

Town of Bakersfield, Vermont HAZARD MITIGATION PLAN 2019



Approved Pending Adoption by FEMA:
Adopted by the Town of Bakersfield Selectboard: Date:
FEMA Final Approval:

Resolution to Adopt the Bakersfield Hazard Mitigation Plan

Whereas, natural and man-made disasters may occur at any time, we recognize that by lessening the impacts of these disasters we will save resources, property and lives in the Town of Bakersfield, Vermont;

And whereas the creation of the Town of Bakersfield Hazard Mitigation Plan is necessary for the development of a risk assessment and effective mitigation strategy;

And whereas, the Town of Bakersfield is committed to the mitigation goals and measures as presented in this plan;

And whereas, the respective officials identified in the mitigation action plan are hereby directed to pursue implementation of the recommended actions assigned to them;

Therefore, the Town of Bakersfield Select Board hereby adopts the 2019 Bakersfield Hazard Mitigation Plan.

AUTHORIZING SIGNATURES

Date: _____

Lance Lawyer - Selectboard Chair

Gary Denton – Selectboard

Sam Cribb - Selectboard

Josh Goss - Selectboard

David Houston - Selectboard

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ACKNOWLEDGEMENTS

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Project Participants:

Town of Bakersfield Selectboard

Northwest Regional Planning Commission – Shaun Coleman - Senior Planner

This plan should be considered a plan in work due to the continually changing environment in which these hazards present themselves. This plan must also be reviewed and adjusted as growth in population, industry, and overall community demographics change.

DRAFT

1. INTRODUCTION

The impact of expected, but unpredictable natural and human-caused events can be reduced through community planning. The goal of this plan is to provide an all-hazards local mitigation strategy that makes the Town of Bakersfield more disaster resistant.

Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Based on the results of previous efforts, FEMA and state agencies have come to recognize that it is less expensive to prevent disasters than to repeatedly repair damage after a disaster has struck. This plan recognizes that communities have opportunities to identify mitigation strategies. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where the hazards are most severe and identify local actions that can be taken to reduce the severity of the hazard. The national mission of Emergency Management is prevention, protection, response, recovery, and mitigation.

Hazard mitigation strategies and measures **alter** the hazard by eliminating or reducing the frequency of occurrence, **avert** the hazard by redirecting the impact by means of a structure or land treatment, **adapt** to the hazard by modifying structures or standards or **avoid** the hazard by stopping or limiting development and could include projects such as:

- Flood-proofing structures
- Tying down propane/fuel tanks in flood-prone areas
- Elevating furnaces and water heaters
- Identifying & modifying high traffic incident locations and routes
- Ensuring adequate water supply
- Elevating structures or utilities above flood levels
- Identifying & upgrading undersized culverts
- Proactive land use planning for floodplains and other flood-prone areas
- Proper road maintenance and construction
- Ensuring critical facilities are safely located
- Buyout & relocation of structures in harm's way
- Establish & enforce appropriate building codes
- Public information

2. PURPOSE

The purpose of this Hazard Mitigation Plan is to assist the Town of Bakersfield in identifying all hazards facing the county and their community and identify strategies to begin reducing risks from identified hazards. Once adopted, the local mitigation plan is not legally binding; instead, it outlines goals and actions to prevent future loss of life and property.

Adopting and maintaining the Hazard Mitigation Plan will provide the following benefits:

- Make certain funding sources are 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, including Vermont Emergency Relief Assistance Funding.
- Support effective pre- and post-disaster decision making efforts.

- Lessen the Town’s vulnerability to disasters by identified initiatives ranked by importance.
- Connect hazard mitigation planning to community planning where possible.

3. COMMUNITY PROFILE

The Town of Bakersfield is located in eastern Franklin County (44.7820° N, 72.8029° W.) Bakersfield shares borders with the towns of Fletcher, Fairfield, Enosburgh, Montgomery, Waterville and Belvidere. Bakersfield is within 20 miles of the City of St. Albans, the regional growth center, and approximately 40 miles from the City of Burlington, Vermont’s largest city. The total area of Bakersfield is approximately 28,145 acres or 44 square miles. The population of the community is 1,230, according to the 2017 American Community Survey. There were 567 total housing units in 2017, of which 491 are owner-occupied, 57 are renter-occupied, and 76 are vacant or seasonal. Most housing units were counted as single units (96%).

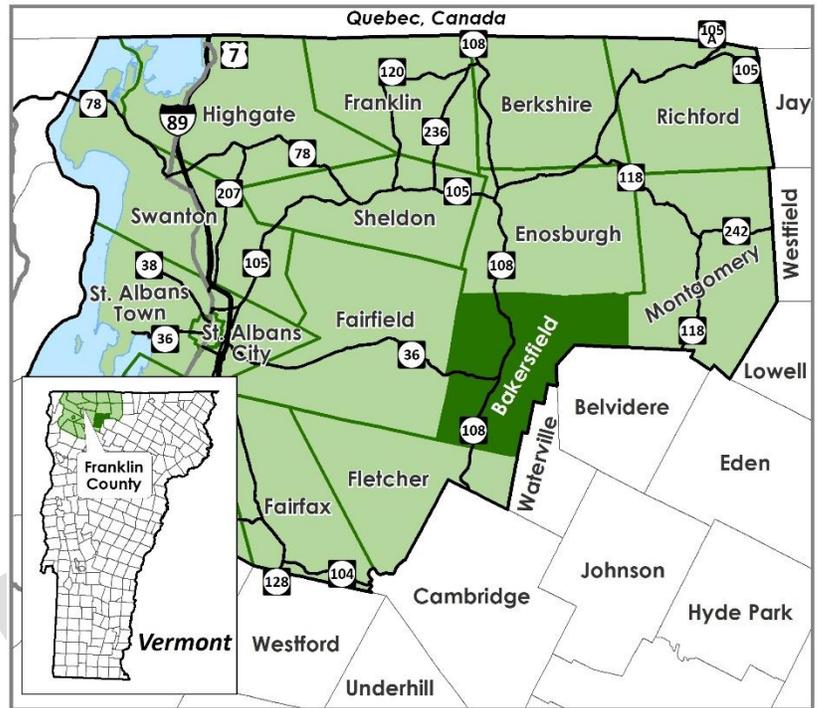


Figure 1- Location Map

The scenic character of Bakersfield could best be described as quiet open farmland and forest with spectacular mountain views and a classic New England Village. For the most part, the Town’s rural character and small New England village appeal is still healthy and strong. The community of Bakersfield contains a significant collection of historic structures, as listed on the National and State Historic, ranging from stores, cabins, and barns to farm complexes. In addition, Bakersfield continues to show vitality not only in its economic growth, but in growth of the quality of Bakersfield as a community. Community action, which involves the citizens of the town, produced that quality that townspeople wish to preserve as part of the growth process.

Existing Land Use

As of 2017, there were a total of 28,145 acres of land in Bakersfield divided into 734 parcels averaging 38 acres in size. Approximately 4,100 acres of the land in Town are used for farming and agriculture. Most of the land is used for permanent residences (36% of all acreage); an additional 16.9% of the land is used for vacation homes. Thus, residences use just over 52% of the land in the Town.

Permanent Residences: About 52% of land is residential use. The average lot size of the 282 lots that are less than ten acres is 1.9 acres.

Commercial Uses: There are 18 commercial parcels of land in the Town; however, this figure does not include businesses that are not reported on the Grand List, such as home businesses, or farms.

Farms: Over 4,100 acres of land in Bakersfield is classified as farm.

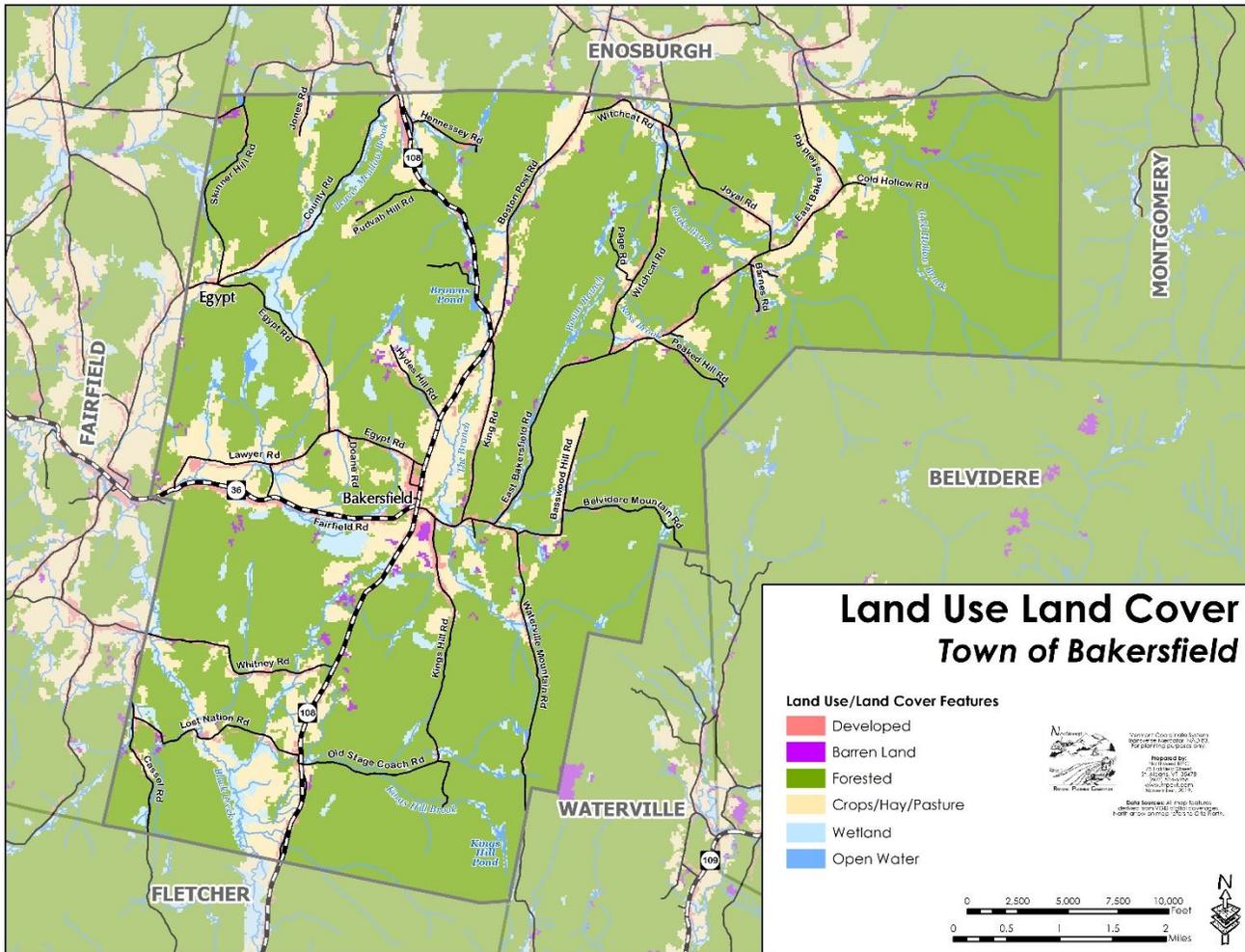


Figure 2 - Land Use/Land Cover

Forested Land: Bakersfield has substantial areas of forested land with no other land uses (8,200 acres). This includes mature forests, wetland forests, and young forests that are growing up from old farm fields or pastures. The Land Use/Land Cover Map shows forested areas (Figure 3.2). The large tracts of forest land shown on the map include small open non-forested areas and young forests that were once hay fields or pasture.

Village Areas: The Village District has received status as a Vermont Designated Village Center, which affords the area with benefits that further the community’s goals for the district. Benefits include priority consideration for state grants, priority site consideration by the State Building and General Services (BGS) when leasing or constructing buildings, and a variety of tax credits available to commercial property owners in the district. The tax credits provide incentives to improve commercial structures in the district, which will in turn encourage revitalization and reinvestment. Priority consideration for grants allows the Town to take on planning and other implementation activities that support the Village.

Future Land Use

The town of Bakersfield currently divides its land use into the following zoning districts: Village, High Density Residential, Low Density Residential, Rural, Conservation, Watershed, Aquifer, and Flood Hazard. The purposes of

these districts are summarized below and a complete description can be found in the town of Bakersfield Zoning Bylaws adopted on March 7, 2017.

Village Center District: The Village Center represents the historic center of Bakersfield. This district has a distinct historic character which features mixed residential, commercial and public uses in a historic village setting. Development in this district should protect and preserve existing historic resources, promote pedestrian access and maintain the village character, including its historic settlement pattern, scenic character and sense of community.

High Density Residential District: This district is comprised of the area around the village center where additional high-density development could be accommodated. This district provides a transition between the compact development of the village center and the rural areas of Bakersfield. It is designed to allow a radial pattern of development around the village in an effort to discourage linear sprawl. Development in this district should complement and extend the character and traditional development pattern of the village core. Interconnected street networks and pedestrian access are encouraged in this district.

Rural District: It is intended that this district remain rural, agricultural and silvicultural. The preservation of farmland and prime agricultural soils is a major objective. Rural residential development and compatible rural uses, at a density the land can support are permitted. Clustered development that protects large, contiguous tracts of farmland or open space is appropriate in this district. Within the rural district, additional restrictions are included to protect an important Heron Rookery in northwestern Bakersfield, consistent with the requests of the Vermont Department of Fish and Wildlife.

Conservation District: This district is designated to protect the natural resources and scenic value of mainly forested lands that lack direct access to public roads, are important for wildlife and wildlife habitat, and which are poorly suited for development. Included are areas of high elevation, steep slopes and swamplands. Concern must be given to building on any slope greater than 15% because the soils in these areas tend to be thin and unstable, making them unsuitable for development. The Conservation District includes the watershed that provides Bakersfield's municipal water supply and land uses that might reduce the water quality in this area are restricted. Only limited, low-density development is to be permitted in this district.

Aquifer Overlay District: The purpose of the Aquifer Overlay District is to protect the public health and safety by preserving and maintaining the community water source from incompatible development. No new construction is permitted within the Aquifer Overlay District.

