developed area impacted									
2 = Less than 50% of developed area impacted	0	1	4	0	0	4	0	2	0
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									
1 = Few injuries or illnesses	0	1	1	0	0	2	0	1	0
2 = Few fatalities or illnesses									
3 = Numerous Fatalities									
Property Damage									
Key: 0 = No property damage									
1 = Few properties destroyed or damaged									
2 = Few destroyed but many damaged	0	1	1	0	0	1	0	1	0
3 = Few damaged and many destroyed									
4 = Many properties destroyed and damaged									
Environmental Damage									
Key: 0 = Little or no environmental damage									
1 = Resources damaged with short-term recovery	0	2	1	0	0	1	0	1	0
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									
2 = High direct and low indirect costs	0	2	1	0	0	1	0	1	0
2 = Low direct and high indirect costs									
3= High direct and high indirect costs									
Sum of Area & Consequences Scores	0	7	7	0	0	9	0	6	0
Probability of Occurrence									
Key: 1 = Unknown but rare occurrence									
2 = Unknown but anticipate an occurrence									
3 = 100 years or less occurrence	1	1	1	1	0	4	0	1	0
4 = 25 years or less occurrence									
5 = Once a year or more occurrence									
TOTAL RISK RATING									
Total Risk Rating =									
Sum of Area & Consequences Scores									
x Probability of Occurrence	0	7	7	0	0	36	0	6	0

3.4.3 Societal Hazards

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

- Epidemic (4)
- Crime (15)

The likelihood of an epidemic is difficult to gauge, but its consequences could be severe. The largest organizations in the town (and the ones with the highest populations on any given day) would be most susceptible to becoming zones of high attack rates and would look to State Health Department recommendations on closure notices. Because of the rural nature of the town, there are few societal hazards.

Table 3-4 Societal hazards risk estimation matrix, Charleston

Hazard and Risk Analysis: SOCIETAL HAZARDS	Crime	Civil Disturbance	Terrorism	Epidemic	Economic Recession	Key Employer Loss
Area Impacted Key: 0 = No developed area impacted 1 = Less than 25% of developed area impacted 2 = Less than 50% of developed area impacted 3 = Less than 75% of developed area impacted 4 = Over 75% of developed area impacted	1	0	0	2	0	0
Consequences						
Health & Safety Consequences Key: 0 = No health and safety impact 1 = Few injuries or illnesses 2 = Few fatalities or illnesses 3 = Numerous Fatalities	0	0	0	2	0	0
Property Damage Key: 0 = No property damage 1 = Few properties destroyed or damaged 2 = Few destroyed but many damaged 3 = Few damaged and many destroyed 4 = Many properties destroyed and damaged	1	0	0	0	0	0
Environmental Damage Key: 0 = Little or no environmental damage 1 = Resources damaged with short-term recovery 2 = Resources damaged with long-term recovery 3 = Resources destroyed beyond recovery	0	0	0	0	0	0
Economic Disruption Key: 0 = No economic impact 1 = Low direct and/or indirect costs 2 = High direct and low indirect costs 2 = Low direct and high indirect costs 3 = High direct and high indirect costs	1	0	0	0	0	0
Sum of Area & Consequences Scores	3	0	0	4	0	0
Probability of Occurrence Key: 1 = Unknown but rare occurrence 2 = Unknown but anticipate an occurrence 3 = 100 years or less occurrence 4 = 25 years or less occurrence 5 = Once a year or more occurrence	5	1	1	1	1	1
TOTAL RISK RATING Total Risk Rating = Sum of Area & Consequences Scores x Probability of Occurrence	15	0	0	4	0	0

3.4.4 Hazard Summary

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

- Severe Winter Storm
- Power Loss
- Flooding
- Telecommunications Failure
- Major Transportation Incident
- Epidemic

It should be noted that two natural hazards on the list—severe winter storm and flooding —could be the cause of the highest-rated technological hazards, power loss and telecommunications failure. Winter storms are the highest rated hazard for Charleston, due in large part to their widespread nature and frequent occurrence.

SECTION 4: VULNERABILITY ASSESSMENT

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." The Charleston Base Map shows the geographic distribution of some critical facilities and utilities. Table 4-1 identifies critical facilities in Charleston, excluding critical facilities designated as hazardous materials storage sites, which are listed in Tables 2-1 and 2-2.

Table 4-1 Critical facilities in the Town of Charleston

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

4.2 Infrastructure

4.2.1 Town Highways

The following is a statistical overview of roads in the Town of Charleston. These tables show the range of road types within the town, from highways to 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.

Table 4-2 Town highway mileage by class, Town of Charleston

Class 1	Class 2	Class 3	Class 4	State Hwy	Fed Hwy	Interstate	Total 1, 2, 3, State Hwy
0	10.5	30.51	9.01	13.88	0	0	63

Source: data derived from VTrans TransRDS GIS data – Charleston Town Plan 2013

Table 4-3 Town highway mileage by surface type, Town of Charleston

Paved	Gravel	Soil or Graded	Unimproved	Impassable	Unknown	Total
5	35.5	9.01	0	0	0	49.51

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

4.2.2 Bridges, Culverts, and Dams

Bridges:

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 NVDA and represent those of greatest concern for the town. This analysis does not take into account the fluvial geomorphology or the elevation of the bridge above the floodplain.

Table 4-4 Inventoried bridges in the Town of Charleston with identified need

Class	Bridge Type	Deficiency	Bridge Features	Scour Critical	Located in Floodplain
TOWN SHORT	SLAB	FUNCTIONALLY DEFICIENCY	HUDSON ROAD	3 - SCOUR CRITICAL	NO
TOWN SHORT	SLAB	UNKNOWN	MAD BROOK	NO	NO
TOWN SHORT	SLAB	UNKNOWN	WESTMORE	NO	NO

The entire Bridge Inventory with maps for the town can be found on the state site: https://vtculverts.org/bridges#list

Culverts:

Citizens must buy their own driveway culverts but the Town will install them. The Town maintains a culvert inventory that assesses over 800 culverts with data on length, overall condition, size and location. This data guides the town's culvert maintenance and replacement plan. All culverts removed from the Town roads become the Town's property. Usable culverts will be reused on Class 4 roads. Less useful culverts are sold on a first come first serve basis and others are sold as scrap metal. Guardrails are placed on an as-needed basis or as required by the state. A supply of beam rail and posts are stored at the Town Pit on Ten Mile Square Road. Culverts located in the 100-year floodplain are listed below

Table 4-5: Charleston culverts located in 100-year floodplain

All (48) culverts on Hudson Road are in the 100-year Floodplain.
All (4) on Twin Bridges

Source: The entire Culvert Inventory with maps for the town can be found on the state site: https://vtculverts.org/map.

Dams:

The National Dam Inventory shows two structures in the town. The first is the West Charleston Hydroelectric Plant, federally licensed as the Clyde River Hydroelectric Project (FERC Project No. 2306). The facility ceased operation in 1998 due to poor condition but Great Bay Hydro, a private energy company based in Portsmouth, NH, acquired the facility from Citizens Utilities in 2004. The second and upstream from Great Bay Hydro's operation is the two-turbine Barton Village Hydropower Project (FERC No. 7725), operated by Barton Village Electric, which serves more than 2,000 customers in Barton, Westmore, West Charleston, Brownington, Evansville, and Sutton. The plant operates in "run-of-river" mode. Originally constructed in the 1890s, the current facility is between 60 and 70 years old.

