Multi-Hazard Mitigation Plan Update 2020

Town of Northwood, NH

Expiration of Current Plan: July 26, 2025
Updated 2020
Submitted to the New Hampshire Homeland Security & Emergency Management
By the
Town of Northwood, NH
with Strafford Regional Planning Commission

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The following organizations have contributed invaluable assistance and support for this project:
The Northwood Multi-Hazard Mitigation Committee
New Hampshire Homeland Security Emergency Management (HSEM)
Town of Northwood

The 2020 Town of Northwood Multi-Hazard Mitigation Planning Committee

15 people have attended meetings and/or been instrumental in completing this plan:

Bob Young	Northwood Emergency Management Director
Heather Thibodeau	Northwood Town Administrator
Glen Drolet	Northwood Police Chief
Mark Tetreault	Northwood Fire Chief
Peter Elliott	Northwood Highway Department
Linda Smith	Northwood Land Use Department
Shane Wells	Northwood Police Lieutenant
Greg LeBlanc	Northwood Deputy Fire Chief
Betsy Colburn	Northwood Fire, School, Town Historian
Scott Bryer	Northwood Board of Selectmen
Bob Strobel	Northwood Planning Board
Lee Baldwin	Northwood Planning Board
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Executive Summary

This Plan was revised and updated to meet statutory requirements and to assist the Town of Northwood in reducing and mitigating future losses from natural and man-made hazardous events. An initial edition of this Plan was developed and presented to FEMA in 2005. The plan was revised in 2014 and was updated in 2019-2020 to reflect the most recent information obtained through the evolution of the hazard mitigation program at the State. This update was developed by Strafford Regional Planning Commission (SRPC) and participants from the Multi-Hazard Mitigation Planning Committee, which was made up by Bob Young, Emergency Management Director; Heather Thibodeau, Town Administrator; Glen Drolet, Police Chief; Mark Tetreault, Fire Chief; Peter Elliott, Highway Department; Linda Smith, Land Use Department; Shane Wells, Police Lieutenant; Greg LeBlanc, Deputy Fire Chief; Betsy Colburn, Fire, School, Town Historian; Scott Bryer, Board of Selectmen; Bob Strobel, Planning Board; Lee Baldwin, Planning Board; Wini Young, Conservation Commission; Shelley Frost, Conservation Commission; Kayla Henderson, State Hazard Mitigation Planner, HSEM.

The Plan references historical events, as well as identifies specific vulnerabilities that are likely to impact the town. Overall vulnerability to hazards includes:

High Vulnerability	**Moderate Vulnerability**	**Low Vulnerability**
Flooding (Including Dam Breach)	Large Crowd Events	Earhquake, Landslide, & Subsidence
Large Fires (Wildfire and Urban Fire)	Extreme Heat & Drought	Geomagnetic & Electromagnetic Events
Severe Winter Weather		
Severe Windstorms (Tornados, Thunderstorms, Downbursts & Hurricanes)		
Public Health Threats		
Hazardous Materials		
Cyber Security		

A description of each hazard and the extent, past events and impacts, potential future impacts to the community, and potential loss estimates associated with each hazard was included in the plan. As part of this analysis, the planning team reviewed past and existing mitigation strategies and made updates for improvement. Lastly, the planning team developed a series of new mitigation actions to be completed over the course of this plan's five-year cycle. Each mitigation action was prioritized using the STAPLEE Method and responsibilities for implementation were identified. This plan provides an updated list of Critical Infrastructure and Key Resources (CI/KR) categorized as follows: Emergency Response Facilities (ERF), Non-Emergency Response Facilities (NERF), Facilities and Populations to Protect (FPP), Water Resources (WR), and Potential Resources (PR). All critical assets were inventoried and mapped.

The revision process included reviewing hazard mitigation plans from other municipalities, technical manuals, federal and state laws, the State Hazard Mitigation Plan, research data, and other available mitigation documents from multiple sources. Combining elements from these sources, the Planning Team was able to produce this integrated multi-hazard plan and recognizes that such a plan must be considered a work in progress.

The Town of Northwood received conditional approval on February 20, 2020. The plan was adopted by the Select Board on March 31, 2020 after consultation with Town leadership. The Plan received formal approval from FEMA on July 27, 2020

In addition to periodic reviews there are three specific situations which require a formal review of the plan. The plan will be reviewed:

- Annually to assess whether the existing and suggested mitigation strategies have been successful and remain current in light of any changes in federal state and local regulations and statutes. This review will address the Plan's effectiveness, accuracy and completeness in regard to the implementation strategy. The review will address any recommended improvements to the Plan, and address any weaknesses identified that the Plan did not adequately address.
- Every five years. The Plan will be revised and updated using the same criteria outlined above. At that time, it is expected to be thoroughly reviewed and updated as necessary. The public will be allowed and encouraged to participate in that five-year revision process.
- After any declared emergency event, the EMD shall review the plan using the same criteria outlined above.
- If the Town adopts any major modifications to its land use planning documents, the jurisdiction will conduct a Plan review and make changes as applicable.

Chapter 1: Multi-Hazard Mitigation Planning Process

Authority

Northwood's Multi-Hazard Mitigation Plan was prepared pursuant to Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Act), herein enacted by Section 104 of the Disaster Mitigation Act of 2000 (DMA) (P.L. 106-390). This Act provides new and revitalized approaches to mitigation planning. Section 322 of DMA 2000 emphasizes the need for state, local and tribal entities to closely coordinate mitigation planning and implementation efforts. This revised multi-hazard plan will be referred to as the "Plan." Northwood's Plan has been prepared by the Multi-Hazard Mitigation Committee (the Committee) with the assistance and professional services of Strafford Regional Planning Commission (SRPC) under contract with New Hampshire Homeland Security Emergency Management (HSEM) operating under the guidance of Section 206.405 of 44 CFR Chapter 1 (10-1-2010 Edition). This plan is funded, in part, by HSEM through grants from FEMA (Federal Emergency Management Agency). Funds from town dues and matching funds for Committee member's time are also part of the funding formula.