Flood Hazard Overlay District: The purpose of the Flood Hazard Overlay District is to minimize and prevent the loss of life and property, the disruption of commerce, and the extraordinary costs that result from flooding and other flood-related hazards. Within this district, the design and construction of development should be accomplished in a manner that minimizes or eliminates the potential for flooding and loss or damage to life and property. Uses in the flood hazards areas shall be restricted to agriculture, conservation and outdoor recreation.

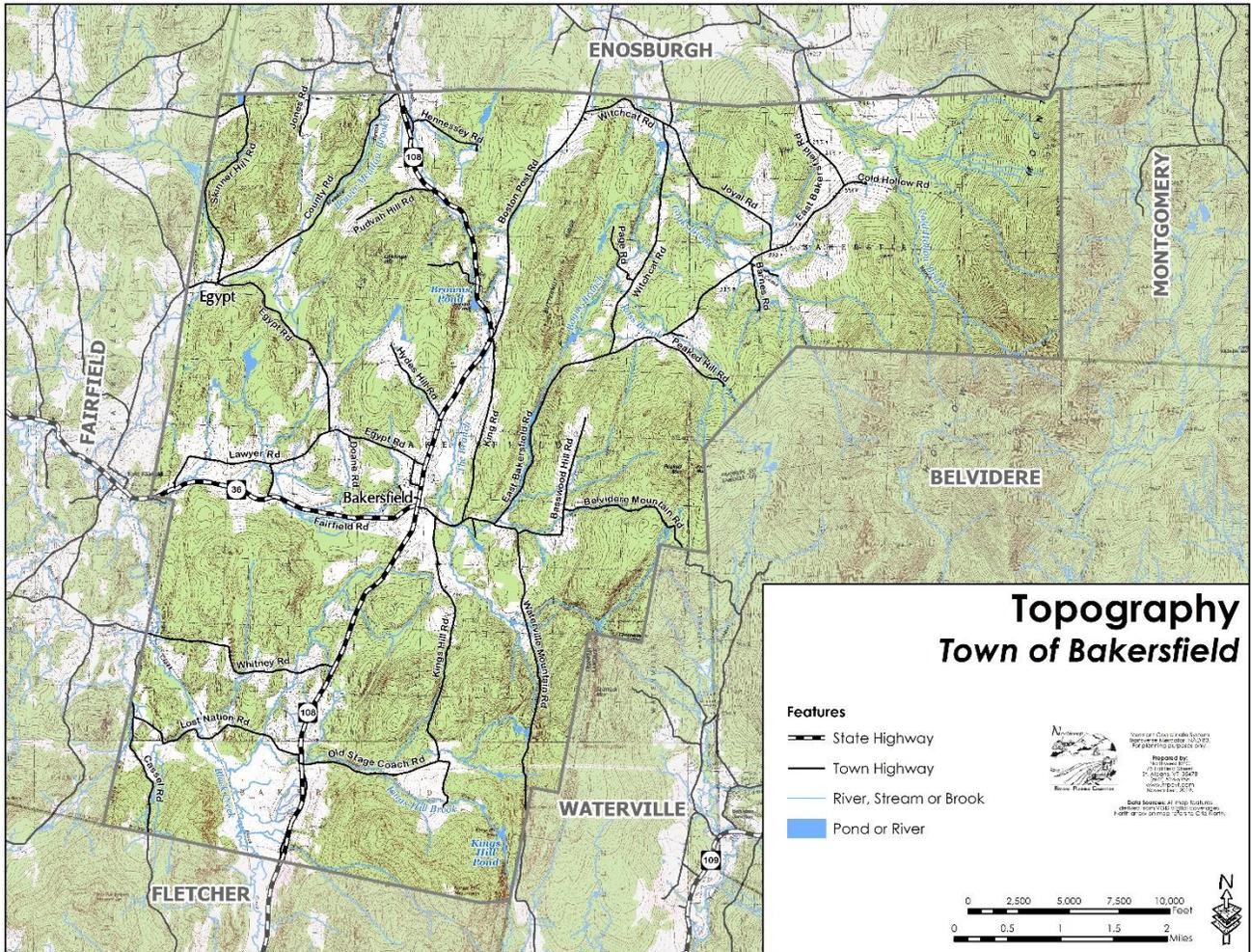


Figure 3 - Topography

The character of Bakersfield’s soils, topography, geology, and ground and surface water will influence the future growth and development of the Town. U.S. Soil Conservation Service Soil Survey maps provide valuable information on soils, slopes, geology, ground water, resource potential and wetlands.

Development Trends

Bakersfield’s population historically has been steady. However, between 1970 and 2000 the population increased steadily (Figure 3.4). Population projections are based on past trends in birth, deaths and migration which provide reasonable estimates of future conditions.

Development is characterized by a concentration of structures and land uses devoted to small-scale commercial, residential, governmental and recreational uses. The character of the Village is an important social and economic asset to the community. The Town does not have adequate sewer making the potential for additional development difficult. This coincides with Bakersfield’s desire to maintain its rural character.

Energy

Vermont Electric Cooperative, Inc, Green Mountain Power, and Enosburgh Village Electric Department all provide electrical service to town residents.

According to the 2017 American Community Survey, wood is the most popular home heating fuels and was used by 215 homes. Fuel oil and kerosene gas is the second most popular home heating fuel with 193 homes and propane was the third most popular home heating fuel with 51 units.

Emergency Services

Bakersfield is served by a volunteer fire department that includes a First Response Program. Bakersfield has a mutual aid agreement with 27 other communities, but serves only 4 or 5 of those communities on a regular basis. There are approximately 28 volunteer members who serve on the fire department, including first responders. The equipment consists of a 1989 Pumper, a 1997 Tanker/Pumper and a 1989 Rescue Truck. Both the Pumper and the rescue truck are in need of replacement. The Town of Bakersfield recently constructed a new fire station in 2009.

The Town of Bakersfield has an agreement with Enosburgh Ambulance Services for emergency response service. Medical treatment is provided by ambulance services, doctors, dentists, and the Northwest Medical Center hospital in nearby St. Albans.

The Vermont State Police (VSP) is the primary law enforcement agency responsible for public safety in Bakersfield. As in many rural communities, the level of police protection is a concern in Bakersfield. Because of the limited service, response times can be long.

Water Supply

Bakersfield has a municipal water system, under the jurisdiction of Fire District #1, located on Kings Hill southeast of the village. There is a 120,000-gallon concrete reservoir located northwest of the village. Access to the municipal water system is limited to the village. It is the goal of the Fire District to ensure a safe and unchlorinated water supply.

Additional well and pump: In order to continue to meet demand, the Fire District has identified a need for an additional well and pump for the water system. In 2007, the Fire District raised their rates in order to cover the cost of this upgrade.

Sewage Disposal

There is no municipal sewer system in Bakersfield and disposal is handled through individual septic systems. Presently there are no plans for a municipal sewer plant due to the expense and the population size in Bakersfield.

Transportation

Bakersfield lies approximately 14 miles east of Interstate 89, easily accessible by VT36. There are 10.39 miles of State Highway in Bakersfield, 2.51 miles of VT36 and 8.03 miles of VT108. The Town maintains a total of 51.94 miles of roads, 9.36 miles of class 2 roads, 32.08 miles of class 3 roads and 10.50 miles of class 4 roads. Town Roads 3 and 8, in particular, have experienced the greatest increase in traffic during the past five years.

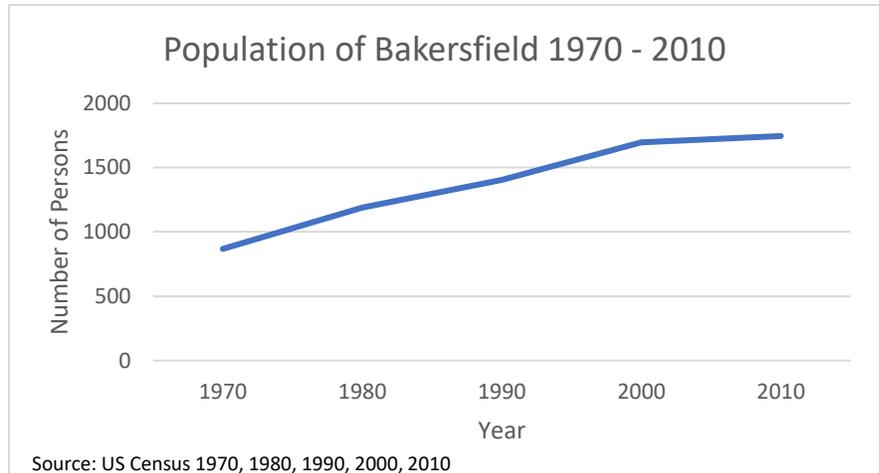


Figure 4 - Bakersfield Population

The closest park and ride facility is located at Exit 17. Passengers can meet up with the St. Albans Link Express at the Exit 17 park and ride for access to Chittenden County or St. Albans. The feasibility of a park and ride in Bakersfield has been discussed, but is not an option at this time. There is currently no bus service that passes through the town. However, Special Service Transportation Authority (SSTA) is a local organization that provides transportation services to seniors and people with disabilities in order to help them remain independent.

4. PLANNING PROCESS

Documentation of the Planning Process, Public Involvement and Input from Neighboring Communities

The Town of Bakersfield held several planning meetings to discuss the development of a Hazard Mitigation Plan. All meetings were open to the public and some were held at regularly scheduled Selectboard meetings. Public in attendance at the meetings were encouraged to participate. All Selectboard meeting agendas were posted at 3 locations in the municipality in compliance with the requirements of Vermont Open Meeting Law. All meetings were chaired by the Chair of the Selectboard, Lance Lawyer. Hard copies of drafts discussed at meetings were available to the public in attendance at meetings and upon request.

The Town of Bakersfield held their initial planning meeting to approve the Hazard Mitigation Plan project on November 25, 2019. A sample plan was reviewed before the project was approved, and criteria for FEMA funding was also discussed. The meeting was at a regularly scheduled Selectboard meeting. The draft and adoption of the plan, along with mitigation measures, was discussed at the scheduled Selectboard meeting on December 9, 2019. Meeting agendas were posted in accordance with Vermont Open Meeting Law. No public comments regarding the plan were received at these meetings.

A draft of the plan was posted for public comment on the NRPC and Town websites between December 11, 2019 and December 23, 2019. Draft copies of the Plan were also sent to the town clerks of all neighboring communities on December 10, 2019. Comments were requested to be sent to NRPC by January 10, 2020. No comments were received.

Incorporation of Existing Plans, Studies, Reports and Technical Information

Mitigation plans from around the country, current State Mitigation Plans, FEMA planning standards, the FEMA Flood Mitigation Assistance Program requirements and the National Flood Insurance Program's Community Rating System were examined. Other materials examined consisted of community plans, including:

- Bakersfield, Vermont Town Plan 2018-2025
- Town of Bakersfield, Vermont Development Regulations 2017
- State of Vermont Hazard Mitigation Plan 2018
- Town of Bakersfield Flood Insurance Study, 1985
- Town of Bakersfield Flood Insurance Rate Maps 1985
- Northwest Regional Planning Commission Regional Plan 2015

A complete list of references may be found in Attachment G.

5. RISK ASSESSMENT

Identifying Hazards, Profiling Hazards, Estimating Losses and Assessing Vulnerability

The NRPC staff and Town of Bakersfield EMD collected data and compiled research on hazards including: severe winter storm /ice storm, flooding, thunderstorms (high winds, lightning, hail), loss of electrical service, structure

fire, hazardous materials, drought, telecommunications systems failure, tornado, earthquake, major fire – wildland, civil disturbance, terrorism/WMD. Research materials came from local, state and federal agencies including FEMA, NOAA, NCDC and DOT. Research was also conducted by referencing historical local newspapers, texts, interviewing residents, and scientific documents. Internet references were widely utilized in historical research applications. Current mitigation activities, resources, programs, and potential action items from research materials and stakeholder interviews were also identified.

The information is based on interviews with local officials and the best available data sources found from federal, state, regional, and local agencies and departments. The risk and/or impact of several hazards were negligible and the state examination was considered sufficient in justifying the time spent on the analysis.

Data from Bakersfield Planning Commission, Northwest Regional Planning Commission, Local Emergency Planning Committee and Bakersfield Emergency Services were used to assist in the analysis of areas affected by various hazards. The results of the analysis are listed in Attachment H. The community hazard mitigation maps are included in Attachments E and F.

Hazard identification and risk assessment can be a highly complex, time consuming and very costly effort if sophisticated technical and engineering studies are undertaken. The Town of Bakersfield does not have the resources to undertake hazard identification and risk assessment studies to this level of detail. The Town of Bakersfield and the Northwest Regional Planning Commission used a module of Mitigation 20/20 software which included a hazard profile matrix (Table 5.1) that was used to develop a risk rating for each identified hazard. The matrix is intended to be completed by relying on hazard identification and risk evaluation information that is available as well as the knowledge and judgment of planning participants. Health and safety consequences, property damage, environmental damage and economic disruption are classified as consequences of occurrence of each hazard. The following is a description of the risk characteristics used to classify each hazard primarily based on Mitigation 20/20 program:

Frequency of Occurrence:

1. Rare: Unknown but likely to occur in the next 500 years
2. Unlikely: Unknown and unlikely to occur in the next 100 years
3. Possible: Likely to occur in the next 100 years
4. Likely: Likely to occur in the next 25 years
5. Highly Likely: Likely to occur once a year or more

Impact or % Community Impacted:

0. Negligible: < 10% of properties damaged.
1. Limited: 10% to < 25% of properties damages/Loss of essential facilities/services for up to 7 days/few (<1% of population) injuries possible.
2. Critical: 25% to 50% of properties damaged/Loss of essential facilities/services for > 7 days < 14 days/Major (< 10% of population) injuries/few deaths possible.
3. Catastrophic: > 50% of properties damaged/ loss of essential facilities/services for > 14 days/Severe (> 10% of population) injuries/multiple deaths possible.