4.2.3 Water, Wastewater and Natural Gas Service Areas

The Town currently has no water, wastewater or natural gas service areas. Water and sewer systems are the sole responsibility of the property owner and they are required to meet state and federal regulatory standards.

4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines

High-tension electric transmission run through the Town of Charleston, running along VT RT 105.

4.3 Estimating Potential Losses in Designated Hazard Areas

12 residences and 0 commercial/industrial structures are located within the 100-year floodplain. Assuming a 2007 median grand list value, the estimated potential losses due to a major flood event inundating the floodplain are less than 1%. This estimate only takes structures into account, it does not account for personal property or business losses. The town has no repetitive loss properties.

4.4 Land Use and Development Trends Related to Mitigation

Charleston's land use is primarily residential and commercial. The Town of Charleston covers 24,662 acres (38.5 square miles). Population density is 26.6 people per square mile. Residences are concentrated primarily within the East and West Charleston Village areas, around the larger lakes, and along the larger state and Town roads, leaving much of the Town's acreage in an undeveloped condition. Nearly all of the land in Charleston is privately owned with exception of a few small state owned fishing access areas, Town-owned office and road maintenance facilities and a municipal Town Forest. The Town Forest is located along the Class 4 Town Farm Road on the Charleston-Westmore town line, and includes 184 acres within the Town of Charleston, as well as a contiguous 50 acres in Westmore. In Charleston, 9500 acres (41%) are currently enrolled in UVA (use value appraisal), including 51% of all parcels greater than 50 acres. This represents an increase of 2900 acres (15%) since 2003. Lands conserved by the Vermont Land Trust total 3221 acres (13%). One of the largest blocks of UVA and conserved acreage is found in the east corner of Town, made up of a dairy farm, the NorthWoods Stewardship Center, and multiple smaller private ownerships.

Table 4-6: Charleston Land Cover Types (Source VCGI)

Broad type Detail
Forested
Mixed forest 24.1%
Evergreen forest 23.3%
Deciduous forest 16.3%
Forested wetland 9.2%
Total forested 72.9%
Agricultural
Hay/pasture 7.8%
Row crop 6.8%
Total agricultural 14.6%
Other nonforested
Water 5.7%
Transportation/utilities 4.0%
Non-forested wetland 1.8%
Residential 0.6%
Brush/transitional 0.3%
Commercial/industrial 0.0%
Total other non-forested 12.4%

Parcel sizes in Charleston range widely, from a fraction of an acre to over 1100 acres, with 74% of parcels being at least 50 acres in size—slightly above the state average (VNRC 2012). Increasing land values and development have resulted in steady subdivision of large parcels, inhibited somewhat by the UVA program or conservation easements through various organizations—most notably the Vermont Land Trust (VLT).

4.4.2 Future Development and Housing

Charleston can benefit from attracting new business. Although unemployment in the Town is lower than the state average and the nation, there is strong support among Town residents for new job opportunities and the contribution that new business can make to the Town's tax base. New business areas appropriate for the Town include farming, agriculture, manufacturing, technology, health care, service businesses, tourism, and other residential scale enterprises that can be well integrated within the town's rural setting in ways that protect natural resources and scenic beauty. Charleston is adjacent to five municipalities: Brighton to the east; Morgan to the east and north; Derby to the north and west; Brownington to the west and south; and Westmore to the south. Interaction with these towns in terms of their land use and future development has been and continues to be a concern when actions conflict with the objectives

and land conservation measures set forth in the Charleston Town Plan. Despite the advantages of attracting new businesses and housing, the town does not foresee major development occurring in the next five year planning cycle. Other than individual real-estate transactions, there is little anticipated business development projected. With local shopping centers long-established and conveniently located in near-by Derby and Newport coupled with a stable population size and major business being farming, the town does not foresee substantial development occurring.

Housing

Mobile Homes occupied by full-time and part time residents continue to be a significant part of the housing mix (17% of overall housing units). According to the 2010 U.S. Census, about one-third of the Town's housing stock was built before 1950 (27% before 1940), and almost half was built between 1960 and 1990. About 12% has been built since 2000:

- About 45% of housing is valued between $50,000 and $150,000.
- 13% between $150,000 and $200,000.
- 28% between $200,000 and $300,000.
- 8% above $300,000.
- 43% of rental units cost between $500 and $750 per month.
- 50% cost between $750 and $1000 per month.
- 7% cost between $1000 and $1500 per month.

SECTION 5: MITIGATION STRATEGY

5.1 Charleston Town Goals and Policies that support Hazard Mitigation

5.1.1 Purpose and Goals

5.1.1.1 Community Goals

a. Continue supporting state standards with local, POS water/sewer sources

b. Take advantage of the UVM/ACCD mobile home park preparedness programs to support resiliency of this large and disproportionally impacted population during disasters.

c. Consider implementation of special population tracking within the community whereby residents unable to drive or that have no one to depend on can self-identify for inclusion in a maintained data-base so that rescue personal and emergency managers can account for this demographic.

d. Work with residents, NVDA, rescue services (Derby and Island Pond), Vermont EMS and the LEPC to accomplish greater efficiency in response times for residents living closer to Island Pond.

5.1.1.2 Capital Improvement Goals

a. Provide services and facilities deemed necessary for the orderly and rational development of the Town.

5.1.1.3 Public Participation Goals

a. Continue to solicit input regarding planning issues from town residents and from other entities which can help to offer solutions and insight into the problems the Town faces both now and in the future via formal meetings and advertised opportunities for input.

b. Utilize LEPC meetings to increase awareness, enhance planning and engage in exercises that address needs in the community.

5.1.1.4 Regulatory Devices Goals

a. The town is confident that state regulations will serve the town best and adopts to not have zoning at this time.

b. Maintain and continue a Capital Expense Budget and Program for the purpose of ensuring that Charleston's rate of growth does not outstrip the Town's ability to pay for the associated necessary services such as roads, schools, police and fire protection, solid waste, etc. The town's capital expense budget is for roads and maintaining town office and garage. School budget is administered separately by school board. There is not a local police force but a mutual aid agreement that includes 19 departments. Solid waste is handled by local haulers.

5.1.2 Land Use

5.1.2.1 Flood Hazard Overlay District

a. Work to develop a Flood Hazard Area Overlay District to include all designated flood hazard areas. The purpose of the Flood Hazard Area Overlay District is to (1) protect public health,

safety, and welfare by preventing or minimizing hazards to life and property due to flooding, and (2) to ensure that private property owners within designated flood hazard areas are eligible for flood insurance under the National Flood Insurance Program (NFIP). The town has elected not to be part of the NFIP but is dedicated to not encouraging new development in the floodplain. The town has no mobile home parks and very few residences at risk of flooding with no repetitive loss properties.

5.1.3 Natural Resources

5.1.3.1 Natural Resources Goals

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

b. Ensure that permits issued for development near sensitive areas, such as steep slopes, high elevations, wetlands, scenic vistas and wildlife habitats, contain conditions assuring conformance to the goals set forth in this plan.