Purpose and History

The ultimate purpose of Disaster Mitigation Act of 2000 (DMA) is to:

> *Establish a national disaster hazard mitigation program –*
>
> *To reduce the loss of life and property, human suffering, economic disruption and disaster assistance costs resulting from natural disasters; and*
>
> *To provide a source of pre-disaster hazard mitigation funding that will assist States and local governments (including Indian tribes) in implementing effective hazard mitigation measures that are designed to ensure the continued functionality of critical services and facilities after a natural disaster.*

DMA 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act by, among other things, adding a new section "322 – Mitigation Planning" which states:

> *As a condition of a receipt of an increased Federal share for hazard mitigation measures under subsection (e), a State, local, or tribal government shall develop and submit for approval to the President a mitigation plan that outlines processes for identifying the natural hazards, risks, and vulnerabilities of the area under the jurisdiction of the government.*

HSEM's goal is for all New Hampshire communities to complete a local multi-hazard plan as a means to reduce future losses from natural and man-made events before, during, or after they occur. HSEM has outlined a process whereby communities throughout the state may become eligible for grants and other assistance upon completion of this multi-hazard plan. The state's regional planning commissions are charged with providing assistance to selected communities to help develop local plans.

Northwood's Multi-Hazard Mitigation Plan is a planning tool for reducing future losses from natural and man-made disasters as required by the Disaster Mitigation Act of 2000.

The DMA places new emphasis on local mitigation planning. It requires local a local jurisdiction to prepare and adopt a FEMA approved jurisdiction-wide Hazard Mitigation Plan as a condition for receiving Hazard Mitigation Assistance (HMA) project grants and other grants every five years. In addition to updating their plans every five years to continue program eligibility, local governments should review the plan yearly.

Scope of the Plan

This Plan addresses only one jurisdiction: the Town of Northwood, NH. The Plan addresses 14 types of natural and man-made hazards that may affect the Town:

- 6 hazards rated as having a **High** overall risk in Northwood:
  - Tornado/Downburst
  - Severe Winter Weather
  - Earthquake/Landslide
  - Public Health Threats
  - Cyber Security
  - Solar Storms

- 6 hazards rated as having a **Moderate** overall risk in Northwood:
  - Flooding (Including Dam Breach)
  - Hurricanes and Tropical Storms
  - Severe Thunderstorms
  - Wildfire
  - Drought
  - Hazardous Materials/Human Induced Events

- 2 hazards rated as having a **Low** overall risk in Northwood:
  - Extreme Temperatures
  - Extended Power Outages

It describes each hazard and identifies past occurrences of hazard events and assesses probability of future hazard events in the Town. The Plan assesses the vulnerability of key infrastructure and critical facilities; existing residential buildings and other structures within Northwood; and future development. The Plan also addresses the administrative, technical, and physical capacity of emergency response services and response coordination between federal, state, and local entities.

Multi-Hazard Mitigation Goals

The Town's multi-hazard goals are based on the State of New Hampshire Multi-Hazard Mitigation Plan (2013) goals and include:

- Ensure the protection of the general population, citizens and guests of Northwood, New Hampshire, before during and after a hazard.
- Protect existing properties and structures through mitigation activities.
- Provide resources to residents of Northwood, when needed, to become more resilient to hazards that impact the town's critical support services, critical facilities, infrastructure, economy, environment, historical & cultural treasures and private property.
- Support the Presidential Policy Directive (PPD-8) through prevention, mitigation, preparedness, response, and recovery actions.
- Work regionally to identify, introduce, and implement cost effective hazard mitigation measures in order to accomplish the town's goals.

- Develop and implement programs to promote hazard mitigation to protect infrastructure throughout the town to reduce liability with respect to natural and human-caused hazards generally.
- Address the challenges posed by climate change as they pertain to increasing risks in the town's infrastructure and natural environment.

Multi-Hazard Mitigation Planning Process

Overview

The Plan was developed and updated with substantial local, state, and federal coordination. The completion of this new multi-hazard plan required significant planning preparation and represents the collaborative efforts of the Town of Northwood, an ad-hoc local Multi-Hazard Mitigation Planning Committee, and SRPC. The Committee followed an established ten step multi-hazard mitigation planning process (see box, right). The Committee met 4 times over a 4-month period to discuss the range of hazards included in this plan as well as brainstorm mitigation needs and strategies to address these hazards and their impacts on people, business, and infrastructure in the Town. All meetings were geared to accommodate brainstorming, open discussion, and an increased awareness of potential threats to the Town. This process results in significant cross talk regarding all types of natural and man-made hazards.

Ten Step Multi-Hazard Mitigation Planning Process

1. Establish and Orient a Hazard Mitigation Planning Committee
2. Identify Past and Potential Hazards
3. Identify of Hazards and Critical Facilities
4. Assess Vulnerability – Estimating Potential Losses
5. Analyze Development Trends
6. Identify Existing Mitigation Strategies and Proposed Improvements
7. Develop Specific Mitigation Measures
8. Prioritize Mitigation Measures
9. Prepare Mitigation Action Plan
10. Adopt and Implement the Plan

Public Involvement

Public involvement is an important part of the planning process. A local Multi-Hazard Mitigation Planning Committee (the Committee) was formed to guide and oversee the development of this Plan. Representatives from all Town departments were recruited to participate on the Committee, Community officials were encouraged to contact as many people as they could to participate in the planning process. Members of the public and other stakeholders from neighboring communities were also informed of and encouraged to attend the Committee's meetings. Feedback from the Committee was incorporated throughout the plan; no feedback was received from the general public.

To build awareness of the Plan and opportunity to be involved, a public notice, stressing the public nature of the process, was posted on the Town's website in advance of each Committee meeting. The Committee met 4 times between March 14, 2019 and June 27, 2019. A public notice was also posted on Strafford Regional Planning Commission's website, and information about the Plan was included in SRPC's news updates in order to ensure that adjacent communities were aware of Northwood's committee meetings and had the opportunity to attend.