Health & Safety Impacts:

0. No health and safety impact

1. Few injuries or illnesses
2. Few fatalities but many injuries or illnesses
3. Numerous fatalities

Property Damage:

0. No property damage
1. Few properties destroyed or damaged
2. Few destroyed but many damaged
3. Few damaged but many destroyed
4. Many properties destroyed and damaged

Environmental Damage:

0. Little or no environmental damage
1. Resources damaged with short term recovery practical
2. Resources damaged with long term recovery feasible
3. Resources destroyed beyond recovery

Economic:

0. No economic disruption
1. Low direct and/or indirect costs
2. High direct and low indirect costs
3. Low direct and high indirect costs
4. High direct and high indirect costs

The risk estimation matrix (See Attachment H and Table 5.1) for the Town derives a “relative risk score” using a qualitative process in which to compile estimates of the likely frequency of occurrence, the extent of the community that would be impacted, and the likely consequences in terms of public safety, property damage, economic impacts and harm to environmental resources. The total is considered in this plan to constitute the “relative risk score”. The hazards with the highest risk score are severe winter storm (ice storm) followed by flooding and fluvial erosion/landslide. It should be noted that the communities overall risk rating is low (241 out of a possible high of 1,600).

Each hazard was analyzed to estimate losses within the Town of Bakersfield. The result is included in each hazard profile and in Table 5.1. Human losses were not calculated during this exercise, but could be expected to occur depending on the type and severity of the hazard. Most figures exclude both the land value and contents of the structure. The data was calculated using FEMA’s Understanding Your Risks: Identifying Hazards and Estimating Losses (August 2001).

Vulnerability Scores

Vulnerability assessments build on the identification of hazards in the community and the risk that the hazards pose to the community. The vulnerability assessment process examines more specifically how the facilities and systems of the Town would be damaged or disrupted by the identified hazard.

The combination of the impact of the hazard and the frequency was used to determine the community vulnerability (risk score) as HIGH, MODERATE or LOW. The vulnerability classifications based on risk scores are as follows:

- 0-24 LOW
- 25-49 MODERATE
- 50-75 HIGH

For example, a flood event is *highly likely* (nearly 100% probability in the next year) in many communities within Franklin County but the degree of impact varies, so a *highly likely* flood with *critical* or *catastrophic* impact rates the community vulnerability as HIGH. A community with a *highly likely* or *likely* (at least one chance in the next 10 years) flood with a *limited* impact would receive a vulnerability rating of MODERATE. The vulnerability of a community having the occurrence of an event as *possible* or *unlikely* with *limited* or *negligible* impact would be LOW.

In order to determine estimated losses due to natural and man-made hazards in Bakersfield, each hazard area was analyzed; results are shown below. Human losses were not calculated during this exercise, but could be expected to occur depending on the type and severity of the hazard. Most of these figures exclude both the land value and contents of the structure. The median value of a home in Bakersfield is \$207,300 according to the 2013 to 2017 American Community Survey estimates.

A full summary of hazards and impacts is provided in Table 1.

Table 1 Summary of Hazards and Impacts for the Town of Bakersfield

Hazard Type	Frequency Of Occurrence	Impact/Magnitude	Risk Score (Vulnerability)	Estimated Potential Losses (Dollars)	Vulnerability
Severe Winter Storm/Ice Storm	Highly Likely	Limited to Catastrophic	Moderate to High	n/a	Roads, bridges, commercial and residential structures, seasonal homes, public buildings, (Bakersfield School, PWB, Rec Center, Library, cemeteries), school, church, and utilities.
Flooding/Fluvial Erosion	Highly Likely	Limited to Catastrophic	Moderate to High	\$ 1,877,500	Loss of road access, power loss, telecommunications loss. Roads, bridges, commercial and residential structures, seasonal homes and utilities.
Severe Thunderstorm (High Winds, Lightning, Hail)	Highly Likely	Limited	Moderate	n/a	Falling limbs and/or trees, power loss, church, school, telecommunications loss, structural damage, crop damage. Commercial and residential structures, seasonal homes, public buildings (Bakersfield School), utilities.
Loss of Electrical Service	Likely	Limited to Critical	Moderate	n/a	Public building (Bakersfield School), church, utilities, residential and seasonal homes, commercial structures, including commercial farms.
Structure Fire	Highly Likely	Limited	Low	\$1,036,500 (estimated 5 structures/year)	All structure types especially those lacking early detection systems.

Hazardous Materials	Possible	Limited	Low	n/a	Residential and seasonal homes, commercial structures, public buildings including Town Office/Bakersfield School, Public Works Building/Garage, Recreation Center, Library Buildings, State Garage, church, school, utilities, and the environment.
Drought	Possible	Limited to Catastrophic	Low	n/a	Commercial structures – farms, livestock, private wells, public structures (water reservoir, water pumping station and wastewater treatment plant), residential and seasonal homes and vulnerable populations.
Loss of Water & Sewer Service	Rare	Limited	Low	n/a	Public Health, residential and seasonal homes, commercial structures, church, public structures (e.g. Water Reservoir and Wastewater Treatment Plant, Town Office.)
Telecommunication Systems Failure	Likely	Limited	Low	n/a	Residential structures, seasonal homes, commercial, public buildings (e.g. Town Office) elementary school, utilities. Special needs populations.
Tornado	Possible	Limited	Low	\$9,028,910	Falling limbs and/or trees, power loss, telecommunications loss. Structural damage to residential and seasonal homes, public buildings (Town Office, State Garage, Public Works Building/Garage, Recreation Center, State Garage, Water Pumping Station) commercial structures and utilities.
Earthquake	Possible	Limited to Catastrophic	Low	\$42,198,674	Infrastructure (roads, bridges), structural damage to residences, seasonal homes, commercial building, public buildings (Town Office, State Garage, Public Works Building/Garage, Community Center, Water Pumping Station, Water Reservoir), utilities.
Major Fire - Wildland	Possible	Limited	Low	n/a	Residential and seasonal homes, commercial structures, utility poles and lines, road closures, fires in rural areas lacking fire breaks.
Terrorism/WMD and Civil Disturbance*	Rare	Limited	Low	n/a	School, public building (Town Office, State Garage, Public Works Building/Garage, Community Center, Water Pumping Station).
Extreme Temperatures*	Possible	Limited	Low	n/a	Fauna, public health.

Hurricane*	Unlikely	Limited	Low	n/a	Local and state transportation networks. Residences, businesses, Town Office, State Garage, Public Works Building/Garage, Community Center, Water Pumping Station and Elementary School.
Infectious Disease Outbreak*	Possible	Limited	Low	n/a	Fauna, public health.
Invasive Species*	Possible	Limited	Low	n/a	Agricultural crops, forests.
Rock Cuts*	Rare	Limited	Low	n/a	None.
Nuclear Power Plant Failure*	Rare	Limited to Catastrophic	Low	n/a	All flora and fauna. Public health, Agriculture.
Rockslide/Landslide*	Rare	Limited	Low	n/a	None.
*Has never occurred.					

All the hazards identified in the state hazard mitigation plan were considered. The Committee decided it is not feasible to study each in depth again as many of the hazards were considered unlikely or rare. The hazards not profiled in this plan update are considered to be unlikely or rare in the Town of Bakersfield and therefore will not be profiled in this plan update. Those hazards that are not considered in the local plan may have been profiled in the State Hazard Mitigation Plan. The hazards not addressed in this plan update along with the justification for not including them are outlined in the following table.

Table 2 Justifications for Hazards Not Profiled

Hazard Not Profiled	Justification
Loss of Electrical Service	Rarely occurs and typically a consequence of other hazards such as winter storm (ice storm). Utilities are privately owned and regulated by public safety board. Town has emergency power generator at Bakersfield School.
Ice Jams	There are no rivers in Bakersfield and therefore there is no hazard posed by ice jams.
Dam Inundation	There are no dams in Bakersfield.
Structure Fire	There are on average 4 calls to the Fire Department related to structure fires in town each year. The Fire Department has set response procedures they follow structure fires. New construction follows state fire marshal codes.
Hazardous Materials	There are no large scale hazmat storage sites or manufacturing facilities in town. Hazardous materials are mostly propane and gasoline. The Town Fire Departments follows set hazmat response protocols should a spill occur.
Drought	Has not occurred in memory. Dry conditions occur briefly in late summer if they occur at all.
Telecommunications Systems Failure	Typically accompanies another hazard such as power loss, winter storm (ice storm). Telecommunications infrastructure that serves town is privately held.
Tornado	Has never occurred in Town. Generally profiled under high winds.
Earthquake	A moderate scale earthquake has never occurred in Town. The Town does not lie near any fault zone. Refer to Vermont State Hazard Mitigation Plan for further information regarding earthquake risk.
Major Fire – Wildland	Large wildland fire complex has never occurred in Town. Small grass fire in spring and summer occur rarely and typically less than an acre in size. Town fire department has response procedures to handle hazard.
Terrorism / WMD and Civil Disturbance	Has never occurred in Town. Vermont State Police would be primary response agency for any terrorist type incident.
Extreme Temperatures	The Committee agreed that extreme temperatures a non-issue because they are brief in duration if they occur at all. Hot spells in summer and cold snaps in winter are just part of life in Bakersfield and not a concern.
Hurricane	The Town is too far north from the Atlantic coast. Vermont does not have any coastline. Tropical storms are profiled under High Winds section.

Infectious Disease Outbreak	Has not occurred in Town. Considered rare.
Invasive Species	Considered rare. Town would rely on state to assist individuals and commercial ag producers in mitigation and response to invasive outbreak.
Rock Cuts	None in town.
Nuclear Power Plant Failure	Bakersfield is approximately 190 miles northwest from the nearest nuclear power plant, which is the recently decommissioned VT Yankee Nuclear Power Plant owned by Entergy Nuclear Vermont Yankee, LLC.
Rockslide/Landslide	Do not occur in Town. No areas where rockslides are an issue.

The community has identified and chosen to focus mitigation action items on the following hazards: Severe Winter Storm/Ice Storm, Flooding, and Severe Thunderstorms (High Wind, Lightning, and Hail). These are the hazards that are most likely to occur in Bakersfield Town and are the hazards the town has developed mitigation actions around.

Severe Winter Storm/Ice Storm

Description

Winter storms with snow, ice and freezing temperatures in various combinations are fairly commonplace in Bakersfield. Winter storms are accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, severe snow drifting, and dangerous wind chill. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Extreme cold often accompanies a severe winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life – threatening. Severe winter storm can bring heavy accumulations of ice which can down trees, electrical wires, power poles and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards along the roadways.

Impact and Geographic Area of the Hazard

The primary impacts of a winter storms / ice storm typically include disruptions to transportation networks due to fallen limbs and trees, school closings and occasionally telecommunications and power outages. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards along roadways.

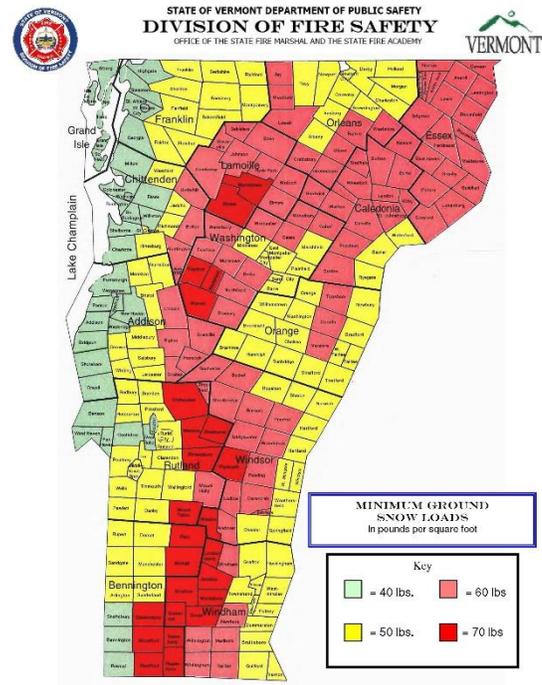


Figure 5 - Construction Snow Loads

Table 3 – Fall Snowfall in Burlington

Burlington, Vermont Top 10 Fall Snowfall Totals Sep-Nov					
Highest			Lowest		
Rank	Snowfall	Year(s)	Rank	Snowfall	Year(s)
1	24.0"	1900	1	0	2009/1948/1937/1915
2	23.0"	1921	2	0.1"	2004
3	21.9"	1906	3	0.4"	2010/1953/1930
4	20.4"	2002	4	0.5"	2003/1946/1941/1934/1918
5	19.4"	1910	5	0.7"	1999/1960/1894
6	19.2"	1971	6	0.8"	1982
7	18.8"	1968	7	0.9"	1988/1929
8	16.1"	1997	8	1.0"	1931
9	16.0"	1977	9	1.3"	1964
10	15.6"	1969	10	1.4"	1939

Source: National Oceanic and Atmospheric Administration

Winter storms / ice storms affect the entire Town and generally cause disruptions to public and private services. Construction standards for snow load (see map below) indicate that structures in Bakersfield should be built to withstand loads of 60 pounds per square foot. At that point, design standards would be exceeded and the structure runs the risk of collapse. Given this standard, a snowstorm which dumped 40 inches of snow or 10 inches of ice would likely result in a few collapsed roofs, especially on structures which are not built to these standards.

Table 4 – Winter Snowfall in Burlington

Burlington, Vermont Top 10 Winter Snowfall Totals Dec-Feb					
Highest			Lowest		
Rank	Snowfall	Year(s)	Rank	Snowfall	Year(s)
1	103.4"	2007-08	1	18.4"	1912-13
2	97.9"	2010-11	2	20.4"	1979-80
3	96.9"	1970-71	3	21.9"	1928-29
4	90.1"	2009-10	4	23.6"	1936-37
5	81.7"	1965-66	5	24.0"	1898-99
6	80.7"	2003-04	6	25.0"	1904-05
7	80.0"	1957-58	7	25.6"	1940-41
8	79.4"	2008-09	8	26.3"	2011-12
9	78.6"	1946-47	9	27.0"	1900-01
10	75.7"	1969-70	10	27.4"	1960-61

Source: National Oceanic and Atmospheric Administration

The primary impacts of an ice storm typically include disruption to transportation networks due to fallen limbs and trees, school closings and occasionally telecommunications and power outages. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards along roadways.

Vulnerable populations, such as the elderly, those dependent on medical equipment and specialized health or physical care, are at risk to all types of winter storms. Also at risk are farms and livestock. Barns can collapse due to heavy snow and ice loads. Dairy cattle are susceptible to mastitis¹ if they are unable to be milked. Many larger dairy farms have stationary or portable PTO driven generators as back-up power for automated milking

equipment. Also at risk are people who use electric heat in their homes when associated power outages occur.