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

d. The Conservation Commission shall also be an active participant in the local management plans for Charleston's Natural Areas.

5.1.3.2 Policies

a. Through both town and state-level management, work to:

- Encourage and maintain naturally vegetated shorelines, buffers and setbacks for all rivers, ponds and streams.
- Allow higher density or cluster development in existing and designated settlement areas and low density development in the remaining areas.
- Reduce flood hazard and repetitive road and driveway washout through continued updates and adherence to the Town Capitol Budget and Road Plan.
- Identify and manage pollution, flooding and fluvial erosion hazards along rivers and streams as they arise.

5.1.4 Transportation Plan

5.1.4.1 Transportation Goals

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

a. Maintaining safe operating conditions on the present system of town roads through design to keep traffic at appropriate speeds and timely maintenance, including consideration of additional paving (though only on portions of roads prone to damage) should state funding become available.

b. Protection of existing town roads from flood damage and uncontrolled storm water runoff.

c. Preserving the capacity of town roads and maintain adequate traffic flows and safety.

d. Support the road maintenance crew through Town-provided training sessions.

e. Ensuring that owners and managers of recreational areas provide and maintain adequate and safe parking facilities.

f. Continuing long term access opportunities to gravel and sand deposits for future road maintenance use (the town has secured a 50 year supply of good sand and gravel).

5.1.5 Utilities and Facilities Plan

5.1.5.1 Utilities and Facilities Goals

a. Maintain current relationships with the Vermont State Police and Rescue for police and emergency medical services, respectively.

b. Lack of crime does not support necessity for additional actions or planning at this time.

c. Identify effective locations for tanker truck access to water in portions of town that currently do not have adequate supplies. The Charleston Fire Department and NVDA shall be responsible for this task.

d. Promote high-speed internet access throughout town to assist and encourage local businesses to reside in Charleston.

e. Ensure adequate provision of water sources for fire suppression by requiring dry hydrants, fire ponds, water storage at Charleston Valley, or other measures as conditions on town land use permits where appropriate. The Planning Commission will work with developers and property owners on this task.

f. Work to develop a recruiting plan for fire department as a problem facing the town is an ageing membership where no new (young) volunteers are coming in due to the perceived commitment of time the training required.

5.1.6 Educational Facilities

5.1.6.1 Educational Goals

a. The School Board should work with the Selectboard and the Charleston Volunteer Fire Department to ensure that the necessary equipment exists at the Elementary School for its use as an emergency shelter.

b. Increase emergency planning cohesion between school and town EOPs through mutual participation and presentation at scheduled LEPC meetings and town and/or school meetings.

5.2 Existing Town of Charleston Actions that Support Hazard Mitigation

The town has done an excellent job at monitoring and addressing transportation issues, engaging in a documented and systematic approach to mitigation actions. The Selectboard has successfully pursued funding to address needs. Using Better Back Roads, Structures Grants and HMGP funding streams, the town has been able to enhance its transportation resilience and overall preparedness. The town has received approval for HMGP-funded road improvement project on Cole Road. The town has applied for a generator grant under FEMA's HMGP program to enhance sheltering capabilities at the elementary school as well as a HMGP-funded road

improvement project on Hudson Road (Site#3 below). The town has addressed its current and future needs in relation to HMGP and/or 406 Mitigation (PA) funded projects. By and large, road improvement projects remain the primary focus for the town and the areas identified were selected based on the condition of culverts and ditches and primarily focused on runoff issues particularly as the incidence of heavy storms has increased. In many cases, culverts properly sized for normal rain events are overwhelmed by the severe ones. The town will seek local, state and federal grants to address the sites.

Charleston will earmark the funds necessary to complete one major problem each year for the next 5 years and will keep its VOBCIT inventory current to improve its institutional memory. In conjunction with the Echo Lake Protective Association and other town committees, the town will apply for HMGP funding and from Better Back Roads Cat B grants for each site over the next five years. The total budget for the projects is $1,092,201.00. The towns expects to request additional appropriations over and above the regular budget to provide the town share, and or utilize Structures Grants from the state to fund the balance of these projects. This will be a serious commitment for the town but upgrading roads will pay off in less repair and maintenance in the future. Currently outlined mitigation projects from the *2014 Road Inventory and Capital Budget Plan* are detailed below:

Town of Charleston - Road Erosion Site Inventory May 2014			
Site # 1 Durgin Road			
Priority:	#1-2015		
Road Name:	Durgin Rd		
TH#:	#2		
Location:	From Morgan townline to Vt Rt 105 in West Charleston village.		
Nearest Water Body:	Clyde River		
Distance to Water Body:	It crosses the river at West Charleston village and all drainage goes to the Clyde.		
Current Condition:	Needs several culverts replaced and to be resurfaced with blacktop.		
Proposed Solution:	To replace culverts and resurface with blacktop 1-1.5" shim		
Estimated Costs to Improve/ Repair			
Culvert,Ditching and Bank Stabilization			
Materials:	3-24" x 40' HDP smooth culverts @ 1,820.00	Cost:	$5,460.00
Materials:	213 cu yds. 3/4" crusher run gravel @$ 21.45/cu yd	Cost:	$4,800.00
Materials:	Matting and seed 1500ft.	Cost:	$5,200.00
Machinery:	Excavator @$600.00/day 2 day	Cost:	$1,200.00
Machinery:	Town trucks (local share)	Cost:	0
Labor:		Cost:	
Total Culvert, Ditch and Bank Stabilization Costs:			**$16,680.00**
Re-paving Roads			
Materials:	1 mile blacktop includes machinery and labor	Cost:	$1,000,000.00
Materials:		Cost:	
Machinery:		Cost:	
Machinery:		Cost:	
Machinery:		Cost:	
Labor:		Cost:	
Total Crowning and Re-grading Roads			**$100,000.00**
Total Estimate for this project:			**$116,680.00**

Town of Charleston - Road Erosion Site Inventory May 2014			
Site#1 Church Hill/Mill Street			
Priority:	#1-2015		
Road Name:	Church Hill Road/ Mill Street		
TH#:	# 3n and # 47		
Location:	From Vt Rt 105 in East Charleston village to intersection with West Echo Lake Rd		
Nearest Water Body:	Mill Brooke		
Distance to Water Body:	Crosses brook at Duane Mouton's -drainage goes into brook and on to Clyde river		
Current Condition:	Needs updated culverts w/splash pools (18") to meet code and needs blacktop and gravel resurfacing, ditching and grading.		
Proposed Solution:	Replace culverts with 18" to meet code and ditch Mill street		
Estimated Costs to Improve/ Repair			
Ditch and Bank Stabilization			
Materials:	3-18" x 40' HDP smooth culverts @ 608.00	Cost:	$1,824.00
Materials:	Ditching , matting and seeding 500 ft	Cost:	$970.00
Materials:		Cost:	
Materials:		Cost:	
Machinery:	Included in price	Cost:	
Machinery:		Cost:	
Machinery:		Cost:	
Labor:	Included in price	Cost:	
Total Ditch and Bank Stabilization Costs:			**$2,794.00**
Crowning and Re-grading Roads			
Materials:	500 ft of blacktop	Cost:	$10,000.00
Materials:	400 cubic yards 3/4" crusher run gravel @ 21.45	Cost:	$8,580.00
Machinery:	Town trucks , grader and labor	Cost:	0
Machinery:		Cost:	
Machinery:		Cost:	
Labor:		Cost:	
Total Crowning and Re-grading Roads			**$18,580.00**
Total Estimate for this project:			**$21,374.00**