Adoption and Integration

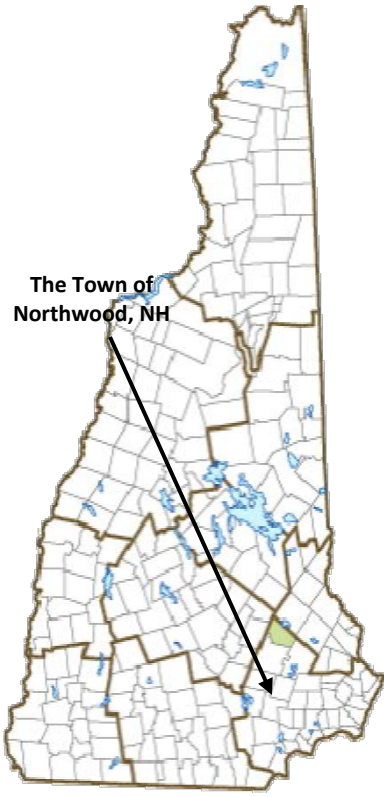
Once approved by the Planning Committee, the Plan will be forwarded to HSEM and FEMA for Conditional Approval. Upon review and conditional approval by HSEM and FEMA, the Administration will consider leadership and public comments and must promulgate a signed Resolution to Adopt the Plan.

Elements of the Plan will be incorporated into other planning processes and documents, such as the Town's Master Plan, Capital Improvement Plan, and Emergency Operations Plan. The Town will refer to this Multi-Hazard Mitigation Plan, as appropriate, in other documents.

Chapter 2: Community Profile

A. Introduction

Northwood, a small town in southeastern New Hampshire, was founded in 1773 when its first settlers successfully petitioned the Governor's Council requesting separation from Nottingham. Since this section of Nottingham had been known as the great north woods, the newly formed town was called Northwood. The Town of Northwood is in southeastern NH within Rockingham County. The towns bordering Northwood are: Strafford to the north, Deerfield to the south, Nottingham to the east, Epsom and Pittsfield to the west. Northwood contains 28.1 square miles of land area and 2.1 square miles of inland water.



Northwood has only experienced minor natural hazards in the past; however, there is always the potential for natural hazards to occur, especially snow and ice storms and flooding due to the geographic area of Northwood, as well as wildfires since Northwood contains a large amount of forest area.

Incorporated: 1773

Origin: This territory was first settled in 1763, and known as the North Woods, a parish of Nottingham. It was incorporated as a separate town upon agreement with Nottingham in 1773. In 1791, the General Court of New Hampshire authorized a committee to survey and lay out a road between Durham and Concord, which became the First New Hampshire Turnpike. The road runs the length of Northwood, and the town's many taverns accommodated travelers. At one time, there were some 12 sawmills in the town, five of which were replaced by shoe factories.

Villages and Place Names: Northwood Center, Northwood Narrows, Northwood Ridge

Population, Year of the First Census Taken: 744 residents in 1790

Population Trends: Population change for Northwood totaled 3,207 over 50 years, from 1,034 in 1960 to 4,241 in 2010. The largest decennial percent change was 47 percent between 1960 to 1970, followed by increases of 43 and 44 percent over the next two decades. The 2010 Census estimate for Northwood was 4,241 residents, which ranked 90th among New Hampshire's incorporated cities and towns.

Population Density and Land Area, 2008 (*NH Office of Energy & Planning*): 151.2 persons per square mile of land area. Northwood contains 28.1 square miles of land area and 2.0 square miles of inland water area.

B. Northwood's History & Past Development Trends

A Brief History of Northwood

Written by the Northwood Cookbook Committee

Northwood, a small town in southeastern New Hampshire, was founded in 1773 when its first settlers successfully petitioned the Governor's Council requesting separation from Nottingham. Since this section of Nottingham had been known as the great north woods, the newly formed town was called Northwood.

The First New Hampshire Turnpike was built about 1800 to connect Portsmouth, New Hampshire's only seaport, with the state capitol, Concord; it runs the length of Northwood. Also called Route Four, the highway has been a major influence on the town since it was constructed. Throughout the nineteenth century, our many early taverns accommodated sledge and stage passengers. In this century travelers with speedier vehicles have enjoyed our summer boarding houses, overnight cabins, motels and restaurants. Other visitors, not seeking food or sleep, go antiquing in the dozens of shops along the road.

Though thousands of motorists each day see our town only as they hurry along our eight-mile "main street," some call it home. About 3,200 persons are full-time residents and about twice as many have second homes here. Though Northwood is sometimes called a bedroom community, there are more than one hundred small businesses in town, employing from one to twenty-five workers each.

Northwood is proud of its nine lakes and ponds, its mountain views, miles of country roads, and its many lovely old homes and public buildings.

Northwood is lightly developed. Most of the developed land is of residential nature, with only scattered commercial and public uses. The residential uses are predominantly single-family detached homes. In general, the pattern of developed uses is so dispersed that it requires driving to get around, except perhaps for the relatively few people living in the Town center. Commuting out of town to work is also clearly a necessity for the majority of people given the relatively small number of commercial land uses in Northwood. Town Hall is at the center with Police at western extreme. The Elementary School is at the Ridge, two miles to the East. Coe-Brown is at the Center as is the Town Recycling and Public Works as well as Northwood Meadow State Park. The Library is at the East end of town. The remainder of Town is not densely settled, and maintains a comfortable rural scale. Remaining development naturally follows along the road network. The dispersed nature of roads, however, has kept density low. There is no municipal water or sewer, and the Town controls density based on the ability of soils to provide for sanitary water supply and sewage disposal. A ring of homes and camps surrounds Northwood and Harvey Lakes. Similar, though somewhat less extensive, development has occurred at most of the other larger ponds in Northwood.

Northwood contains many wetland areas. Major wetlands in Northwood include Betty Meadows, Northwood Narrows area, and Northwood Center. Many of the wetlands in Northwood are also floodplains. Major floodplains are located along Kelsey Brook, Narrows Brook, Tucker Brook and North Lucas Pond.