Extent and Probability

The National Weather service defines a blizzard as “a storm which contains large amounts of snow or blowing snow, with winds in excess of 35 mph and visibilities of less than 1/4 mile for an extended period of time (at least 3 hours).

¹ Mastitis is the inflammation of the mammary gland caused by microorganisms, usually bacteria that invade the udder, multiply and produce toxins that are harmful to the mammary gland.

Table 5 – Spring Snowfall in Burlington

Burlington, Vermont					
Top 10 Spring Snowfall Totals					
Mar-May					
Highest			Lowest		
Rank	Snowfall	Year(s)	Rank	Snowfall	Year(s)
1	52.7"	1933	1	0.1"	1945
2	47.8"	2001	2	1.0"	1903
3	45.7"	1971	3	2.0"	1910
4	37.7"	1974	4	2.7"	1927
5	36.4"	1916	5	3.1"	1934
6	36.1"	1997	6	3.2"	1991
7	34.4"	1994	7	3.9"	1946
8	33.9"	1983	8	4.0"	1905
9	31.0"	2007/1972	9	4.1"	1915
10	30.1"	2011	10	4.2"	1921
Source: National Oceanic and Atmospheric Administration					

Winter storms / ice storms occur annually in Bakersfield, typically in the form of a Nor'easter. Nor'easters occur most often in the winter and early spring, but also sometimes during the fall. These storms can leave inches of rain or several feet of snow on the region, and sometimes last for several days.

Bakersfield's recent history has not recorded any loss of life due to the extreme winter weather. These random events are difficult to set a cost to repair or replace any of the structures or utilities affected. Impacts to future populations, residences, new buildings, critical facilities and infrastructure are anticipated to remain the same.

The Town is equipped to handle most winter emergencies, including maintaining road accessibility through various snow and tree

debris removal equipment. The Town has access to private machinery, including bulldozers, plows, ATVs and snowmobiles, should they be needed in the event of an emergency. Heavy wet snows occurring during early fall and late spring and ice storms in the winter months are the cause of most power failures.

Past Occurrences:

According to the National Climate Data Center, there have been 85 winter storms events affecting Franklin County, Vermont, including Bakersfield, since January 1, 1997 totaling approximately \$1,097,500 in property damages and no deaths in the region. Additionally, there were 3 severe ice storms in the region causing \$2,500,000 in property damages and no deaths.

Table 6 – Winter Storms/Ice Events in Bakersfield		
Date	Location	Severity Remarks / Description of Area Impacted
January 6, 1998	Addison, Chittenden, Franklin, Grand Isle, Orange, and Windsor	DR 1201. This storm is referred to as the Ice Storm of 1998. Snow turned to freezing rain. Ice accumulations were generally between 1 and 2 inches with locally greater accumulations over portions of Grand Isle County. The impact on the region was dramatic. Trees and power lines snapped due to the weight of the ice. Power outages lasted for several days. Damage to the utility companies ran in the millions. With no electricity, the agricultural community was unable to milk cows with loss of income and damage to cows. Travel was dramatically impacted and many roads and bridges closed due to ice and fallen trees. The National Guard assisted with cleanup operations after the storm. Falling tree limbs and other debris was a significant hazard during and following the storm. It is not known what the financial losses were to the Town as a result of the storm. There was \$1,500,000 in damages in Grand Isle County. Public Assistance funding was \$5,899,183.

December 20, 2013	Addison, Chittenden, Franklin, Grand Isle, Lamoille, Orleans and Caledonia County	Two rounds of freezing rain accumulated around an inch across Grand Isle causing numerous vehicle accidents as well as damage to trees and utility lines. There were brief power outages during this time. There was an estimate of \$250,000 of property damages from the event.
February 25, 2010	Central and Northern Vermont	Heavy wet snow fell across the State that resulted in snowfall accumulations of 6 to 30 inches. The weight of the heavy snow accounted for widespread power outages across the region that resulted in upwards of 50,000 customers state-wide without power.
January 2-3, 2010	Central and Northern Vermont	Near record snow fell across the county from a powerful Atlantic storm system. Northwest winds of 15 to 25 mph with higher gusts caused considerable blowing and drifting snow with 4 to 5 foot snow drifts reported. A record 33.1 inches of snow fell at Burlington International Airport in South Burlington.
February 19 – 21, 2009	Northern Vermont	A prolonged flow of cool, moist and unstable air created persistent snow showers across the northern Counties during the afternoon of February 20th and continued until the early morning hours of February 21st. There were significant snowfall amounts (more than 12 inches) observed at various ski resorts. From 3 to 8 inches of snowfall accumulated within Grand Isle County and across the Champlain Valley.
January 29, 2009	Grand Isle County	Snow overspread the State early in the morning and continued into the evening hours. Snowfall accumulations with this storm were generally 8 to 14 inches in the County. There were no reported damages.
February 14, 2007	New England	Known regionally as the “Valentine’s Day Storm”. A winter storm blanketed most of New England. In Vermont, snow fell heavy at times from late morning through early evening before dissipating during the night. Snowfall rates of 2 to 4 inches per hour and brisk winds of 15 to 25 mph caused near whiteout conditions at times, along with considerable blowing and drifting snow, making roads nearly impassable. Temperatures in the single numbers combined with brisk winds created wind chill values of 10 degrees below zero or colder.
October 20, 2006	Grand Isle County	A low pressure system brought cold air to the northern portion of the state. Heavy, wet snow accumulation of 3-6 inches occurred in Georgia damaging many trees and causing power disruptions.
February 13, 2000	Grand Isle County	A storm system over the Ohio Valley tracked across central New England during Monday, February 14th. Heavy snow fell across the area with accumulations generally between 7 and 14 inches.
April 10, 1996	Statewide	A classic Nor’easter, this system spread snow across the region for nearly two days. The snow tapered off to flurries by late evening on the second day. The heaviest snow fell over and east of the Green Mountains with 7 to 14 inches. In the Champlain Valley 2 to 5 inches

		fell with heaviest amounts above the 700-foot level. The wet snow resulted in some power outages and minor automobile accidents across the state.
February 28, 1995	Grand Isle County	A low-pressure system which developed in the Ohio Valley resulted in a mixture of snow, sleet, and freezing rain across Vermont. Snow accumulations ranged from four to eight inches across much of Grand Isle County.
March 13-14, 1993	State-wide	One of the worst storms of the century. Known as the "Blizzard of 93", it was one of the most powerful storms (Nor'easters) on record. The system moved up the Eastern Seaboard on the 13th and 14th coming close to breaking pressure and snowfall records in many locations. Snowfall amounts ranged from 10 to 28 inches across the state. Due to the weight of the snow that accumulated over March, there were numerous damage reports of barns and building roofs being damaged or at risk of collapsing
January 3, 1993	Northern Vermont	A combination of a cold surface and warm moist air aloft created freezing rain and freezing drizzle across the state. Road surfaces in Grand Isle County were covered in "black ice". "Black ice" is a thin transparent form of ice allowing the black asphalt surface of a road to be seen through the ice. "Black ice" conditions typically result in numerous traffic accidents as motorists are unaware that the road surface is covered in ice.

The Town has classified severe winter storms/ice storms to be highly likely each year. Every winter there is a winter event where Town residents will have to address snow and ice build-up on personal property and the Town's public works department will have to ensure the roads remain clear of snow and ice.

Flooding/Fluvial Erosion

Description:

Historically in Vermont, flooding has been the number one natural disaster in loss of life and property. Most flash flooding is caused by heavy rain from thunderstorms. Smaller creeks and streams are particularly vulnerable to flash flooding. Flooding in Bakersfield also comes from inundation and fluvial erosion.

The following is the definition of flood, according to FEMA:

Flood: A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties (at least 1 of which is the policyholder's property) from:

- Overflow of inland or tidal waters; or
- Unusual and rapid accumulation or runoff of surface waters from any source; or
- Mudflow; or

Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Impact and Geographic Area of the Hazard

Bakersfield is threatened by two types of flooding: inundation and fluvial erosion. Inundation-type flooding is regulated through the NFIP. It involves the rise of water over a floodplain.

Bakersfield lies within the Tyler Branch and Black Creek subwatersheds of the Missisquoi River basin. The western side of Town drains into the Black Creek subwatershed which includes Black Creek, Elm Brook and Kings Hill Brook. The eastern side of Town drains north to the Tyler Branch and includes Beaver Meadow Brook, Bogue Branch, Cold Hollow Brook, Cooks Brook, Ross Brook, The Branch, and Tyler Branch. The headwaters of the Tyler Branch watershed are located in the Cold Hollow Mountains which form the eastern boundary of Bakersfield and are among the more rugged parts of the Missisquoi River basin. Flood plains in Bakersfield follow along the brooks and creeks of undeveloped areas of forest lands and marshes and land that is in agricultural use. Summer or fall storms are more likely to be responsible for major flooding. Most flash flooding is caused by heavy rain from thunderstorms. Smaller creeks and streams are particularly vulnerable to flash flooding. Black Creek, the Branch, Beaver Meadow Brook and their tributaries typically flood in the spring of each year, and during periods of concentrated rain events.

Fluvial erosion is the destruction of river banks caused by the movement of rivers and streams. This occurs when the stream is unstable and has more energy than is needed to transport its sediment load, due to channel alterations or runoff events that increase water speed in the channel. Fluvial erosion hazard mapping was released by the VT Agency of Natural Resources (ANR) in early December 2014. This mapping assists municipalities in developing bylaws and effective mitigation strategies to regulate development within fluvial erosion hazard zones (aka "river corridors"). River corridors have been mapped along the Black Creek, The Branch, and Beaver Meadow Brook.

Bakersfield adopted local river corridor regulations in 2017 as a part of the Bakersfield Development Regulations to meet the State's model bylaw and to protect against fluvial erosion. These regulations are effective over mapped river corridors and a 50-foot setback from the top of bank/slope of smaller rivers and streams.

Floodplain Mapping

According to the most recent data available from the Vermont Agency of Natural Resources, as of June 2018, the Town of Bakersfield has 1 flood insurance policy in force with \$280,000 in insurance in-force and \$388 total premiums. There have been no NFIP flood insurance claims in Bakersfield since 1978. There are no repetitive loss properties.

A GIS based overlay analysis was conducted using FIRM data with the Vermont E-911 address data of structure location. The results found that there are thirteen (13) structures within the 100 or 500-year flood plain in Bakersfield. Nine (9) are all-season single-family units, one (1) mobile home, three (3) are seasonal single-family units. There are no Tier II hazardous materials storage sites within the 100 or 500-year flood plain.

The assessed value of all structures in Bakersfield is \$88.4 million. Assuming a range of town-wide damage of 1% to 5%, a damaging flood could result in \$884,000 to \$4,420,000 of total damage excluding building contents. Impacts to future populations, residences, new buildings, critical facilities and infrastructure are anticipated to remain the same.

Extent / Probability

Flash floods, rain storms and fluvial erosion are all are a locally probable hazard events according to plan participants. Flash floods typically occur during summer when a large thunderstorm or a series of rain storms result in high volumes of rain over a short period of time. Higher-elevation drainage areas and streams are

particularly susceptible to flash floods. Flash floods are likely in Bakersfield, and potential damage to Route 118 or Route 36 could limit access to town, as it is the major transportation corridor through the community. Flooding and fluvial erosion are considered highly likely by the town.

There is a stream gauge on the Missisquoi River located to the northeast of Bakersfield. This is the closest gauge to Bakersfield. The highest recorded measurement was 23.10 feet, which was measured on November 4, 1927. Flood height is 13 feet, a height which has been exceeded 8 times since 2000. According to NOAA, gauge heights at this location will result in the following results:

Gauge Height	Potential Effects
23	Devastating flooding occurs. This stage equals the Great Flood of 1927. Bridges on Routes 118, 108, and 105 will be covered in water, and may be destroyed. Large sections of Routes 118, 108, and 105 and local roads will be covered in water. Water will inundate homes in East Bakersfield and Enosburg Falls.
17	Severe flooding will occur from Richford downstream to Sheldon along the Missisquoi. Water will enter homes in East Bakersfield, and cover portions of Route 118 near East Bakersfield and Route 105 between East Bakersfield and Enosburg Falls. Missisquoi Street in Enosburg Falls will flood. Flooding of farmland will be widespread along the Missisquoi in Franklin county. This stage is equivalent to the FEMA 1 Percent Annual Chance Flood.
16	There will be widespread flooding along the Missisquoi from Richford to Sheldon. Water will cover portions of Route 105 between Enosburg Falls and East Bakersfield, and will approach Route 236 in Sheldon and Route 118 in East Bakersfield. There will be extensive field flooding.
14	Widespread flooding of low lying fields and roadways will occur from Richford to Enosburg. Water will approach Route 118 at East Bakersfield, and Route 105 between Enosburg Falls and East Bakersfield. Yards will be flooded in East Bakersfield.
13	Widespread flooding of low lying fields and some low lying roads will occur along the Missisquoi from Richford to Enosburg. Water will enter the yards of riverside homes in East Bakersfield.

Extent for inundation flooding: The National Weather Service Reports that river gauge heights on the Missisquoi River in East Bakersfield have exceeded 13 feet (flood height) approximately 47 times since 1918 (with increased frequency since the 1990s).

Extent for fluvial erosion: The worst areas that are causing issues in the Town of Bakersfield are along Waterville Mountain Road, Witney Road, Basswood Hill Road, Jordan Road, and Peaked Hill Road.

Past Occurrences:

The flood of November 1927 has been the most severe flood on historic record with the Town of Bakersfield. The storm brought 3.2 inches of rainfall within 24 hours and a total of 6.32 inches for the duration of the storm. Many of the residents of Bakersfield had to be evacuated from their homes and rescued in boats. The farms within the community lost most of their livestock and houses were flooded.

The January 15, 1996 winter storm (FEMA 1101 DR) triggered flooding throughout the Town and County. The flooding damaged many roads throughout Town. During the night of July 14 through to the morning of July 15, 1997, heavy rain fell continuously throughout eastern Franklin County (FEM-1184-DR). Several roads, bridges and culverts were damaged in Town. There was \$7,256,842 in public assistance funding in 5 counties hit hardest by the event. There are no specific damage estimates for Bakersfield.