Town of Charleston - Road Erosion Site Inventory May 2014	
Site # 2 Cole Road	
Priority:	Site # 2-2016
Road Name:	Cole Road
TH#:	# 39
Location:	Mad Brook crossing at Westmore town line
Nearest Water Body:	Mad Brook
Distance to Water Body:	Crosses brook
Current Condition:	Currently a double culvert one 48" concrete sectional (poor condition) and a 36" steel (fair condition) do not handle heavy runoff events and the road has been repeatedly over topped and washed out. This area has been the most trouble of any in town.
Proposed Solution:	Replace twin culverts with a concrete box culvert with 70' clear opening, with concrete head and wing walls. Place 12"x22'x500' of 3/4" crusher run gravel 407cu yds redo ditch and rip rap

Estimated Costs to Improve/ Repair			
Culverts,Ditch and Bank Stabilization			
Materials:	Concrete box culvert 70opening w/concrete head and wing walls	Cost:	$150,000.00
Materials:	12"x22'x500' 3/3" crusher run gravel @$21.45	Cost:	$8,739.00
Machinery:	Included in materials price	Cost:	0
Labor:	Included in materials price	Cost:	0
Total Ditch and Bank Stabilization Costs:			**$158,734.00**
Crowning and Re-grading Roads			
Materials:	12"x22'x500' 3/4"crusher run gravel @$21.45	Cost:	$8,739.00
Materials:	1000' ditching and rip rap	Cost:	$5,600.00
Machinery:	Grader 8 hours @$80.00/hr	Cost:	$640.00
Machinery:	Trucking included in material price	Cost:	0
Labor:	Included in machinery time	Cost:	0

Total Crowning and Re-grading Roads	**$14,979.00**
Total Estimate for this project:	**$173,713.00**

Town of Charleston - Road Erosion Site Inventory May 2014			
Site#3-Hudson Road- Center School Rd to Twin Bridge Rd			
Priority:	#3-2016		
Road Name:	Hudson Rd		
TH#:	#1		
Location:	From Center School Rd (east) to 1000 ft. past Twin Bridge Rd		
Nearest Water Body:	The Clyde River is the nearest body of water. It still has an intact flood plan with minimal intrusion from structures.		
Distance to Water Body:	Approximately 2000 ft depending on river's twists and turns.		
Current Condition:	This section of the Hudson Rd has been repeatedly washed out, in the last 4 years in particular. This is due to significant logging of the ridge above the road and to the increase of heavy runoff events. The road also has the heaviest traffic in town, over 850 per day on weekdays much of it heavy trucks. The road has an insufficient gravel base and surface coat that cannot stand this degree of wear requiring an extreme amount of maintenance during mud season and when saturated from summer rain. Culvert are too small to take the heavy runoff and need to be oversized in this section with riprap headers and splash pools. Ditches cleaned and lined with matting and seeded.		
Proposed Solution:	Replace culverts at the Bowen Hill , at Letorneau's, and Twin Bridge Rd with 30" or larger with rip rap and splash pools. Place and compact 12" of base run gravel in two lifts from the intersection of Center School Rd and the Hudson Rd east to 1000ft. past the intersection of Twin Bridge Rd and the Hudson Rd. Place and compact in two lifts 12" of 3/4" crusher run gravel on the same section.		
Estimated Costs to Improve/ Repair			
Culvert ,Ditch and Bank Stabilization			
Materials:	1-36" x 40' smooth HDP culvert w/headwall and splash pool	Cost:	$27,400.00
Materials:	1 -30" x 40' smooth HDP culvert w/riprap headwall & splash pool	Cost:	$3,800.00
Materials:	2 -18" x 20' smooth HDP culverts	Cost:	$1,216.00
Materials:	1 -24" x 40' smooth HDP culvert w/riprap headwall & splash pool	Cost:	$1,820.00
Materials	3060' ditching, matting and seeding	Cost:	$10,000.00
Machinery:	Excavator costs included in culvert estimates	Cost:	$0.00
Machinery:	Grader (local match)	Cost:	$0.00
Machinery:	Town trucks, loaders (local match)	Cost:	0
Labor:	Included in equipment rental or town employees (local match)	Cost:	0
Total Culvert, Ditching and Bank Stabilization Costs:			**$44,236.00**
Crowning and Re-grading Roads			
Materials:	7928 cubic yards of bank run gravel in place on rd @$21.45	Cost:	$170,055.00
Materials:	7267 cubic yards of 3/4" crusher run gravel in place @$21.45	Cost:	$155,884.30
Machinery:	4 Ten wheeler trucks @$80.00/hr 448 hours	Cost:	$35,904.00
Machinery:	Vibrating roller @ $375.00/day 3 days	Cost:	$1,125.00
Machinery:	Grader (local match)	Cost:	0
Labor:	Flagger @$200.00/day 14 days	Cost:	$2,240.00
Total Crowning and Re-grading Roads			**$335,208.00**
Total Estimate for this project:			**$379,444.00**

Town of Charleston - Road Erosion Site Inventory May 2014			
Site # 4 Twin Bridge Rd			
Priority:	#4-2017		
Road Name:	Twin Bridge Rd		
TH#:	# 3s		
Location:	From VT Rt 105 at East Charleston village to intersection with Hudson Rd		
Nearest Water Body:	Clyde River		
Distance to Water Body:	Crosses river in several spots		
Current Condition:	Large 48" culverts number 1,2&3 cannot handle heavy runoff and flooding events. Other culverts on this road are insufficient and in poor condition. The surface needs to be raised by 12" of bank run gravel and 12" of 3/4" crusher run gravel.		
Proposed Solution:	Replace culvert 1,2,&3 with a D squash pipe or box culvert that provides 20 clear span with concrete head and wing walls. Move culverts 1,2&3 (all 48") to replace culverts 4,5&8 Move culvert #5 (24") to replace culvert #6 Move culvert #4 (30") to replace culvert #7 12" x 24' x 4224' of bank run gravel applied and compacted in 6" lifts.(3755cu yds) 12" x 22 x 4224' of 3/4" crusher run applied and compacted in 6" lifts (3442cu yds)		
Estimated Costs to Improve/ Repair			
Culvert, Ditch and Bank Stabilization			
Materials:	Large D squash culvert with concrete head and wing walls	Cost:	$150,000.00
Materials:	1000 ton 12" minus rock @$35.00/ton	Cost	$35,000.00
Materials:	300 cu yds. Stone fill type 1 to set culverts @ $ 21.45/cu yd	Cost:	$6,435.00
Machinery:	Excavator to set culverts and 12" minus on both road sides 2640 ft. @$80.00/hr 115 hrs	Cost:	$9,200.00
Machinery:	Trucking included in placed material cost	Cost:	0
Labor:	Flagger @$200.00/day 14 days	Cost:	$2,800.00
Total Culvert, Ditch and Bank Stabilization Costs:			**$203,435.00**
Machinery:	Excavator costs included in culvert estimates	Cost:	$0.00
Machinery:	Grader (local match)	Cost:	$0.00
Machinery:	Town trucks, loaders (local match)	Cost:	0
Labor:	Included in equipment rental or town employees (local match)	Cost:	0
Total Culvert, Ditching and Bank Stabilization Costs:			**$44,236.00**
Crowning and Re-grading Roads			
Materials:	7928 cubic yards of bank run gravel in place on rd @$21.45	Cost:	$170,055.00
Materials:	7267 cubic yards of 3/4" crusher run gravel in place @$21.45	Cost:	$155,884.30
Machinery:	4 Ten wheeler trucks @$80.00/hr 448 hours	Cost:	$35,904.00
Machinery:	Vibrating roller @ $375.00/day 3 days	Cost:	$1,125.00
Machinery:	Grader (local match)	Cost:	0
Labor:	Flagger @$200.00/day 14 days	Cost:	$2,240.00
Total Crowning and Re-grading Roads			**$335,208.00**
Total Estimate for this project:			**$379,444.00**