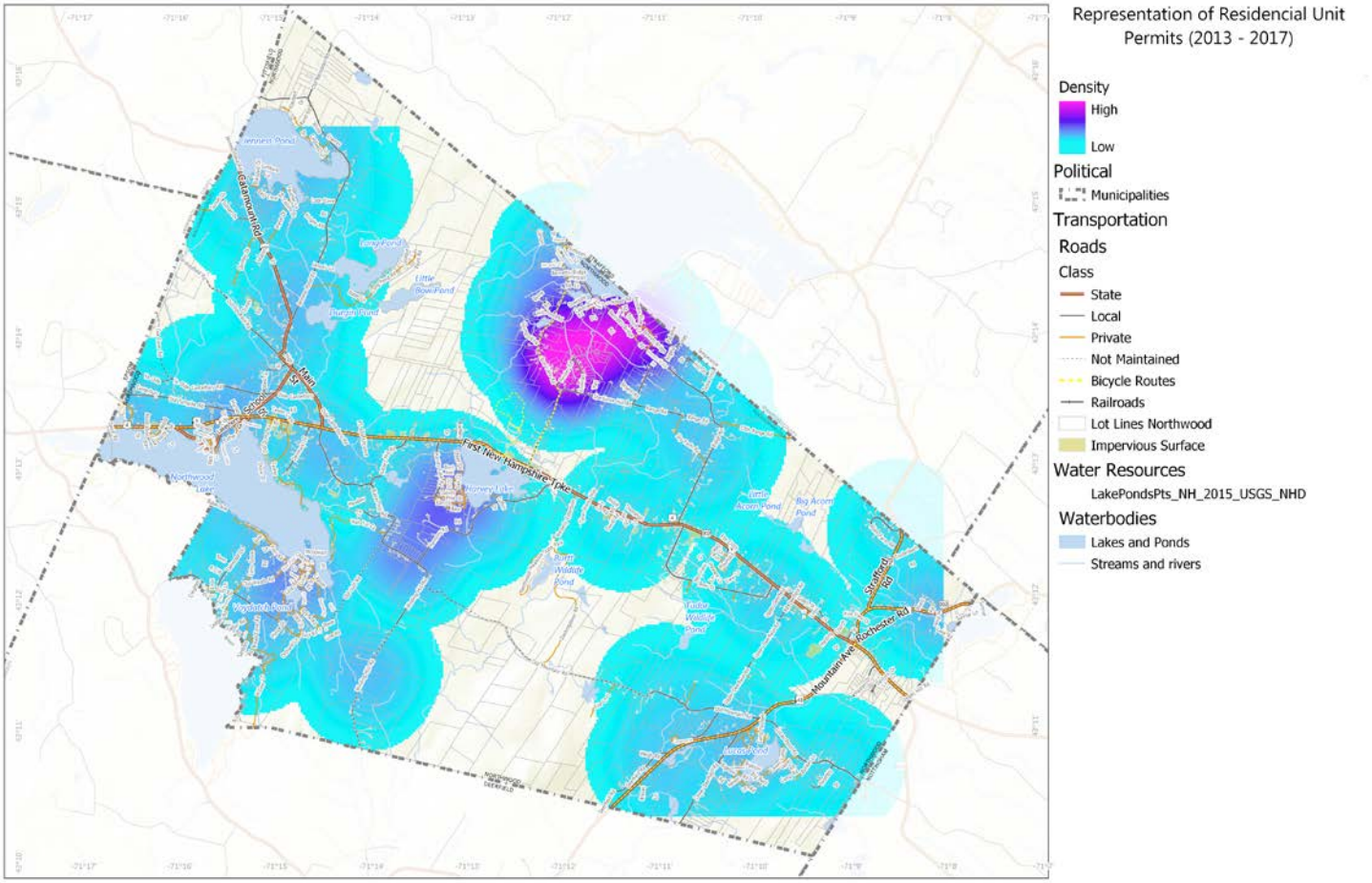
Northwood updated its Master Plan in 2004, which includes future land use planning based on the principles of smart growth, suggested enacting zoning controls which encouraged new housing units and community oriented businesses to be located in or near the villages of East Northwood, the Ridge and Northwood Narrows. A land build out analysis was completed in 2006 to assist the Town in planning. The Planning Board continues to consider implementation strategies for future land use to achieve those planning principles.

Since this plan was last updated in 2014, building permit data collected by SRPC shows a total of 90 building permits were issued for new buildings, all of which were for residential structures. While various businesses along route 4 have renovated, expanded, or changed uses during this time, only construction of an entirely new structure is captured by this data source. Similarly, Northwood has seen many existing waterfront cabins converted from seasonal camps to year-round residential use. This conversion is typically classified as a renovation and is not captured in this data.

Building Permits Issued, 2013-2017

Building Type	2013	2014	2015	2016	2017	Total
Manufactured Home	0	1	2	3	1	7
Single Unit Residential	14	6	18	23	22	83
Yearly Total	**14**	**7**	**20**	**26**	**23**	**90**

These structures are mostly concentrated near Bow Lake, with smaller concentrations near Harvey Lake and other lakes and great ponds.



C. Future Development Trends

Excerpts taken from the 2004 Master Plan: Northwood, NH.

At the 2004 Master Plan Visioning Workshop four concerns with regard to future land use emerged as most important to Northwood residents:

1. Maintain rural character;
2. Protect and preserve natural resources;
3. Provide recreational opportunities; and
4. Achieve a balance between residential development and economic development.

The major issue surrounding future land use is achieving a reasonable balance between Northwood's traditional rural character and future development, while understanding the need to allow for growth of the community.

According to the Smart Growth New Hampshire Steering Committee, there are eight principles that summarize the land use issues facing rural New Hampshire Towns.

1. Maintain traditional compact settlement patterns to efficiently use land resources and investment in infrastructure.
2. Foster the traditional character of New Hampshire downtowns, villages, and neighborhoods by encouraging development that is comfortable for pedestrians and conducive to community life.
3. Incorporate a mix of uses to provide a variety of housing, employment, shopping, services, and social opportunities for all members of the community.
4. Provide choices and safety in transportation to create livable, walkable communities that increase accessibility for people of all ages.
5. Preserve New Hampshire's working landscape by sustaining farm and forestland and other rural land to maintain contiguous tracts of open land and minimize land use conflicts.
6. Protect environmental quality by minimizing impact from people and maintaining natural areas that contribute to the health and quality of life in New Hampshire.
7. Involve the community in planning and implementing to ensure that the development retains and enhances sense of place, traditions, goals, and values of the local community.
8. Manage growth locally, but work with neighboring towns to address common goal and common problems more effectively.