In 1998, above average precipitation events occurred in January, March and April. On August 11, 1998, road flooding was especially severe in Bakersfield to the point where many roads were closed. Many homes had water in their basements. Damages estimates across the county were approximately \$1,000,000.

Mild weather with melting snow and rain on January 24, 1999. resulted in a few rivers reaching or exceeding their banks during Sunday. In particular, flooding was reported around the Bakersfield-Montgomery-Enosburgh area. Damage estimate from the event were approximately \$10,000.

On February 28, 2000 mild winter weather combined with a cold front creating flood conditions throughout Bakersfield and neighboring communities. Steady rain added to the snowmelt runoff. Several roads in town were flooded. There are no documented damages.

The Burlington Weather Service reports that 2004 was the third wettest summer on record. On September 23, 2004 a declaration was made (FEMA 1559-DR) due to severe storms and flooding from August 12th through September 12th 2004. Some of the flooding that occurred was a result of heavy rain produced from Tropical Storm Francis. Floods forced temporary closure of several roads. There was approximately \$10,000 in damages across the county.

A two-day heavy rainfall event occurred on May 18th and 19th, 2006 compounding above normal rainfall conditions. Two-day rain fall amounts of 3 to 5 inches were common in Franklin County with locally more than 6 inches along the resulting in numerous flooded roads as well as some road and culvert washouts.

On June 29, 2006 a series of thunderstorms and tropical like showers moved over the Bakersfield area during the evening and delivered heavy rainfall on already saturated soils. An unofficial weather spotter reported 3.30 inches of precipitation in 90 minutes. The end result was several flooded basements, a few flooded road culverts, some minor washouts on Route 108 through town and some minor washouts along Route 36 between Bakersfield and Fairfield. There was approximately \$20,000 in damages reported in the county.

In many portions of Vermont, June and July 2008 were the wettest records for those months in 114 years of record keeping (NOAA 2008), and the overall summer of 2008 was the third wettest on record for that same time span (NRCC 2009). Annual precipitation levels were the fifth highest on record in Vermont during 2008, with both high snow and rainfall recorded during the year throughout much of the northeast. Three disaster declarations were made from June through August: June 14-17 (DR 1778), July 18-21 (DR 1784) and August 8 – 12 (DR1780).

The year 2011 was a record year for flooding in the state of Vermont. The first floods occurred over a two-week period in April and May of 2011 (DR 1995, 4043). These floods impacted the northern half of the state, including the counties of Addison, Chittenden, Essex, Franklin, Grand Isle, Lamoille, Orleans, Washington, and Windham. The damage totaled over \$1.8 million in FEMA assistance. In the spring, heavy rains in late March/early April on top of a deep late season snowpack resulted in riverine flooding and sent Lake Champlain well over the 500-year flood elevation breaking the 140-year-old peak stage elevation. Additionally, flooding and fluvial erosion caused by Tropical Storm Irene was catastrophic, destroying property and taking lives, and again eliciting a disaster

declaration (DR-4022). Bakersfield was one of a few Vermont communities to not be greatly affected by these flood events.

Floods are a reminder to residents the power inherent in nature and is an urgent reminder of the need for proper management and appropriate use of critical floodplain areas. Development within floodplains poses significant risks and should generally be avoided. River channels and floodplains function as a single hydrologic unit, periodically transferring floodwaters and sediment from one to the other. Appropriate uses of floodplains are those that can accommodate this cycle. Examples of uses that are appropriate to floodplains include agriculture, open space and recreation.

Severe Thunderstorms (High Winds, Lightning, Hail)

Description

Thunderstorms are caused by an updraft, which occurs when warm, moist air rises vertically into the atmosphere. The updraft creates a cumulus cloud, which will eventually be the thunderstorm cloud. Severe thunderstorm winds are brief in duration and bring gusts in excess of 50 mph. Severe thunderstorms are capable of producing high winds, large hail, lightning, flooding, rains, and tornadoes.

The National Weather Service (NWS) issues a wind advisory when winds are sustained at 31 to 39 mph for at least one hour or any gusts 46 to 57 mph. Winds of 58 mph or higher cause the NWS to issue a High Wind Warning. In Vermont, high winds are most often seen accompanying severe thunderstorms. In fact, straight-line winds are often responsible for most of the wind damage associated with a thunderstorm. These winds are often confused with tornadoes because of similar damage and wind speeds.

Beaufort Number	Wind Speed Range (mph)	NOAA Terminology	Description
0	0	Calm	Smoke rises vertically.
1	1-3	Light air	Direction shown by smoke but not by wind vanes.
2	4-7	Light breeze	Wind felt on exposed skin; leaves rustle.
3	8-12	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag.
4	13-18	Moderate breeze	Raises dust and loose paper; small branches are moved.
5	19-24	Fresh breeze	Small trees sway.
6	25-31	Strong breeze	Large branches in motion; umbrellas used with difficulty
7	32-38	Near gale	Whole trees in motion, inconvenience felt when walking against the wind.
8	39-46	Gale	Breaks twigs off trees. Cars veer on road. Generally, impedes progress.
9	47-54	Severe Gale	Light structural damage.
10	55-63	Storm	Trees uprooted. Considerable structural damage
11	64-73	Violent Storm	Widespread structural damage.
12	74-95	Hurricane	Considerable and widespread damage to structure

Impact and Geographic Area of the Hazard

The Town has experienced a variety of high winds from storm systems that develop along ridgelines. Typically, high winds accompany strong thunderstorms that often generate lightning and/or hail. Micro bursts with high wind speeds and high precipitation accumulations over brief periods often down trees, branches, and power lines and can overwhelm local drainage networks for brief periods. There are rare instances where lightning has caused structure fires (barns) and grass fires during dry periods.

High winds are a hazardous threat to the Town and most commonly accompany other storm events. Violent windstorms are possible in Bakersfield. High winds associated with severe thunderstorms affect forested areas, utility lines and exposed property and are common along the Lake Shoreline corridor throughout Town.

There are no loss estimates for lightning because it is extremely difficult to predict where the event will occur and the type of associated structural damage. Damages could come in the form of destroyed electrical appliances, structure fires, or wildland fires. Death or serious injury could occur to individuals exposed to lightning. Private properties in Bakersfield have experienced lightning strikes. High elevations and areas around bodies of water such as lakes and ponds are more susceptible. Bakersfield’s road crew is equipped with associated debris removal equipment.

Extent/Probability

There have been 31 thunderstorm events in the region since January 1, 1998 according to the National Climatic Data Center. Of those, all are classified as severe thunderstorms with wind speeds of 50 knots or greater. Severe thunderstorms can cause power outages, property damage, transportation interruptions, affect businesses and can cause loss of life. Micro bursts with high wind speeds and high precipitation accumulations over brief periods often down trees and branches and power lines and can overwhelm local drainage networks for brief periods. Micro bursts have occurred almost annually in the past 10 years.

Lightning strikes in Franklin County average between 4-6 strikes per square mile each year based on data collected by NASA satellites between 1995 and 2002. Within the Town of Bakersfield, these numbers would average 1-2 lightning strikes every 5 years. There is very little data on lightning strikes in Town.

Hailstorms usually occur in Vermont during the summer months and generally accompany passing thunderstorms. While local in nature, these storms are especially significant to area farmers, who can lose entire fields of crops in a single hailstorm. Large hail is also capable of property damage. There have been 49 recorded hail events in Franklin County between 1998 and 2018. Hail is considered a relatively infrequent occurrence. Those hail events that do occur tend to be highly localized and limited to a relatively small area and typically occur with thunderstorms.

It is extremely difficult to predict where the event will occur and the type of associated structural damage. The estimated damage from a severe thunderstorm event occurring to 10% of all structures in Town with 20% damage is \$1,768,382. The estimated cost does not include building contents, land values or damages to utilities. There are no known deaths that have occurred in Town due to severe thunderstorms.

Past Occurrences

Private properties in Bakersfield have experienced lightning strikes however, no data on lightning strikes in Town is kept. The Town’s Highway and Fire Departments have appropriate debris removal equipment to clear trees and limbs from following thunderstorms.

Loss estimates for lightning are difficult to ascertain because it is extremely difficult to predict where the event will occur and the type of associated structural damage. Damages could come in the form of destroyed electrical appliances, structure fires, or wildland fires. Death or serious injury could occur to individuals exposed to lightning.

Table 9 Severe Thunderstorm Events		
Date	Location	Severity Remarks / Description of Area Impacted

October 29, 2017	Counties of Grand Isle, Addison, Chittenden, Essex, Franklin, Lamoille, Orange, Orleans, Washington and Windham	From October 29-30, a strong thunderstorm fueled by an ex-tropical storm brought damaging winds to Vermont, causing power outages and knocking trees down throughout the state. Winds reached over 70 mph at times and rain caused flooding. Estimated damages were \$4,687,401.61 across all of the involved counties.
February 17, 2006	Counties of Grand Isle, Chittenden, and Franklin	On an arctic front entered the Champlain Valley of Vermont. Sustained winds of 30 to 40 mph with damaging wind gusts in excess of 60 mph moved across the region between late morning and midafternoon. There were widespread reports of trees and power lines down across. There was an estimated \$150,000 in property damages within the affected area.
October 16, 2005	Counties of Grand Isle, Addison, Chittenden, Franklin and Rutland	Strong winds from Canada swept across Vermont. There were brief power disruptions, downed trees and associated damages to residential property throughout Town. Property damage estimate were approximately \$35,000 for the 5 County area.
September 17, 1999	New England	Remnants of Tropical Storm Floyd moved across eastern New England. Strong winds combined with saturated soils from heavy rain resulted in trees and power lines blown down. A few boats were damaged along the shores of Lake Champlain. The strongest winds reported were 43 knots (50 mph) in Bakersfield and on adjacent Lake Champlain. Rainfall across the county associated with the remnants of Floyd was 3 1/2 to 4 inches. .
February 15, 1995	Grand Isle and Franklin Counties	A strong pressure gradient across the state resulted in wind gusts over 50 knots across parts of the Champlain Valley. Property damage estimates for were \$50,000.
December 26, 1993	Statewide	A strong pressure gradient developed across the state in the wake of an arctic front resulting in high winds and damage in parts of every county. Trees and tree limbs were downed resulting in significant damage in some areas. Numerous power outages were reported across the state. Property damage estimates state-wide were \$500,000.

6. ASSESSING VULNERABILITY

While Bakersfield has identified severe winter storm/ice storm, flooding, and severe thunderstorms (High Wind, Lightning, and Hail) as its most common hazards, only flooding is covered in the following section. Flooding is the easiest hazard to assess specifically in terms of the vulnerability of both public and private property. Winter storm/ice storm and severe thunderstorms are much more unpredictable in terms of how they may impact property in Bakersfield.

Structures in the SFHA

There are approximately 19 structures within FEMA-designated Special Flood Hazard Areas (SFHAs)². Properties within SFHAs, that have a mortgage, are required to purchase flood insurance. Bakersfield's participation in the

² Flood Hazard Summary Report for Bakersfield, available on VT ANR's Floodready website <<https://anrweb.vt.gov/DEC/FoFReports/>>

National Flood Insurance Program (NFIP) gives residents and business owners access to discount flood insurance through the National Flood Insurance Program. Flood insurance can still be purchased privately, however it is more expensive. Development in SFHAs must meet additional construction standards as outlined in Bakersfield’s floodplain regulations.

There are approximately 20 structures located in the Vermont Agency of Natural Resources-designated River Corridor.

Repetitive Loss Properties

According to the State Hazard Mitigation Officer, the Town of Bakersfield has no repetitive loss properties. The definition of severe repetitive loss as applied to this program was established in the National Flood Insurance Act. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- (a) That has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; or
- (b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart. ³

Critical Facilities

A critical facility is defined as a facility in either the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the appropriate jurisdictions, or fulfills important public safety, emergency response, and/or disaster recovery functions.

The critical facilities identified in the Town of Bakersfield Hazard Mitigation Plan, listed fully in Attachment A, include shelters; government offices; hazardous materials storage sites; and the school.

Participation and Compliance with the National Flood Insurance Program (NFIP)

The National Flood Insurance Program (NFIP) is a voluntary program organized by the Federal Emergency Management Agency (FEMA) that includes participation from 20,000 communities nationwide and 247 Vermont towns and cities. Combined with floodplain mapping and floodplain management at the municipal level, the NFIP participation makes affordable flood insurance available to all homeowners, renters, and businesses, regardless of whether they are located in a floodplain.

Type	Number	Value Including Land
Residential Homes	567	\$90,289,100
Seasonal Homes	63	\$8,933,000
Mobile Homes – Unlanded	77	\$4,958,800
Mobile Homes - Landed	46	\$5,075,200
Farms	22	\$10,337,700
Commercial	18	\$8,531,400
Other (Utilities, Woodland and Miscellaneous)	59	\$9,259,800
Total Listed Value	735	\$137,685,000

³ FEMA <<http://www.fema.gov/severe-repetitive-loss-program>>

FEMA published a flood hazard study for the Town of Bakersfield in 1985. Flood Insurance Rate Maps (FIRMs) were prepared by FEMA in 1985. Flood hazard areas were identified along the brooks and streams that run through the town. The FIRMs and Study are available for review on-line at FEMA.gov.

Creation of the Flood Hazard District in the Town's Development Regulations enabled Bakersfield to be eligible for FEMA's National Flood Insurance Program (NFIP), which permits residents within the Flood Hazard District to purchase flood insurance. The purpose of the district is to prevent increases in flooding caused by development in flood hazard area, to minimize future public and private losses due to floods, and to promote the public health, safety and general welfare. The Town is committed to enforcing floodplain regulations and ordinances to be eligible to participate in the NFIP program and protect the people and property of Bakersfield by restricting development in flood prone areas. Bakersfield is a member in good standing with the NFIP (CID 500216B). The Town will continue to ensure future compliance with the NFIP by making sure that local regulations meet NFIP minimums and conducting enforcement as necessary.

The Town works with the elected officials, the State, the Northwest Regional Commission, and FEMA to correct existing compliance issues and prevent any further NFIP compliance issues through continuous communications, training and education.