Town of Charleston - Road Erosion Site Inventory May 2014			
Site#5-Hudson Road At Colburn's			
Priority:	#5-2019		
Road Name:	Hudson Rd		
TH#:	#1		
Location:	Stream beside Colburn's house.		
Nearest Water Body:	Clyde River		
Distance to Water Body:	1500ft.		
Current Condition:	This stream comes off a steep ridge that was recently logged which combined with the increased sever runoff events has resulted in repeated washouts of the road.		
Proposed Solution:	Replace current culvert with a 48" x 40' culvert with concrete head and wing walls with a splash pit.		
Estimated Costs to Improve/ Repair			
Culvert Upgrade and Bank Stabilization			
Materials:	48" x 40' gal steel culvert with concrete head and wing walls and splash pit	Cost:	$29,510.00
Materials:	200 cu yds. 3/4" crusher run gravel @ $ 21.45/cu yd	Cost:	$4,290.00
Machinery:	Included in price	Cost:	0
Labor:	Included in price	Cost:	0
Total Culvert and Bank Stabilization Costs:			**$33,800.00**
Crowning and Re-grading Roads			
Materials:		Cost:	0
Machinery:		Cost:	0
Labor:		Cost:	0
Total Crowning and Re-grading Roads			**0**
Total Estimate for this project:			**$33,800.00**

***Summary of protected mitigation projects as defined in the Charleston Road Inventory and Capitol Budget Plan for 2015-2020*:**

Location	Total Cost	From State or FEMA	Town Budget	Additional Funding Needed	Completion Date
Site #1					
#3 Church Hill/ #47 Mill Street	**$ 21,374**	**$ 4,800**	**$ 6,000**	**$ 10,574**	**9/1/2015**
# 2 Durgin Rd	**$ 116,680**	**$ 80,000**	**$ 6,000**	**$30,680**	**9/1/2015**
Site#2					
#39 Cole Road	**$ 173,713**	**$ 134,259**	**$ 6,000**	**$ 33,453**	**9/1/2016**
Site#3					
#1 Hudson Road	**$379,444**	**$ 284,585**	**$ 6,000**	**$ 88,861**	**9/1/2017**
Site#4					
#3s Twin Bridge Road	**$ 362,990**	**$ 272,242**	**$6,000**	**$ 84,747**	**9/1/2018**
Site#5					
#1 Hudson Road	**$ 38,000**	**$ 34,200**	**$ 3,800**	**$ 0**	**9/1/2019**
Total Est. Budget	**$ 1,092,201**	**$ 810,082**	**$ 33,800**	**$ 248,315**	

Table 5-1 Existing municipal actions that support hazard mitigation, Town of Charleston

Type of Existing Protection	Description /Details/Comments	Issues or Concerns
Emergency Response		
Police Services	Vermont State Police	None at this time
Fire Services	Charleston VFD	Water access for fire department is problematic; some roads are difficult to access.
Fire Department Personnel		Need for new volunteers remains as current roster ages.
Fire Department Mutual Aid Agreements	Northeast International Mutual Aid (19 participants)	None at this time
EMS Services	Newport/Island Pond	Response times on Island Pond side are slow and need improvement.
Other Municipal Services		
Highway Services	Town Highway Department	None at this time
Highway personnel	4 FTE field personnel	MOU's completed with residents to avoid future conflict and liability over culvert and ditching work
Water / Sewer Department	None	None at this time
Planning and Zoning personnel		None at this time
Residential Building Code / Inspection	No	None at this time
Emergency Plans		
Local Emergency Operations Plan (LEOP)	2014	Assure sheltering plans and contact information is up to date and vulnerable populations addressed.
Municipal Rapid Response Plan	2005	Replaced by LEOP
School Emergency/Evacuation Plan(s)	2014	Increased collaboration (with town staff, LEPC, NVDA), knowledge of roles and drills are next step.
Municipal HAZMAT Plan	None	Not required but enhanced knowledge via HMEP funded transportation study through LEPC would benefit town.
Dam Emergency Plans	Great Bay Hydro has shared its comprehensive Emergency Response Plan with the Town.	Invite representatives to LEPC and town to increase collaboration. Assure understanding of risk and associated protocol for residents and impacted town infrastructure (if any).
Shelter, Primary	Charleston Elementary School	Work with ARC with Sheltering Initiative to obtain training and supplies. Include volunteer staff in planning communication and schedule drills to test efficacy.
Replacement Power, backup generator	HMGP grant approved/award awaiting Hazard Mitigation plan approval	None at this time
Shelter, Secondary:	Plymouth Church	Assure continued communication lines are open and contacts are correct (See LEOP comments)
Replacement Power, backup generator	Yes	Assure maintenance program
Municipal Plans		
Town / Municipal Comprehensive Plan	2013	None at this time
Town of Charleston Road Inventory and Capital Budget Plan	2014	None at this time
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	Utilize most current state regs	None at this time
Highway Access (curb cut) Policy	Application process, review by Highway Dept. Foreman with final approval by Selectboard	None at this time

Participation in National Flood Insurance Program (NFIP) and Floodplain/Flood Hazard Area Ordinance	No, the town elects not to Participate.	Residential homes or businesses in the floodplain is not an outstanding concern for the town and the barrier to obtaining mortgages would serve has a deleterious consequence to participating. SFHA mapping update is needed.
Culvert and bridge Inventory	2014	https://vtculverts.org/map https://vtculverts.org/bridges#list Town of Charleston Road Inventory and Capital Budget Plan (2014)

5.3 Town of Charleston All-Hazards Mitigation Goals

The following goals were developed by OPHCS and NVDA staff in 2014, and approved by Town of Charleston officials during the development of this plan.

1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
3) Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
4) Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
5) Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
6) Consider formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5).
7) Consider formal incorporation of this Local All-Hazards Mitigation Plan particularly the recommended mitigation actions, into the municipal/town operating and capital plans & programs especially, but not limited to, as they relate to public facilities and infrastructure.