These elements have been reinforced in a variety of ways, either through official Town policy or via the practical realities of developing in Northwood. Northwood's Conservation Overlay District places limits the types of uses and development that can occur in some of the remotest areas of town to agricultural uses, natural resource extraction, and small-scale residential development. RSA 674:41, which requires special permissions for building on a class VI or private road, has also limited the scale of development in outlying areas, as many rural roads are not actively maintained by the Town. The Wetland Conservation Overlay Distict, Steep Slopes Protection Overlay District, and state shoreland protections also restrict development in particularly sensitive areas. Furthermore, Northwood does not provide Town water or sewer, meaning most development must have enough land to accommodate onsite wells and/or septic.

Conclusion

Northwood has seen a fair amount of growth and development since the last update to this plan. Northwood retains a significant amount of undeveloped land, and the most intense development in town is largely confined to Route 4, both as a result of Town policy and practicality. New development is subject to the most recent building and zoning regulations, making it safer and less susceptible to damage. However, the desirability of waterfront property has led to concentrations of residential development in some outlying areas near Northwood's many surface waterbodies. Northwood's long history means that many parcels in this area are smaller than would be permitted today, further concentrating these developments. While the community's overall vulnerability to potential hazards is largely unchanged, some of these specific areas may be more vulnerable to hazards than they have in the past.

Chapter 3: Asset Inventory

Critical Facilities and Key Resources

This chapter includes Critical Facilities and Key Resources (CF/KR) within the Town of Northwood that were identified by the Committee during the update of this plan.

FEMA describes the term 'critical facilities' as all manmade structures or other improvements that, because of their function, size, service area, or uniqueness, have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if they are destroyed, damaged, or if their functionality is impaired.[1] These facilities include all public and private facilities that a community considers essential for the delivery of vital services for the protection of the community, such as emergency operations centers, shelters, or utilities. [1]

"Critical facilities, and the functions they perform, are the most significant components of the system that protects the health, safety, and well-being of communities at risk."

-FEMA Critical Facility Design Considerations

Critical Facilities in Northwood are broken into the following categories:

- Emergency Response Facilities: Primary facilities and resources that may be needed during an emergency response.
- Non-Emergency Response Facilities: Facilities that are essential for the everyday operation of Northwood that, although critical, are not typically necessary for an immediate emergency response effort.
- Facilities and Populations to protect: Facilities that need to be protected because of their importance to the Town and to residents who may need help during a hazard event.
- Potential Resources: Facilities that may be helpful for emergency response, cleanup, or recovery.
- Water Resources: Potential sources of water for firefighting

Table 3.1 includes a list of Critical Facilities and Key Resources (CF/KR), including the type of facility or building. Maps 3.1-3.3 display the location of critical facilities.

Table 3.1 Critical Facilities and Key Resources

Emergency Response Facilities (ERF)		
Facility Name	*Type of Facility*	*Address*
Ridge Fire Station (EOC)	Emergency Operations Center	499 First NH Turnpike,
Town Hall	Back-up EOC/Warming Station	818 First NH Turnpike
Police Station	Back-up EOC	1020 First NH Turnpike
Narrow's Fire Station	Back-up EOC	85 Main Street, Northwood, NH
Coe Brown Academy	Point of Dispensing (POD)	907 First NH Turnpike
Elementary School	Emergency Shelter	511 First NH Turnpike
Highway Department	Public Works Facility	23 Town Works Way
Non-Emergency Response Facilities (NERF)		
Facility Name	*Type of Facility*	*Address*
Power Substation	Power Station	Route 107/Jenness Pond Rd

[1] https://www.fema.gov/media-library-data/20130726-1557-20490-2839/fema543_chapter1.pdf

Power Substation	Power Station	Routes 202/202A
East End Fire Station	Storage Facility	197 First NH Turnpike,
Transfer Station	Recycling/Disposal of Waste	1 Town Works Way

Facilities and Populations to Protect (FPP)		
Facility Name	Type of Facility	Address
Schools, Churches, Licensed Child Care Programs, Licensed Home Providers, & Assisted Living		
Northwood Elementary	School	511 First NH Turnpike
Coe Brown Academy	School	907 First NH Turnpike
Champions Before- and After-School	After-School Program	511 First NH Turnpike
Free Will Baptist Church	Religious Facility (Closed)	First NH Turnpike
St. Joseph's Catholic Church	Religious Facility	First NH Turnpike
Advent Christian Church	Religious Facility	113 School Street
Northwood Congregational Church	Religious Facility	881 First NH Turnpike
Magical Moments Daycare	Licensed Child Care Programs	97 Ridge Road
Path of Discovery Child Care	Licensed Child Care Programs	142 Mountain Avenue
Southern NH Services and Meadows of Northwood	Assisted Living	243 Bow Street
Historic Facilities		
Brookside School	Historic Facility	Northwood Narrows
Bennetts Bridge	Historic Facility	Bennett Bridge Road
Town Hall Complex	Historic Facility	818 First NH Turnpike
Historical Society Museum/Bryant Library	Historic Facility	School Street
Community Hall	Historic Facility	135 Main Street
Old Post Office	Historic Facility	School Street
Masonic Hall	Historic Facility	158 First NH Turnpike
Manufactured Housing		
Mountain View Mobile Home	Manufactured Housing	Mountain View Lane
Tower View Mobile Home	Manufactured Housing	17 Gary Road
Loon Cove Mobile Home	Manufactured Housing	Esther Lane