7. MITIGATION STRATEGY

The following hazard mitigation goals are adopted by Bakersfield:

General Goals

- Prevent/reduce the loss of life and injury resulting from all-hazards events.
- Prevent/reduce the financial losses and infrastructure damage incurred by municipal, residential, agricultural and commercial establishments due to disasters.
- Include hazard mitigation planning in the municipal planning process including the Town Plan, Capital Improvement Plan and Local Emergency Operations Plan.
- Ensure the general public is part of the hazard mitigation planning process.

The following goals and policies from the Bakersfield Town Plan support hazard mitigation.

Town Plan (Adopted 2017) Goals & Policies That Support Hazard Mitigation

Goals

- Encourage and foster an all hazards disaster resilient community.
- Reduce the loss of life and injuries that result from disasters.
- Reduce damages to public infrastructure resulting from all hazards events through hazard mitigation planning and project implementation.

Policies

- Encourage and foster an all hazards disaster resilient community.
- Reduce the loss of life and injuries that result from disasters.
- Reduce damages to public infrastructure resulting from all hazards events through hazard mitigation planning and project implementation.
- Encourage flood emergency preparedness and response planning.
- Encourage the protection and restoration of floodplains and upland forested areas that attenuate and moderate flooding and fluvial erosion.
- Continue to implement high priority projects identified in the Local Hazard Mitigation Plan

- Adopt annually the Local Emergency Operations Plan.
- Participate in the Franklin County Mutual Aid Agreement.
- Resiliency measures will be compatible with natural features, including floodplains, river corridors, land adjacent to streams, wetlands, and upland forests, historic resources; character of neighborhoods; and the capacity of the community to implement them.
- Emergency Management, and the road crew to plan improved emergency response capacity (operations, training, equipment) during natural disasters.
- Evaluate the flood hazard regulations for opportunities to incorporate measures to increase public safety and reduce future damages.
- Consider adopting and implementing river corridors and buffers to discourage future development in high risk areas for flooding or erosion hazards.
- Explore participation in the FEMA Community Rating System (CRS) so as to secure a discount on flood insurance
- Incorporate mitigation measures when developing improvements or expansion to municipal infrastructure.
- Adopt and implement the most recent (currently 2013) VTrans Town Road and Bridge Standards, or stricter standards.

Existing Hazard Mitigation Programs, Projects and Activities

The following is a list of existing hazard mitigation programs, projects, and activities in Bakersfield:

Flooding

- The Town has flood zone regulations which designate a Flood Hazard District and Shore District whose purpose is to minimize future public and private losses caused by development in flood hazard areas.
- The town participates in the National Flood Insurance Program (NFIP). Maintaining compliance with NFIP regulations both now and in the long term is a high priority activity.
- Flood Hazard Areas in Bakersfield are identified on Flood Hazard Boundary Maps (FHBM) and Flood Insurance Rate Maps (FIRMs) produced by FEMA (from 1985). The purpose of these districts, which are located along the flood plains of rivers and streams throughout the Town, is to prevent increases in flooding caused by excessive development of lands within flood hazard areas.
- The Town has adopted local River Corridor regulations as a part of the Bakersfield Development Regulations.
- Ditches located in areas susceptible to flooding are inspected and maintained on an annual basis. Ditches in general are inspected and cleaned
- Culverts are inspected at least once a year. Seasonal maintenance is developed based on an annual inspection.

Severe Winter Storms (Ice Storm)

- Town Highway Department has snow removal equipment.
- Shelter agreement between Bakersfield School and American Red Cross are renewed on a semi-annual basis.
- Road crews have response equipment to deal with downed trees and branches.

Structure Fire and Wildland Fire

- Annual Insurance Service Office (ISO) inspection.
- Fire fighter personal protection equipment upgrades through Federal grant programs.

- Upgrades to fire-fighting offensive and defensive equipment through Federal grant programs.
- Fire fighter training through Vermont Fire Academy.
- Member of Franklin County Mutual Aid Association.
- NIMS/ICS Training for members to meet state NIMS strategy.

Loss of Electrical Service

- Bakersfield School has a stationary generator and transfer switch for use as a community shelter.
- On-going regularly scheduled road maintenance programs includes cutting vegetation away from utility lines.

On-Going Mitigation and Preparedness Activities

- Town is interested in State and Federal funding for mitigation projects and activities.
- Town applies for state grants (Local Roads, Bridge and Culvert) to address road construction/improvement projects.
- Regularly scheduled maintenance programs ongoing (culvert survey & replacement, ditching along roadways, cutting vegetation to allow visibility at intersections).
- Traffic calming and alternate transportation project.
- Town has mapped critical facilities and infrastructure.
- Continue to identify and equip, as appropriate community shelters.
- Community participates in the Vermont Enhanced 911 System.

Identified Hazard Mitigation Actions, Programs, and Activities

The following list documents the questions (criteria) considered by the town of Bakersfield when established as a priority for future hazard mitigation projects. Each of the following criteria was rated according to a numeric score of “1” (indicating Poor), “2” (indicating Average) and “3” (indicating Good). The highest possible score is 36. The full scoring matrix used is located as an appendix.

- 1) Does the action reduce damage?
- 2) Does the action contribute to community objectives?
- 3) Does the action meet existing regulations?
- 4) Does the action protect historic structures or structures critical to Town operations?
- 5) Can the action be implemented quickly?
- 6) Is the action socially acceptable?
- 7) Is the action technically feasible?
- 8) Is the action administratively possible?
- 9) Is the action politically acceptable?
- 10) Is the action legal?
- 11) Does the action offer reasonable benefits compared to its cost of implementation?
- 12) Is the action environmentally sound?

Mitigation actions are listed in terms of mitigating threat or risk to public health and safety, reduction of hazard to community assets, adherence to Town plan and local ordinances, cost, and feasibility. Actions are classified as either short - term or long - term activities. Short –term action items are activities which the municipality may be capable of implementing within one to two years. Long-term action items may require new or additional resources, funding or authorities. Ongoing action items occur at least once per year.

The following identified programs, projects and activities are future mitigation strategies for the Town of Bakersfield. These mitigation strategies have been chosen by the town as the most appropriate policies and programs to lessen the impacts of potential hazards.

Cost-Benefit Analysis

Each project will incorporate a full benefit-cost analysis (BCA) following FEMA’s BCA methodology and latest software to ensure cost effectiveness and maximize savings.

There was a rough cost/benefit analysis done for each project listed in the table. The below cost and benefits tables address the priorities for the mitigation strategies that are stated in the Mitigation Actions Table.

Cost Estimates

High	=>\$100,000
Medium	= \$25,000 – 100,000
Low	=< \$25,000

Benefit Estimates

High	Public Safety
Medium	Infrastructure / Functionality
Low	Aesthetics / General Maintenance

Implementation of the mitigation actions is summarized in the below table, as far as who, when and how they will be carried out. Further details about some actions can be found following the mitigation actions table, in text.

Table 10 – Mitigation Actions						
Priority/ Score	Mitigation Action / Hazard Addressed	Responsibility/ Oversight	Funding Source	Timeframe	Cost / Benefit	Status
High 32	Replace 2 Undersized Culverts on Waterville Mountain Road / Flooding	Selectboard and Highway Department	Town Budget	May 2020 – November 2020	Medium /High	Apply for funding if available. Apply for permitting. Design. Implement.
High 32	Replace an Undersized Culvert on Whitney Road / Flooding	Selectboard and Highway Department	Town Budget	May 2020- November 2020	Medium / High	Apply for funding if available. Apply for permitting. Design. Implement.
High 32	Support Power Utility Efforts to Protect Utility Corridors (tree / branch removal. / Severe Winter Storm (Ice Storm), Severe Thunderstorm (High Wind, Lightning, and Hail)	Selectboard	Local	Short Term Start: May 2020 End: October 2020	Low / High	Support power utility standards of in identifying utility corridors in need of tree pruning.

High 31	Community Education: How to Prepare for Severe Winter Conditions / Severe Winter Storm/Ice Storm.	Emergency Management Coordinator	Town Budget	January 2020– March 2020	Low/ High	September is National Preparedness Month. Fire Academy, FEMA and Red Cross have winter preparedness education materials that could be the basis for community messaging.
High 31	Protect Critical Facilities and Infrastructure from Lightning Damage / Severe Thunderstorm (High Wind, Lightning and Hail)	Selectboard, Highway, Road Foreman,	Town Budget	May 2020 to December 2020	Low/ High	Install lightning protection and surge suppression protection on critical facility on electronic equipment.
High/ Medium 29	Replace 2 Undersized Culverts on Basswood Hill Road/ Flooding	Selectboard, Highway Department	Town Budget	May 2020- November 2020	Medium / High	Apply for funding if available. Apply for permitting. Design. Implement.
High/ Medium 29	Replace Undersized Culvert on Jordan Hill Road / Flooding	Selectboard, Highway Department	Town Budget	May 2020- November 2020	Medium / High	Apply for funding if available. Apply for permitting. Design. Implement.
High/ Medium 29	Update Development Regulations as needed to maintain River Corridor protections with latest VT ANR guidelines in order to maintain 17.5% ERAF rate / Flooding	Planning Commission	Town Budget	Long Term: Monitor from January 2020- January 2026	Low/ High	This action will ensure that Bakersfield maintains this status.
Medium 28	Replace Culvert and Deepen Ditch on Peaked Hill Road / Flooding	Selectboard, Highway Department	Town Budget	May 2020- November 2020	Medium / Medium	Apply for funding if available. Apply for permitting. Design. Implement.

Summary of Mitigation Projects – The following is a summary of each mitigation project identified by Bakersfield:

Replace 2 undersized culverts on Waterville Mountain Road - This action will reduce long-term vulnerability to flooding. The current 24” diameter culverts are undersized and therefore are subject to repeated wash outs including a total road washout during the 2019 “Halloween Storm”. These culverts should be replaced by a 36” diameter (cross sectional area of 7.07 sq. ft.) culvert or similar “squashed” pipe culvert. The installation of a single larger culvert would require closing of the road and blasting the road bed and ditch as well as the installation of a diversion dam in the ditch on the downstream side of the culvert inlet due to the steep terrain and change of direction of the water.

Replace an undersized culvert on Whitney Road - This action will reduce long-term vulnerability to flooding. The current culvert has a diameter of 48” and crosses the road at an angle of about 30 degrees. This represents a stream change of about 60 degrees and even though there is a dam in the ditch to help with this directional change it fails in high water conditions, resulting in extreme washing the roadway.

This culvert should be replaced by 72" diameter culvert (cross sectional area of 28.26 sq. ft.) crossing the road more in alignment with the natural direction of the stream would greatly reduce or eliminate erosive problems. Crossing the road at this "longer" angle would require a much greater length, perhaps 80 feet. A new and larger diversionary dam would need to be installed on the downstream side of the culvert inlet due the high volume and change of direction of the water.

Support Power Utility Efforts to Protect Utility Corridors – This action will reduce a long-term vulnerability for the Town. The utility lines are privately owned; however, the Town will support the power company's utility line and corridor tree pruning program in order to protect power lines. Trees or branches that are a concern to impact utility lines will be reported to the power company. The power company has improved upon their line corridor tree pruning program to reduce the impacts of ice storms and falling trees/branches in recent years.

Public Education on Severe Winter Storm Preparedness – Using social media (Facebook, Front Porch Forum, Town website, direct mailings, local newsprint) the Town Fire Department will publish information to educate the public on winter storm preparedness. The Department will utilize existing materials developed by the American Red Cross, FEMA and State Fire Marshall's Office regarding safe operation of emergency generators, safe winter driving tips, maintenance of chimneys, and carbon monoxide safety. This campaign will be done annually.

Replace 2 Undersized Culverts on Basswood Hill Road - This action will reduce long term vulnerability to flooding. About 150 yards from the junction of Waterville Mountain Road and Basswood Hill Road, travelling East on Basswood Hill Road, because of the bed rock or ledge being only about 36" below the finished road grade, there are two 30" diameter culverts (cross sectional area of 6.28 sq. ft.) that lie side by side. These culverts are unable to handle the volume of water and debris of a large storm and therefor are subject to repeated wash out.

These culverts should be replaced by a 48" diameter (cross sectional area of 12.56 sq. ft.) culvert or similar "squashed" pipe culvert. The installation of a single larger culvert would require closing of the road and blasting the road bed and ditch.

Replace Undersized Culvert on Jordan Road - This action will reduce long term vulnerability to flooding. The repeated failure of an undersized 24" diameter culvert (cross sectional area of 3.14 sq. Ft.) on this short road has caused repeated wash outs. The ditch is in serious need work.

This culvert should be replaced by a 36" diameter (cross sectional area of 7.07 sq. ft.) culvert or similar "squashed" pipe culvert. The installation of a single larger culvert would require closing of the road. The ditch along the eastern edge of the road needs to be brushed, cleaned and lined for the entire length of the road.

Protect Critical Facilities and Infrastructure from Lightning Damage / Severe Thunderstorm - Lightning strikes can damage electronic devices used at Town critical facilities. Installing surge protection equipment will ensure that these devices can be used after a major thunderstorm emergency.

Update Development Regulations as needed to maintain River Corridor protections with latest VT ANR guidelines in order to maintain 17.5% ERAF rate- Bakersfield's Development Regulations currently meet existing VT ANR River Corridor Guidelines and FEMA Floodplain Regulations. Ensuring continued compliance with these standards will reduce vulnerability to flooding and ensure Bakersfield maintains a 17.5% ERAF rate.

Replace Culvert and Deepen Ditch on Peaked Hill Road- This action will reduce long term vulnerability to flooding. Bed rock has made it impossible to ditch a section of the southern edge of the road. Unfortunately, this ditch is

on the upslope side of the road. Any rain at all causes the ditch to overflow onto the road and, because of this, culverts have been placed where they could rather than where they should be blasted out to a depth of 18" to 24" so the water can flow to more appropriate crossing locations. The existing overburdened 12" diameter culvert (cross sectional area of 0.79 sq. ft.) should be removed, water flow should be altered to flow to the southeast and the dry" 12" diameter culvert to a 24" diameter culvert (cross sectional area of 3.14 sq. ft.) should be upsized to a 24" diameter culvert. The installation of the single larger culvert would require closing of the road and blasting the road bed and ditch.