5.4 Mitigation Actions

5.4.1 Current Capabilities and Need for Mitigation Actions

The Town Plan's goals and policies that support hazard mitigation, and the existing mitigation actions, demonstrate the variety of policies and actions forming the foundation of this All Hazards Mitigation Plan. Generally, the Town considers its existing capabilities are adequate to address the identified priority hazards in this Plan.

1) Severe Winter Storm – The Town regards its current hazard mitigation efforts carried out by the road departments as adequate to address winter storm impacts to local roads, however temporary road closure due to winter storms may isolate parts of town. Winter storms are often the cause of the power loss and telecommunications failure.

2) Power Loss – The private service provider which owns and operates the electric utility is responsible for restoring service. Tree trimming and vegetation management, coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation.

3) Flooding – Major infrastructure that has seen repeated damage due to flooding is a concern for the town and they are active in acquiring mitigation funding to address these defined areas. The Town will investigate establishing a Flood Hazard Overlay District to include all designated flood hazard areas.

4) Major Transportation Incidents – Despite having no listed high accident locations, the town is concerned about a transportation-related chemical spill. With the availability of Hazardous Materials Emergency Preparedness (HMEP) funding available to the local LEPC, there is an opportunity to learn more about what types of chemicals are being transported through the town and what response mechanisms may need to be in place.

5) Telecommunications Failure – The private service providers which own and operate landline and cellular services are responsible for restoring service. As with the electric utilities, tree trimming and vegetation management, coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation.

6) Epidemic – In part, the Town relies on epidemic education provided by the state Health Department and the school. Medical facilities are located in nearby communities. The Mitigation Action on public awareness of hazards provides an opportunity to address pandemic hazards, preparedness and mitigation.

5.4.2 Specific Mitigation Actions

Action #1: Continue fluvial geomorphology assessment and develop strategies in response to identified risks in addition to investigating increased mapping of the SFHA.
Status: Ongoing
Primary Responsible Entities: NVDA, Agency of Natural Resources (VT ANR) (for assessments and mapping); Town of Charleston Selectboard (for ordinance changes and other actions).
Potential Partner Entities: Nonprofits, other Town of Charleston officials, and other appropriate entities.
Timeframe: January 2015 – April 2020
Funding Requirements and Sources: Through EMPG funding, NVDA can assist in enhanced mapping of the floodplain within the town. Continuation of assessments and strategy development is contingent upon individual municipalities and/or regional and local organizations, securing funding in partnership with ANR. The level of municipal participation is contingent upon the level of participation asked of staff and that such work would not hinder the ability of municipal staff to carry out their day-to-day municipal duties.

Specific Identified Tasks
Fluvial Geomorphic Assessments - Funding permitting, conduct Phase I and Phase II fluvial geomorphic assessments on streams and waterways in Charleston. If using PDM funding, individual municipalities may select only a subset of streams upon which to perform these assessments and therefore may choose to assess only those sections of streams wherein the history of flood and erosion damage, the history of channel management, and the proximity of existing or potential development or public infrastructure to the active channel makes an assessment a priority. Justification should be provided for streams, watersheds, or stream reaches

not selected for fluvial assessment. Fluvial assessments shall be conducted as guided by the VT ANR Fluvial Geomorphic Assessment Protocols.

Fluvial Erosion Hazard Mapping - Within a year of completed geomorphic assessments for a waterway, funding permitting, a GIS provider (NVDA) should rate the fluvial erosion hazard for each assessed reach, and develop a fluvial erosion hazard map for the waterway, using the GIS extension known as SGAT (or Stream Geomorphic Assessment Tool) for assessed stream reaches. As assessments are completed, a map of all assessed waterways in the town should be created. This data will undergo town review and QA/QC by VT ANR before a final map is drawn.

River Corridor Management Plans – River Corridor Management Plans (RCMP) are encouraged for waterways where Phase I and Phase II assessments have been completed. Creating such a plan requires additional fieldwork and work with local landowners to identify acceptable reach-based management options that enable stream systems to reach equilibrium conditions. Management measures may include stream corridor buffer planting, culvert replacement and roadway improvements, berm removal, and corridor easements. Under Act 110, the Agency of Natural Resources will be identifying best management practices for shorelands and river corridors, and will be providing financial incentives, such as grants and pass-through funding. While the town relies on state regulations for zoning and other regulations, incorporating a RCMP into the Town Plan will only serve to increase the town's awareness in this crucial facet of mitigation planning.

Fluvial Erosion Hazard Mitigation Implementation - Within five years of completing the final fluvial erosion hazard map, the town will draft strategies to avoid or mitigate losses from the identified fluvial erosion hazards. These strategies may include the adoption and implementation of programs, mechanisms or regulations to prevent endangerment of persons and property in riparian corridor areas from fluvial adjustment processes. Efforts could range from a relatively simple, public information campaign about the map to the adoption of a municipal ordinance or by-law that restricts development in such hazard areas.

Rationale / Cost-Benefit Review:

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

Action #2: Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.

Status: Ongoing

Lead Responsible Entity: Town of Charleston Road Foreman

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

Timeframe: January 2015 – April 2020

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

Progress since 2005: The Road Foreman continually monitors road and storm water management capabilities. All bridges and culverts have been electronically accounted for and the town is diligent in maintaining a comprehensive road plan that serves to guide action. The Town of Charleston Road Inventory and Capital Budget Plan (2015-2020) specifies actions, areas of road erosion, estimated costs of repair and future needs with supporting mapping. As mentioned, the town has done an outstanding job in acquiring Hazard Mitigation funding to address crucial infrastructure and can begin moving forward whence this plan is approved. Overview and introduction from the plan itself is included below:

"The purpose of this road inventory update and capital budget plan is to provide an up to date survey of all road structures in an easy to retrieve and manipulate data file that can provide electronic reporting to the state, and to plan specific remedies for drainage and erosion problems on Charleston's roads. We have reviewed and updated all information on Charleston's culverts and bridges on the VOBCIT web site as of May 7 2014. It will be used to store all pertinent information on all aspects of Charleston's roads, report electronically to the state, be used to create reports to FEMA or other grantors when we apply for assistance and help us plan for future projects. The specific sites chosen will further the goal of re-mediating problem areas on town roads to prevent washouts during heavy rain events.

The areas identified in this plan were selected based on the condition of culverts and ditches and primarily focused on runoff issues particularly as the incidence of heavy storms has increased. In many cases, culverts properly sized for normal rain events are overwhelmed by the sever ones. We will seek local, state and federal grants funds to address these sites. This plan will provide a timetable and proposed budget for each one."

Specific Identified Tasks:

Infrastructure Assessment for Storm water Vulnerability – Funding and staff resources permitting, assess the vulnerability and operational capability of municipal-owned roads, culverts and other storm water management infrastructure to predicted storm water and snowmelt in areas with a documented history of recurring problems. The infrastructure will be evaluated regularly prior to replacement or upgrades of the existing infrastructure. Separate analyses of all infrastructure in each municipality is not intended or warranted.

Infrastructure Assessment for Fluvial Erosion/Landslide Vulnerability – Funding and staff resources permitting, assess the operational capability and vulnerability of municipal-owned roads, culverts, bridges and other infrastructure to fluvial erosion of varying severity as determined by Strategy #1 above.