Commercial/Economic Impact Area		
Route 4 Corridor	Economic Impact Area	Route 4 (First NH Turnpike)
Recreational Facilities		
Mary Waldron Beach	Recreational Facility	416 Bow Lake Road
Northwood Beach	Recreational Facility	Lake Shore Drive
Lucas Pond Beach	Recreational Facility	Lucas Pond Road
Bennetts Beach	Recreational Facility	Bennett Bridge Road
Camp Yavneh	Recreational Facility	18 Lucas Pond Road
Camp Wahtutca	Recreational Facility	Blakes Hill Road
Northwood Meadows Park	Recreational Facility	First NH Turnpike
Town Fields	Recreational Facility	Route 4
Hazardous Material Facility		
Harding Metals	Hazardous Materials Facility	Harding Drive
Transfer Station	Recycling/Disposal of Waste	1 Town Works Way

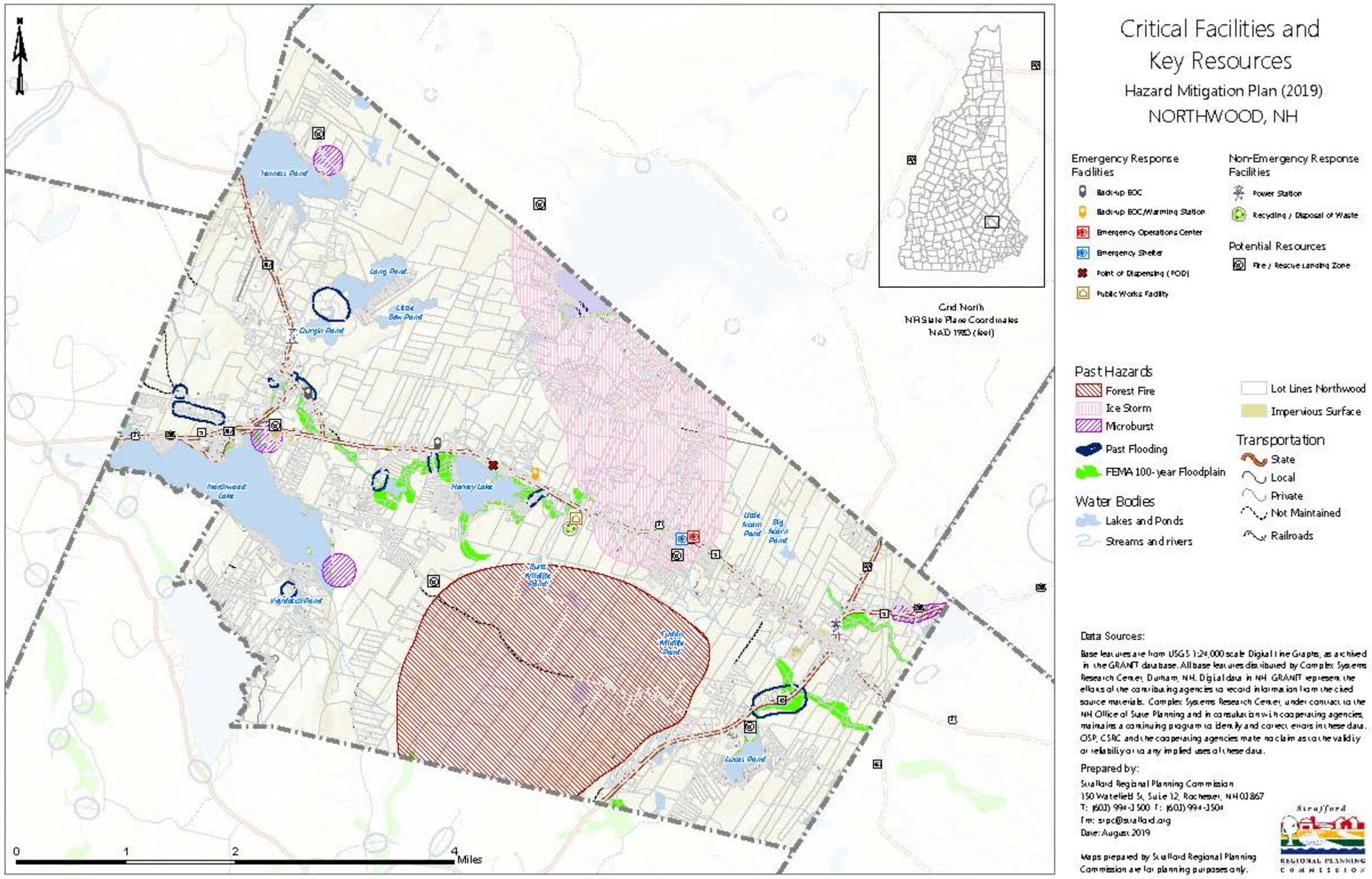
Potential Resources (PR)		
Facility Name	*Type of Facility*	
Airport/Helipad		
Johnson's Seafood & Steak	Fire/Rescue Landing Zone	907 First NH Turnpike
Wallmans Field	Fire/Rescue Landing Zone	18 Winding Hill Road
Northwood Elementary School	Fire/Rescue Landing Zone	511 First NH Turnpike
Camp Yavneh	Fire/Rescue Landing Zone	18 Lucas Pond Road
Briggs Field	Fire/Rescue Landing Zone	454 Jenness Pond Road
Grants Field	Fire/Rescue Landing Zone	

Water Resources (WR)		
Facility Name	*Type of Facility*	
Dry Hydrant	Dry Hydrant	100 Green Street
Dry Hydrant	Dry Hydrant	50 Temperance Hill Drive
Dry Hydrant	Dry Hydrant	59 Bennett Bridge Road
Dry Hydrant	Dry Hydrant	430 Bow Lake Road
Dry Hydrant	Dry Hydrant	35 Bow Lake Road
Dry Hydrant	Dry Hydrant	893 1st NH Turnpike
Dry Hydrant	Dry Hydrant	280 Jenness Pond Road
Dry Hydrant*	Dry Hydrant	100 Catamount Road
Dry Hydrant	Dry Hydrant	160 Old Pittsfield Road
Dry Hydrant	Dry Hydrant	School Street
Dry Hydrant	Dry Hydrant	53 Cole Road
Dry Hydrant*	Dry Hydrant	26 Blakes Hill Road
Dry Hydrant	Dry Hydrant	740 1st NH Turnpike

Dry Hydrant	Dry Hydrant	27 Angela Drive
Cistern	Cistern	19 Davlynn Drive
Cistern	Cistern	49 Knowles Way
Cistern	Cistern	79 Oakwood Drive
Cistern	Cistern	5 Meadow Lane
Cistern	Cistern	617 1st NH Turnpike
*These dry hydrants are out of service as of May/June 2019 but are expected to be replaced for continued use. Other out of service hydrants have been removed from this list.		