Existing Planning and Regulatory Capabilities

Bakersfield is a rural town with a low population. The Town staff includes a Part-time Town Clerk/Treasurer, a part-time Zoning Administrator and one full-time Highway Department staff. The highway department staff covers 51.7 miles of town highway. They are constantly treating roadways in winter months, so they are strained to do other things that come up. The full-time staff size is similar to other towns in northern Vermont of similar size. The Town has a volunteer Planning Commission and Development Review Board.

The Town has no local police department. Vermont State Police and the Grand Isle County Sheriffs' Department cover all areas of law enforcement from traffic violations to major crimes. The town currently contracts with the County Sheriff for additional coverage and help with enforcement of local traffic ordinances.

Bakersfield has a Volunteer Fire Department and Rescue Squad staffed by well-trained and devoted volunteers. The Department responds to fire, rescue, and marine calls in Bakersfield and offers aid to neighboring towns' fire departments as needed.

How this Plan will Improve Existing Capabilities

The following policies, programs and activities related to hazard mitigation are currently in place and/or being implemented in the Town of Bakersfield. In cooperation with NRPC, the Town Emergency Management Coordinator (a member of the Selectboard) analyzed these programs for their effectiveness and noted improvements needed. Bakersfield uses all of the plans listed below to help plan for current and future activities with the town. For example: the Local Emergency Operation Plan has a contact list that is used for response purposes in the case of a hazard event, and is updated every year after Town Meeting. The Town Plan directs visions and goals that include Natural Resources and Land-Use decisions. In the development of this plan, the latest 2017 Town Plan was used. Town Road and Bridge Standards are followed by the town and they do an annual culvert and bridge inventory that is mapped by the NRPC. The town is compliant with the NFIP.

As Bakersfield goes through the update process for the planning mechanisms outlined in the table below, the Town will look to the Hazard Mitigation Plan's Table of Actions and Risk and Vulnerability Assessments to help guide land use district decisions, and guide goals and policies for those districts. After Town Meeting every March, policies and action items in the Town Plan may be reviewed and integrated into hazard mitigation as needed. The Local Emergency Operations Plan contact list should be updated after Town Meeting each year, including updates to vulnerable geographic locations, as well as locations of vulnerable populations. Updates to each of the planning mechanisms outlined in the table below are handled by the responsible party identified in the table. There is no timeframe for updating the below referenced plans and regulations to better incorporate hazard mitigation, however, as each document is updated the hazard mitigation plan will be reviewed for incorporation. The goals of this hazard mitigation plan will be incorporated in the upcoming town plan update to ensure that emergency preparedness and mitigation planning efforts are included in the Town Plan, with particular attention to including the projects in the Mitigation Actions Table. This will assist with ensuring that this plan is utilized and project follow-through occurs.

The following authorities, policies, programs, and resources related to hazard mitigation are currently in place and/or being implemented in the Town of Bakersfield in addition to the NFIP. These programs reduce the effects of hazards to existing, new, and future buildings, infrastructure, and critical facilities by preventing their location in identified hazard areas and ensuring that infrastructure and buildings are designed to minimize damage from hazard events. The Town has analyzed these programs for their effectiveness and noted any improvements that may be needed. Other mitigation/emergency planning related documents and their status are outlined in the below table:

Table 11 Town Policies and Plans			
Existing Protection	Description	Effectiveness/Enforcement/Hazard that is addressed	Gaps in Existing Protection/Improvements Needed
Town Plan	Policies that provide protection and limited development in wellhead protection areas, wetlands, steep slopes, and shallow soils.	Policies and vision for future land use. Includes flood resiliency element. Adopted November 26, 2018.	None found
Development Regulations.	Restrictions on development in potential hazardous areas such as steep slopes, floodplains. Also regulates land development in FEMA flood areas.	Development Regulations recently updated. Adopted March 7, 2017.	None found
Local Emergency Operations Plan	Summary of response and notification procedures.	Semiannual updates.	None found.
Fire Mutual Aid	Assistance from county fire, rescue, municipal and public works departments.	Franklin County Mutual Aid Agreement, 2015.	Does not include ambulance rates.
Road and Bridge Standards	Standards for road and bridge construction and repair.	Adopted April 27, 2015.	
School Emergency Response	Responses by various types of emergency incidents at school.	Vermont School Crisis Guide.	Needs updating.

Through current plans, policies and mitigation actions, Bakersfield is working to decrease damages from severe winter storms (ice storms), floods and structure fires.

Flooding and Development Regulations

The Town of Bakersfield has adopted floodplain regulations in order to protect the health, safety, and welfare of its residents and to allow the community to participate in the National Flood Insurance Program (NFIP). In 1985, the Town established a bylaw for special flood hazard areas. The purpose of this bylaw is:

- Minimize and prevent the loss of life and property, the disruption of commerce, the impairment of the tax base, and the extraordinary public expenditures and demands on public services that result from flooding and other flood related hazards; and

- Ensure that the design and construction of development in flood and other hazard areas are accomplished in a manner that minimizes or eliminates the potential for flood and loss or damage to life and property; and
- Manage all flood hazard areas designated pursuant to 10 V.S.A. § 753; and
- Make the state, municipalities, and individuals eligible for federal flood insurance and other federal disaster recovery and hazard mitigation funds as may be available.

The Town Zoning Administrator is responsible for monitoring compliance with the NFIP.

7. PLAN IMPLEMENTATION, MONITORING & EVALUATION

Monitoring and Updating the Plan – Yearly Review

Once the plan is approved and adopted, the Selectboard in Bakersfield, along with interested and appointed volunteers and stakeholders, will continue to work with staff at the Northwest Regional Commission to monitor, evaluate, and update the plan throughout the next 5-year cycle. The plan will be reviewed annually at the May Selectboard meeting along with the review of the town’s Local Emergency Operations Plan (LEOP), once it is created. During the annual review, the Selectboard will evaluate the plan effectiveness at achieving its stated purpose and goals. This meeting will allow town officials and the public to discuss the town’s progress in implementing mitigation actions and determine if the town is interested in applying for grant funding for projects that can help mitigate future hazardous events; e.g., bridge and culvert replacements, road replacements and grading, as well as buying out any repetitive loss structures that may be in the Special Flood Hazard Area, and revise the plan as needed. Northwest Regional Commission’s staff will assist the Bakersfield Selectboard with this review, as requested by the Town. Progress on actions will be kept track using a table the NRPC will provide to the Selectboard to update. There will be no changes to the plan, unless deemed necessary by the Town. If so, the post disaster review procedure will be followed.

Plan Maintenance (5 Year Update and Evaluation Process)

The Hazard Mitigation Plan is dynamic and should not be static. To ensure that the plan remains current and relevant, it is important that it be updated periodically. The plan should be updated every five years in accordance with the following procedure:

1. The Bakersfield Selectboard will appoint a team to convene a meeting of the hazard mitigation planning committee. The team will include a Bakersfield Emergency Management Director who will chair the meeting. Others members should include local officials such as Selectboard members, Fire Chief, Zoning Administrator, Road Commissioner, Health Officer and interested stakeholders. The Emergency Management Director will work with the Northwest Regional Planning Commission staff and be the point person for the Town.
2. The NRPC staff will guide the Committee through the update process. This update process will include several publicly warned meetings. At these meetings, the Committee will use the existing plan and update as appropriately guided by the NRPC staff to address:
 - a. Update of hazard events and data gathered since the last plan update.
 - b. Changes in community and government processes, which are hazard-related and have occurred since the last review
 - c. Changes in community growth and development trends and their effect on vulnerability.
 - d. Progress in implementation of plan initiatives and projects

- e. Incorporation of new mitigation initiatives and projects.
 - f. Effectiveness of previously implemented initiatives and projects.
 - g. Evaluation of the plan for its effectiveness at achieving its state purpose and goals.
 - h. Evaluation of unanticipated challenges or opportunities that may have occurred between the date of adoption and the date of the report, and their effect on capabilities of the town.
 - i. Evaluation of hazard-related public policies, initiatives and projects.
 - j. How mitigation strategy has been incorporated into other planning mechanisms.
 - k. Review and discussion of the effectiveness of public and private sector coordination and cooperation.
3. From the information gathered at these meetings, along with data collected independently during research for the update, the NRPC staff will prepare and update a draft in conformance with the FEMA *Local Hazard Mitigation Plan Review Tool* document.
 4. The Selectboard will review the draft report. Consensus reached on changes to the draft. Emphasis in plan updates will be put on critically looking at how the plan can become more effective at achieving its stated purpose and goals.
 5. The changes will be incorporated into the Plan by NRPC staff.
 6. The Selectboard will notify the public that the draft is available for public comment and review. The Town will advertise and make available the draft plan for comments both electronically and in hard copy. The draft plan will be distributed electronically to neighboring municipalities.
 7. Public comments will be incorporated by NRPC staff. The final draft will be provided to the plan development participants and town staff for final review and comment with review comments provided to the Emergency Management Director and incorporated into the plan.
 8. The NRPC staff will finalize the plan, with any remaining comments from the plan participants and town staff incorporated, and then submitted electronically to DEMHS State Hazard Mitigation Officer (SHMO) who will then submit to FEMA Region 1.
 9. The Plan will be reviewed by the DEMHS SHMO and FEMA Region 1.
 10. SHMO and FEMA comments will be addressed in the Plan by NRPC staff.
 11. The Plan will be resubmitted as needed until the plan is approved pending adoption by FEMA Region 1. Once the plan is approved by FEMA, it will be ready for adoption.
 12. The Selectboard will adopt the plan and distribute to interested parties.
 13. The final adopted plan will be submitted by NRPC staff to DEMHS and FEMA.
 14. FEMA will issue final approval of the adopted plan.

Continued Public Involvement

The Bakersfield Selectboard is dedicated to involving the public directly in the continual review and updates of the Hazard Mitigation Plan. Copies of the plan will be kept at the Town Office. The existence and location of these

copies will be publicized in the media (newspaper, web sites, Town Annual Report, etc.) In addition, any proposed changes will be publicized in the media.

Programs, Initiatives and Projects Review

Although the plan should be reviewed in its entirety every five years as described above, the Town may review and update its programs, initiatives and projects more often directly with the State Hazard Mitigation Officer (SHMO) based on changing local needs and priorities.

The Town of Bakersfield should incorporate elements of this plan, such as identified projects, into capital planning initiatives and annual budget reviews during Town Meeting.

Post-Disaster Review/Update Procedure

Should a declared disaster occur, a special review will occur amongst the Selectboard, the Emergency Management Coordinator, the NRPC staff, and those involved in the five year update process described above. This review will occur in accordance with the following procedures:

1. Within six months of a declared emergency event, the town will initiate a post disaster review and assessment. Members of the State Hazard Mitigation Committee will be notified that the assessment process has commenced.
2. This post disaster review and assessment will document the facts of the event and assess whether existing Hazard Mitigation projects effectively lowered community vulnerability/damages. New mitigation projects will be discussed, as needed.
3. A draft After Action Report of the review and assessment will be distributed to the hazard mitigation committee.
4. A meeting of the committee will be convened by the Selectboard to make a determination of whether the plan needs to be amended. If the committee determines that NO modification of the plan is needed, then the report is distributed to local communities.
5. If the committee determines that modification of the plan IS needed, then the committee drafts an amended plan based on the recommendations and forwards to the Selectboard for public input.
6. The Selectboard adopts the amended plan after receiving approval-pending-adoption notification from FEMA.

Attachment A**Critical Facilities, Hazmat Storage Facilities, and Vulnerable Sites
Town of Bakersfield**

Facility Name or Facility Designation	Facility Owner	Function	Street or Location
Bakersfield Country Club		Hazmat Storage Facility	Boston Post Road
Bakersfield Elementary/Middle School	Town of Bakersfield	Educational Facility	82 Academy Lane
Bakersfield Fire Department	Town of Bakersfield	Emergency Services	380 Main Street North
Bakersfield Town Garage	Town of Bakersfield	Government	Th3
Bakersfield Town Hall	Town of Bakersfield	Government Facility	40 East Bakersfield Road
Bakersfield United Methodist Church (Tri Church Parish)		Religious Facility	
Brigham Academy	Town of Bakersfield	Government	Academy Lane
Paul's Quick Stop	S.B. Collins, Inc.	Hazmat Storage Facility	Route 108
United Church of Bakersfield/Fairfield	Vermont United Church of Christ	Religious Facility	Route 36 & Route 108

Attachment B

Town of Bakersfield Priority Matrix

Each of the following criteria was rated according to a numeric score of “1” (indicating Poor), “2” (indicating Average) and “3” (indicating Good).

1. Does the action reduce damage?
2. Does the action contribute to community objectives?
3. Does the action meet existing regulations?
4. Does the action protect historic structures or structures critical to Town operations?
5. Can the action be implemented quickly?
6. Is the action socially acceptable?
7. Is the action technically feasible?
8. Is the action administratively possible?
9. Is the action politically acceptable?
10. Is the action legal?
11. Does the action offer reasonable benefits compared to its cost of implementation?
12. Is the action environmentally sound?