Culvert Upgrades - Upgrade culverts and ditching along various roads to mitigate against repeated damages from storm water or spring snowmelt. Specific projects include:
Approved HMGP-funded culvert upgrade on Cole Road
Continued Monitoring of Vulnerable Infrastructure - Monitor various bridges and culvert locations that have erosion and scouring concerns.
Road Improvements - Within political and financial restraints, consider re-engineering certain sections of roads to lower overall maintenance costs, improving snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Specific projects include:
See Charleston Road Inventory and Capitol Budget Plan
Erosion / Landslide Mitigation - Undertake erosion or landslide mitigation projects at various locations where municipal roads regularly incur damage from adjacent rivers/streams and hillsides as applicable. Specific areas of concern:
See Charleston Road Inventory and Capitol Budget Plan
Rationale / Cost-Benefit Review: Conducting vulnerability assessments facilitates a targeted and effective approach to road and storm water management infrastructure. This will prove useful in the development and implementation of municipal capital and operating plans as well as the development and implementation of grant-funded mitigation projects. Some areas suffer low-level but consistent damage during heavy rains and snowmelt. Mitigating against these problems would reduce short and long term maintenance costs and improve the flow of traffic for personal and commercial purposes during flooding events.

Action #3: Maintain and improve capabilities of existing and potential public shelters.
Status: Ongoing
Primary Responsible Entities: Town of Charleston; NVDA Emergency Planning services, American Red Cross, POS Shelter staff.
Potential Partner Entities: LEPC#10; Charleston Fire Chief, ARC's Sheltering Initiative Program
Timeframe: January 2015 – April 2020
Funding Requirements and Sources: DEMHS or FEMA hazard mitigation funding; existing programs, contingent on available resources and funding.
Charleston Elementary School has been identified as the primary emergency shelter. The school does not have an emergency generator. However, HMGP grant approved for generator installation and award awaiting Hazard Mitigation plan approval. Plymouth Church is the secondary shelter and it does have a generator in place.
Specific Identified Tasks:
Maintain Existing Shelter Capability – Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the town and intends to move forward on planning and public involvement. School staff have committed to staffing the shelter and more formalized training is the logical next step and the ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and supply cache.
Assess Vulnerable Population— Develop an awareness of the most at-risk community members during an evacuation and/or sheltering event. Focusing on those that lack resources or capability to reach facilities when in need and create plans on how to address this potential hurdle.
Rationale / Cost-Benefit Review:

More formalized planning in both staffing and notification procedure, especially pertaining to vulnerable populations where transportation and special needs are a concern could potentially significantly reduce the physical, psychological and social impacts of a disaster.

Action #4: Work to enhance response times of emergency medical services in areas of town where there is a known deficit.
Status: New (see below)
Risk or Hazard Addressed: Community input surveys have brought this problem to light and potential solutions need to be addressed after analysis completed.
Primary Responsible Entities: Town of Charleston, Island Pond and Newport EMS and NVDA.
Potential Partner Entities: Vermont EMS, LEPC
Timeframe: January 2015 – April 2020
Funding Requirements and Sources: Financial factors may produce barriers to change. Strategic planning and understanding of the total scope of needs and potential for change is logical first-step.
Specific Identified Tasks:
Work with EMS agencies to develop clear understanding of magnitude of the problem and develop mapping of affected area including demographics and call-volume in affected areas. Develop potential solutions, barriers and needs assessment based on recommendations from Vermont EMS department.
Rationale / Cost-Benefit Review:
Now that this issue has been raised through the public outreach portion constituting this plan, the town should look into what can be done, if in fact, response times to the affected areas are deemed to be below what current benchmarks suggest as adequate at the state/federal level. With EMPG funding, NVDA can assist in the labor involved in the outreach required to further define this potential problem. Additionally, the LEPC can be approached to dedicate funding to accomplish this task with little impact to its operating budget.

Action #5: Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident.
Status: Ongoing
Primary Responsible Entities: Town of Charleston, Charleston Fire Chief, NVDA, LEPC and ARC
Timeframe: January 2015-April 2020
Funding Requirements and Sources: Implementation through existing programs, contingent on available resources and funding. ARC resources come at no cost and opportunities exist for work in this category to be completed with EMPG, LEPC and HMEP (if evacuation exercise uses chemical event as scenario) funding.
Progress: The town is currently updating their Local Emergency Operations Plan (LEOP) and is open to working with the regional LEPC and the DEMHS on trainings and/or exercises related to evacuation and notification protocol.
Specific Identified Tasks:
Evacuation and Sheltering Exercises – Conduct evacuation drills or exercises and evaluate performance.
Evacuation and Sheltering Plans – Review evacuation, sheltering, and relocation plans based on results of drills, exercises, and actual incidents.

Rationale / Cost-Benefit Review:
Town officials note that residents are resistant to evacuation. However, familiarity with evacuation and sheltering could potentially significantly reduce the loss of life and psychological and social impacts of a disaster.

Action #6: Ensure town and school emergency plans are fully coordinated.

Status: Ongoing
Primary Responsible Entities: Town of Charleston; Charleston Elementary School Principal; Charleston Fire Chief, NVDA.
Timeframe: January 2015-April 2020
Funding Requirements and Sources: Implementation through existing programs
Progress since 2005: Because the school board is a distinct entity from town government, there is an increased challenge in coordinating planning efforts. With the movement towards formalizing shelter staffing protocol with the school and adoption of the town's LEOP, an opportunity to begin discussion on this integration can begin.
Specific Identified Tasks:
Maintain Communications – Maintain good communication between school and town officials regarding plans and safety issues, so that any changes to plans are known to all parties.
Monitor Exercises – When evacuation drills and other exercises are carried out, monitor coordination between school and town officials.
Rationale / Cost-Benefit Review: Improved coordination could potentially significantly reduce the loss of life and property damage. EMPG funding to NVDA can serve this endeavor.

Action #7: Raise public awareness of hazards, hazard mitigation and disaster preparedness.

Status: Ongoing
Lead Responsible Entities: Town of Charleston; Charleston Fire Chief, LEPC, NVDA.
Timeframe: January 2015 – April 2020
Progress since 2005: The Volunteer Fire Department annually conducts fire preparedness programs and school and family programs related to hazard awareness and disaster preparedness, including providing information at Town Meeting. The LEPC meets regularly and covers a host of topics related to emergency preparedness and raises awareness in the community about what organizations are doing around emergency response planning and chemical safety. Town meeting day can serve as an annual update and outreach opportunity as well.

Specific Identified Tasks:
School Programs – Continue school programs to raise student awareness of hazards, safety, preparedness and prevention.
Family Programs – Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.
Fire Prevention Programs – Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.
Other hazard awareness programs – Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate as directed by the state department of health and its jurisdictional offices of local health.

Rationale / Cost-Benefit Review: Improved awareness could potentially significantly reduce the loss of life and property damage. Improved awareness would also build understanding and public support for municipal mitigation actions to reduce potential infrastructure and liability costs.