Northwood Community Water Systems					
Name	No. of Service Connections	Total Served Population	Backup Power?	Available Storage Vol.	Comment
Village of Northwood Ridge Water District	55 + School FST	688	Yes - Propane	40,000 gal	
Village at Mead Field	13	20	Yes	6,000 gal	
The Meadow at Northwood	1	31	No	6,000 gal	Emergency Connection with Ridge System
Tower View Coop	22	55	Yes - Propane	6,000 gal	
Loon Estates	29	74	Yes	5000 gal	No ability to receive bulk water delivery during emergency
Northwood Mountain View MHP	59	148	No	14,000 gal	Emergency Connection with Ridge System
Coe-Brown Academy*	4	796	No	0 gal	
Source: NHDES 2019					
*This system is classified as a “Non-Transient, Non-Community” system but was added to this table at the Committee’s request					

Figure 3.1 Emergency Response Facilities, Non-Emergency Response Facilities, and Potential Resources



Critical Facilities and Key Resources

Hazard Mitigation Plan (2019)

NORTHWOOD, NH

Emergency Response Facilities

- Back-up EOC
- Back-up EOC/Warming Station
- Emergency Operations Center
- Emergency Shelter
- Point of Dispensing (POD)
- Public Works Facility

Non-Emergency Response Facilities

- Power Station
- Recycling / Disposal of Waste

Potential Resources

- Fire / Rescue Landing Zone

Past Hazards

- Forest Fire
- Ice Storm
- Microburst
- Past Flooding
- FEMA 100-year Floodplain

Water Bodies

- Lakes and Ponds
- Streams and rivers

- Lot Lines Northwood
- Impervious Surface

Transportation

- State
- Local
- Private
- Not Maintained
- Railroads

Data Sources:

Base features are from USGS 1:24,000 scale Digital Line Graphs, as archived in the GRANIT database. All base features distributed by Complex Systems Research Center, Durham, NH. Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center, under contract to the NH Office of State Planning and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OSP, CSRC and the cooperating agencies make no claim as to the validity or reliability or to any implied uses of these data.

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Date: August 2019

Maps prepared by Strafford Regional Planning Commission are for planning purposes only.