	Criteria												Total Score	
	1	2	3	4	5	6	7	8	9	10	11	12		
Mitigation Action	Replacement of 2 Undersized Culverts on Waterville Mountain Road	3	3	2	1	2	3	3	3	3	3	3	3	32
	Replacement of an Undersized Culvert on Whitney Road	3	3	2	1	2	3	3	3	3	3	3	3	32
	Support Power Utility Efforts to Protect Utility Corridors (tree / branch removal)	3	2	2	2	3	3	3	3	3	3	3	2	32
	Community Education: How to Prepare for Severe Winter Conditions	2	3	3	1	3	2	2	3	3	3	3	3	31
	Protect Critical Facilities and Infrastructure from Lightning Damage	3	2	3	3	3	3	3	2	3	2	2	2	31
	Replace 2 Undersized Culverts on Basswood Hill Road	3	2	2	1	2	3	3	3	2	3	2	3	29
	Replace Undersized Culvert on Jordan Hill Road	3	2	2	1	2	3	3	3	2	3	2	3	29
	Update Development Regulations as needed to maintain Stream (River) Corridor protections with latest VT ANR guidelines in order to maintain 17.5% ERAF rate	2	3	3	1	1	2	3	3	2	3	3	3	29
	Replace Culvert and Deepen Ditch on Peaked Hill Road	2	2	2	1	2	3	3	3	3	3	2	2	28

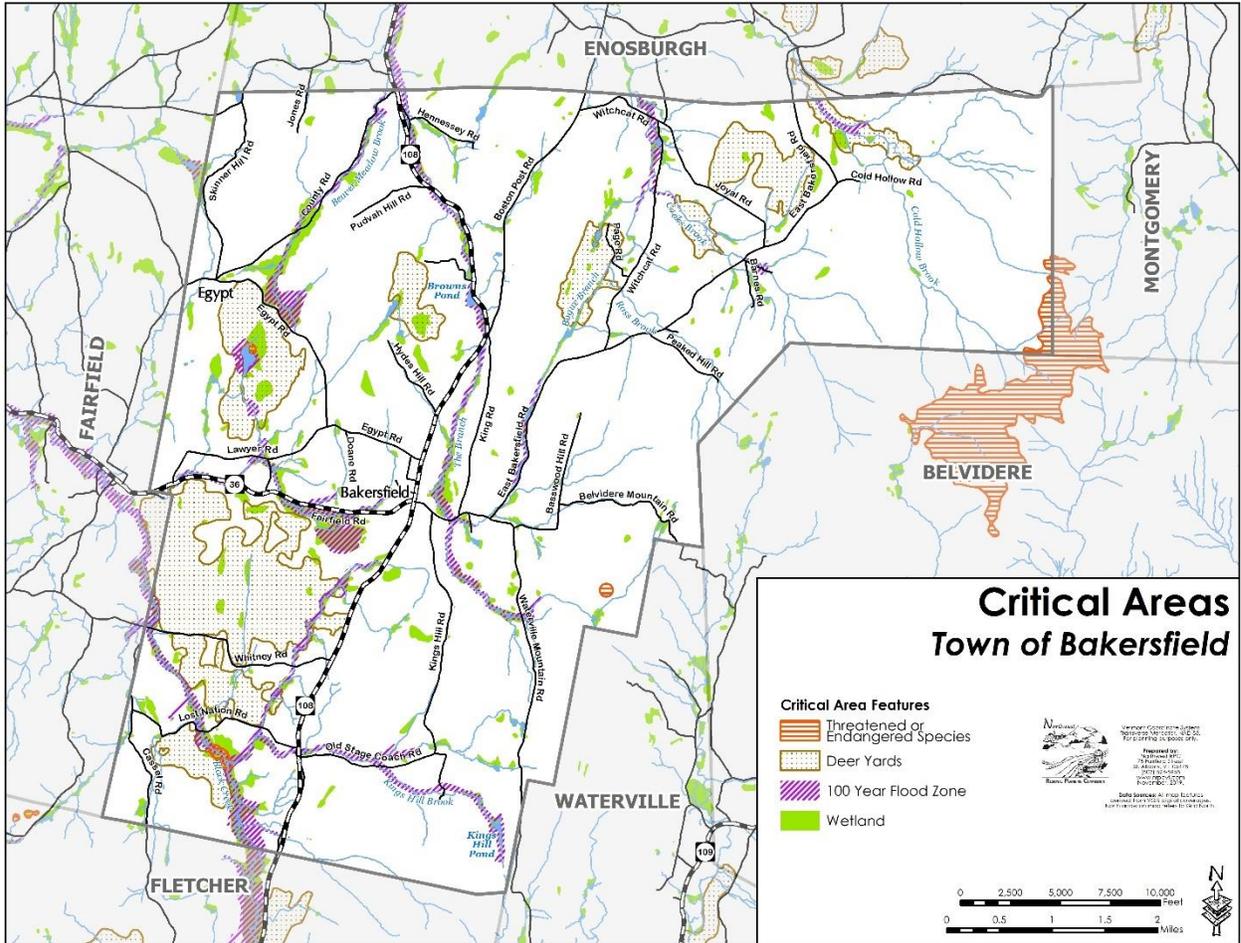
Attachment C

Public Government Participation

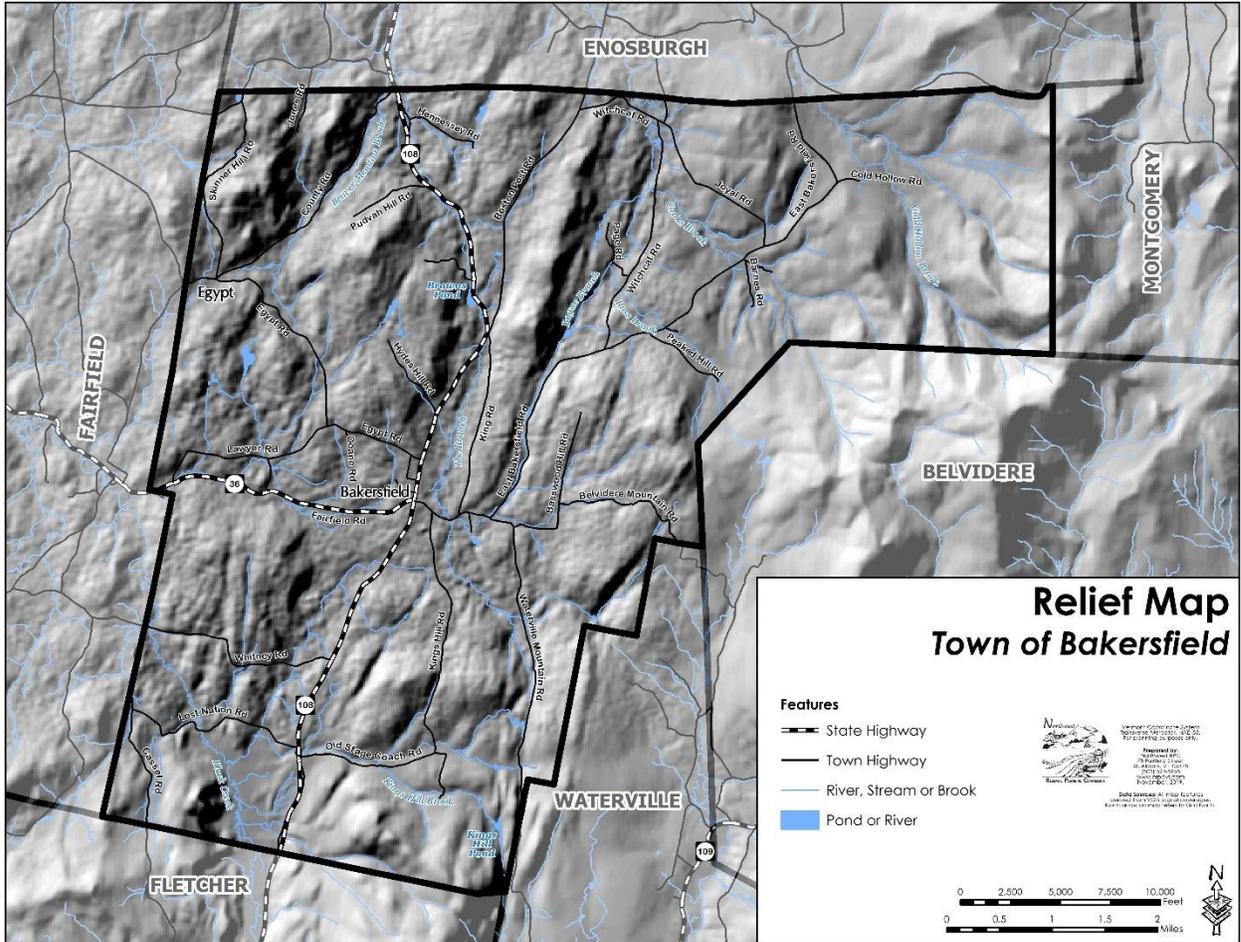
Information in the Hazard Mitigation Plan is based on research from a variety of sources. It encompassed research using a historical perspective and future projections for the vulnerability assessment. The research methods and various contributions to the plan included but were not limited to:

- Town of Bakersfield Select Board
- Northwest Regional Planning Commission

Attachment E
Bakersfield Critical Areas Map



Attachment F
Bakersfield Relief Map



Attachment G

References

- American Community Survey. (2016). Available: <http://www.factfinder.census.gov>
- Cornell University. (2016). Northeast Regional Climate Data Center. Available: <http://www.nrcc.cornell.edu>
- Dupigny-Giroux, L.-A. (2000). Impacts and consequences of the Ice Storm of 1998 for the North American Northeast. Weather, 55, No. 1, pp.7-14.
- Federal Emergency Management Agency. (Various). Town of Bakersfield Flood Insurance Study (1980) and Flood Insurance Rate Maps (2001).
- Federal Emergency Management Agency (2016). Available: <http://www.fema.gov>
- Bakersfield Town (2016). Local Emergency Operations Plan. Bakersfield, VT
- National Oceanic and Atmospheric Administration. (2016). National Climatic Data Center. Available: <http://www.ncdc.noaa.gov/oa/ncdc.html>
- National Oceanic and Atmospheric Administration. (2016). National Weather Service. Available: <http://www.nws.noaa.gov>
- North American Emergency Response Guidebook. (2015) Neenah, WI: J.J. Keller and Associates, Inc.
- Northeast States Emergency Consortium. (2016). Disaster Resistant Communities Resources and Tools. Available: <http://www.nesec.org>
- Northwest Regional Planning Commission. (2016). Regional Plan. St. Albans, VT.
- Town of Bakersfield, VT (2016) Grand List, Bakersfield, VT.
- Town of Winhall, VT (2016). Single Jurisdiction Hazard Mitigation Plan, Windall, VT.
- University of South Carolina, Department of Geography. (2015). Hazards Research Lab. Available: <http://www.cla.sc.edu/GEOG/hrl/index.htm>
- U.S. Department of Agriculture, Soil Conservation Service. (1979). Soil Survey of Franklin County, Vermont. St. Albans, VT.
- U.S. Department of Agriculture, U.S. Forest Service. (2003). Wildfire Hazard Potential. Available: <https://www.firelab.org/project/wildfire-hazard-potential>
- U.S. Environmental Protection Agency. (2003). Computer Aided Management of Emergency Operations (CAMEO). Available: <http://www.epa.gov/ceppo/comeo/>
- U.S. Geologic Survey. (2016). Earthquake Hazards Program. Available: <http://eqhazmaps.usgs.gov>

Vermont Agency of Transportation. (2015). Handbook for Local Officials. Montpelier, VT.

Vermont Center for Geographic Information. (2016). Available: <http://www.vcgi.org>

Vermont Center for Rural Studies. (2016). Available: <http://crs.uvm.edu>

Vermont Department of Environmental Conservation. (2001). Fluvial Geomorphology: A Foundation for Watershed Protection, Management and Restoration. Waterbury, VT.

Vermont Department of Environmental Conservation, Vermont Geologic Survey. (2004). HAZUS-MH Earthquake Reports for Franklin and Grand Isle Counties. Waterbury, VT.

Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. (2013). State of Vermont Hazard Mitigation Plan. Waterbury, VT.

Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. (2015). Repetitive Loss Properties. Waterbury, VT: State Hazard Mitigation Officer.

Vermont Department of Public Safety, Division of Emergency Management and Homeland Security. (2016). Tier II Reports and CAMEO database. Waterbury, VT: Hazardous Materials Compliance Officer.

Attachment H

Hazard Identification and Risk Assessment

Town of Bakersfield

Refer to Section 5 of this plan for a description of the risk characteristics used to classify each hazard .

Hazard	Impacted Area	Probability Of Occurrence	Consequence of Occurrence				Total
			Health & Safety	Property	Environment	Economic	
Flooding	2	5	0	1	1	3	35
Severe Winter Storm (Ice Storm)	3	5	0	1	1	2	35
Fluvial Erosion / Landslide	2	5	0	1	1	2	30
Structure Fire	0	5	1	1	0	3	25
High Winds	2	5	0	1	1	1	25
Thunderstorms / Lightning	1	5	0	1	0	0	10
Hail	1	5	0	1	1	1	20
Loss of Electrical Service	3	2	0	0	0	2	10
Drought	3	1	1	1	2	2	9
Major Fire –Wildland	1	2	0	1	1	1	8
Water & Septic Service Loss	2	1	0	1	2	2	7
Hazardous Materials (Fixed Site and Transport)	2	1	0	1	1	2	6
Tornado	1	1	0	1	1	2	5
Earthquake	1	1	1	1	1	2	6
Telecommunication Systems Failure	3	1	0	0	0	1	4
Civil Disturbance	1	1	0	0	0	1	2
Terrorism/WMD	1	1	1	0	0	2	4

Total Risk Rating

241

Frequency of Occurrence:

1. Rare: Unknown but likely to occur in the next 500 years
2. Unlikely: Unknown and unlikely to occur in the next 100 years
3. Possible: Likely to occur in the next 100 years
4. Likely: Likely to occur in the next 25 years
5. Highly Likely: Likely to occur once a year or more

Impact or % Community Impacted:

0. Negligible: < 10% of properties damaged.
1. Limited: 10% to < 25% of properties damages/Loss of essential facilities/services for up to 7 days/few (<1% of population) injuries possible.
2. Critical: 25% to 50% of properties damaged/Loss of essential facilities/services for > 7 days < 14 days/Major (< 10% of population) injuries/few deaths possible.
3. Catastrophic: > 50% of properties damaged/ loss of essential facilities/services for > 14 days/Severe (> 10% of population) injuries/multiple deaths possible.

Health & Safety Impacts:

0. No health and safety impact
1. Few injuries or illnesses
2. Few fatalities but many injuries or illnesses
3. Numerous fatalities

Property Damage:

0. No property damage
1. Few properties destroyed or damaged
2. Few destroyed but many damaged
3. Few damaged but many destroyed
4. Many properties destroyed and damaged

Environmental Damage:

0. Little or no environmental damage
1. Resources damaged with short term recovery practical
2. Resources damaged with long term recovery feasible
3. Resourced destroyed beyond recovery

Economic:

0. No economic disruption
1. Low direct and/or indirect costs
2. High direct and low indirect costs
3. Low direct and high indirect costs
4. High direct and high indirect costs