5.4.3 Prioritization of Mitigation Strategies

Descriptions of specific projects, where available, are listed in Section 5.4.2 and in Table 5-3 below. Because of the difficulties in quantifying benefits and costs, it was necessary to utilize a simple "Action Evaluation and Prioritization Matrix" in order to effect a simple prioritization of the mitigation actions identified by the jurisdiction. The following list identifies the questions (criteria) considered in the matrix so as to establish an order of priority. Each of the following criteria was rated according to a numeric score of "1" (indicating poor), "2" (indicating below average or unknown), "3" (indicating good), "4" (indicating above average), or "5" (excellent).

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

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

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

Rank	Mitigation Action	Responds to high hazard	Funding potential	Protection value	Time to implement	Social and Political acceptance	Technical feasibility	Admin feasibility	Benefit to Cost	Environmental advantage	TOTAL
3	Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.	5	4	5	2	5	3	3	4	4	35
2	Maintain and improve capabilities of existing and potential public shelters.	2	5	5	4	5	5	4	5	2	37
6	Work to enhance response times of emergency medical services in areas of town where there is a known deficit.	3	3	4	1	3	3	2	3	1	23
5	Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident	3	4	5	2	5	3	3	5	1	27
4	Ensure town and school emergency plans are fully coordinated	3	5	4	4	5	4	3	5	1	34
1	Raise public awareness of hazards, hazard mitigation and disaster preparedness	4	5	5	5	5	5	5	5	1	40
7	Complete fluvial geomorphology (in coordination with state recommendations and protocol) assessment and develop strategies in response to any identified risk	1	2	2	2	2	1	1	1	3	15

Table 5-2 Charleston action evaluation and prioritization matrix

Scoring: 1=Poor 2=Below Average or unknown 3=Average 4=Above Average 5=Excellent

5.5 Implementation and Monitoring of Mitigation Strategies

5.5.1. Public Involvement following Plan Approval
After adoption, the town will continue to maintain web-presence of the mitigation plan with an opportunity for community input available on its website. Additionally, the town will hold an annual public meeting after performing the annual progress report for the mitigation plan to discuss achievements and the following year's implementation plan. At town meeting, the town will present mitigation information and provide the public an opportunity to increase understanding and involvement with planning efforts. The LEPC will also host an annual mitigation plan presentation where response/state agencies, neighboring communities and other stakeholders can provide.

5.5.2. Project Lead and Monitoring Process
The town's Selectboard chair is the project lead and will work in conjunction with the Selectboard, town clerk, residents and NVDA to complete the yearly progress report included in the plan. The town will create a mitigation action collection system that will be used as the source of future updates following the annual evaluation that will occur in conjunction with the progress report using the Plan Implementation Matrix provided below. The Town Clerk will assure that all road improvement projects are tracked in collaboration with the Road Foreman. While mitigation actions are, by default, often addressed at monthly Selectboard meetings. The town will schedule one meeting annually to formally assess the plan after the annual progress report has been completed. Once the plan is approved by FEMA, the calendar will begin for annual review

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

- Status of recommended mitigation actions for the five-year planning period
- Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk
- Identification of a lead person to take ownership of, and champion the Plan if different from Selectboard Chair
- An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.)
- Discussion of how changing conditions and opportunities could impact community resilience in the long term
- Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience

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

5.5.4. Plan Update Process

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

5.5.5. Implementation Matrix for Annual Review of Progress

The following table is intended to aid municipal officials in implementing the mitigation actions for Charleston, and to facilitate the annual monitoring of the plan.

Table 5-3 Charleston All-Hazards Mitigation Plan Implementation Matrix

Action	Primary Responsible Entity	Task	Brief Description	Progress
Complete fluvial geomorphology assessment and develop strategies in response to identified risk.	NVDA, VT ANR	Fluvial Geomorphic Assessments	Conduct Phase I and Phase II fluvial geomorphic assessments on streams and waterways in Charleston.	
	NVDA, 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.	
	TBD, determined by funding.	River Corridor Management Plans	Where Phase I and II assessments are complete, develop a River Corridor Management Plan.	
	Charleston Planning Commission	Fluvial Erosion Hazard Mitigation Implementation	Develop strategies to mitigate losses from identified fluvial erosion hazards.	
	Charleston Planning Commission	Flood Insurance Rating Map Updates	Review draft FIRM data. Update floodplain regulations/zoning.	
Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.	Road Foreman	Infrastructure Assessment for Stormwater Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts and storm water infrastructure.	
	Road Foreman	Infrastructure Assessment for Fluvial Erosion/Landslide Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts, bridges and other infrastructure to fluvial erosion.	
	Road Foreman	Culvert Upgrades	Upgrade culverts and ditching along roads to mitigate against repeated damages from stormwater or spring snowmelt.	

Action	Primary Responsible Entity	Task	Brief Description	Progress
continued	Road Foreman	Continued Monitoring of Vulnerable Infrastructure	Monitor bridges and culverts with erosion and scouring concerns.	
	Road Foreman	Road Improvements	Consider re-engineering certain road sections to lower overall maintenance costs, improve snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes.	
	Road Foreman	Erosion/Landslide Mitigation	Undertake erosion or landslide mitigation projects where roads regularly incur damage from adjacent rivers/streams and hillsides.	
Maintain and improve capabilities of existing and potential public shelters	Emergency Management Director	Maintain and Improve Existing Shelter Capability	Maintain and improve on capabilities of existing emergency shelter capability, including emergency generator.	
	Emergency Management Director	Investigate Alternate Shelters	Investigate capabilities of other buildings sufficient to serve as smaller shelters.	
Work to enhance response times of emergency medical services in areas of town where there is a known deficit	Charleston Planning Commission	Organize working Group to gather data and define problem	What are response times in area Of question and are the above Acceptable limit. What data can VT EMS provide?	
	NVDA	Assist with information Gathering	Communicate with State EMS to get the problem understood better	

Action	Primary Responsible Entity	Task	Brief Description	Progress
Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident	Emergency Management Director, Charleston Fire Chief	Evacuation and Sheltering Exercises	Conduct evacuation drills or exercises and evaluate performance.	
	Emergency Management Director, Charleston Fire Chief	Evacuation and Sheltering Plans	Review evacuation, sheltering, and relocation plans based on results of drills, exercises, and actual incidents.	
Ensure town and school emergency plans are fully coordinated	Emergency Management Director, School Principal, Charleston Fire Chief	Maintain Communications	Maintain good communication between school and town officials regarding plans and safety issues, so that any changes are known to all parties.	
	Emergency Management Director, School Principal, Charleston Fire Chief	Monitor Exercises	When evacuation drills and other exercises are carried out, monitor coordination between school and town officials.	
Raise public awareness of hazards, hazard mitigation and disaster preparedness.	Emergency Management Director; Charleston Fire Chief	School Programs	Continue school programs to raise student awareness of hazards, safety, preparedness and prevention.	
	Emergency Management Director; Charleston Fire Chief	Family Programs	Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.	
	Emergency Management Director; Charleston Fire Chief	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.	
	Emergency Management Director; Charleston Fire Chief	Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs.	

Appendix A: Charleston Base Map

Note: FEMA has not produced digital flood data for Charleston. Charleston has not been enrolled in the Flood Insurance program, so their maps are the old 11"X 17" which are not included in this plan.