Strafford REGIONAL PLANNING COMMISSION

Figure 3.2 Facilities and Populations to Protect

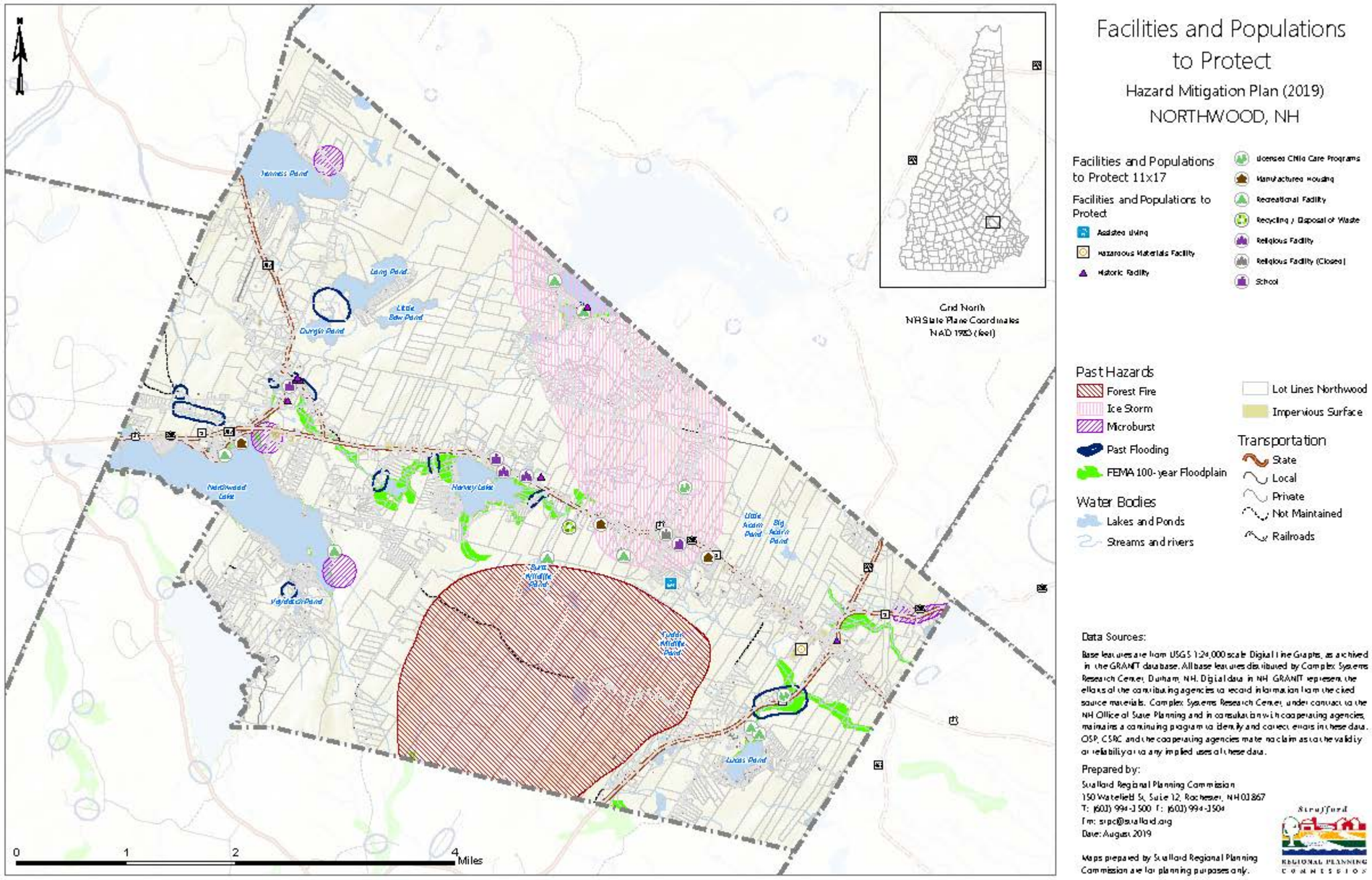
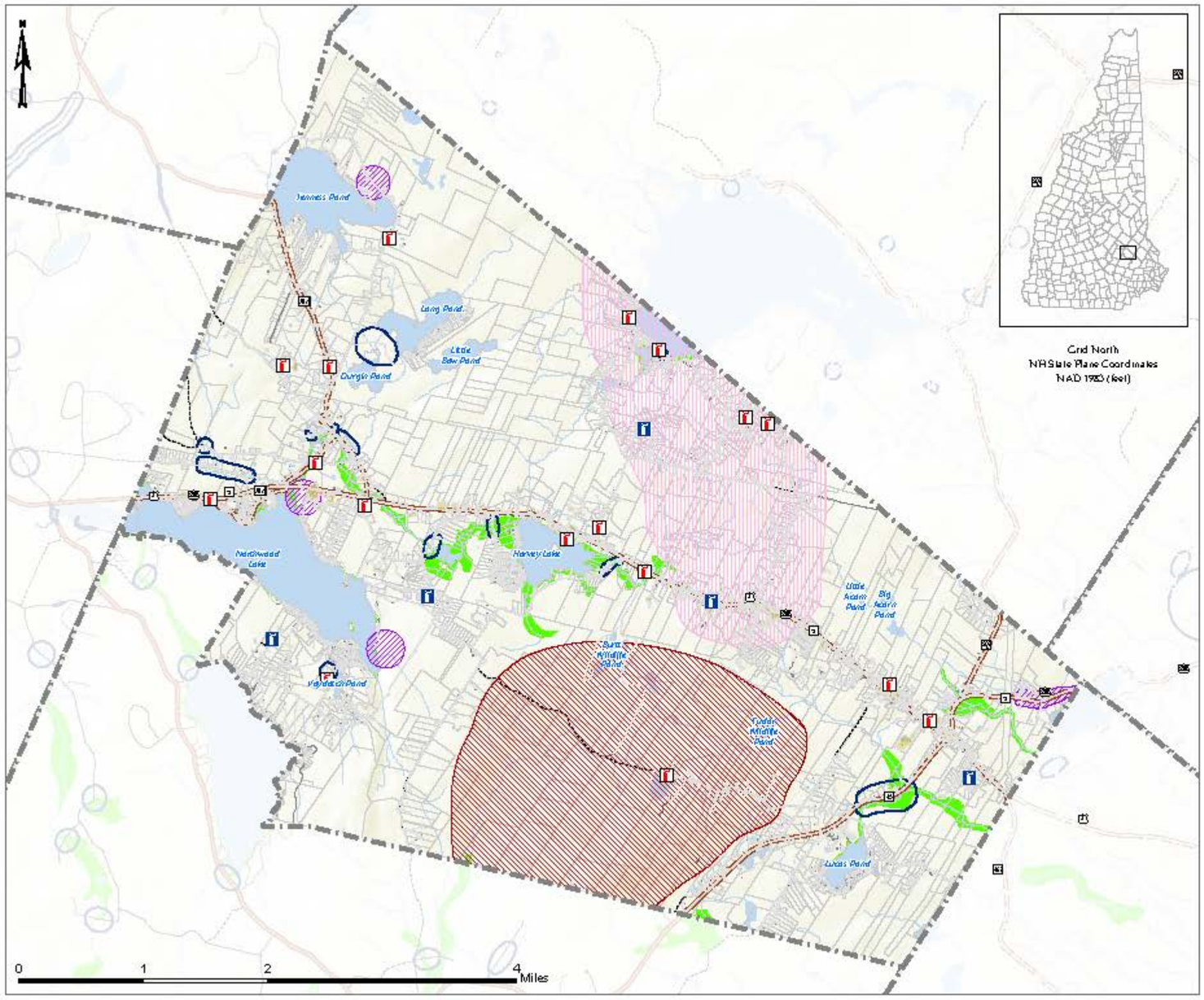


Figure 3.3 Water Resources



Water Resources

Hazard Mitigation Plan (2019)
NORTHWOOD, NH

Water Resources
- Auxiliary Fire Aid
- Cistern

Past Hazards
- Forest Fire
- Ice Storm
- Microburst
- Past Flooding
- FEMA 100-year Floodplain

Water Bodies
- Lakes and Ponds
- Streams and rivers

- Lot Lines Northwood
- Impervious Surface

Transportation
- State
- Local
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Table 3.2 Bridges

Bridge ID	Location
#043/096	US4, US202, NH9 over Narrows Brook
#045/099**	NH107 over Narrows Brook
#045/100 (15 Tons)	Old Canterbury Road over Narrows Brook
#086/090	US4, US202, NH9 over Pedestrian Underpass
#095/113*	Bow Lake Road over Sherburne Brook
#102/081	US4, US202, NH9 over Tucker Brook
#142/046	NH43 over Trout Brook
#153/061	US202, NH9 over Brook
Bennetts Bridge	Bennett Bridge Road over Bow Lake

*Municipal Red List **State Red List

Table 3.3 Dams and Hazard Class

Hazard Class	Name	River or Stream
Low Hazard Structure	Pleasant Lake Dam (Deerfield)	TR Little Suncook River
Low Hazard Structure	North River Pond Dam (Nottingham)	North River
Low Hazard Structure	Sauls Pond	Unnamed Stream
Low Hazard Structure	Dole Marsh Dam	Unnamed Stream
Low Hazard Structure	Meadow Lake Dam	Lamprey River
Significant Hazard Structure	Gulch Mountain Pond Dam	TR Northwood Lake

Table 3.4 Dams in Northwood by Classification

Dam Classification	Classification Definition	Number of Dams in Northwood	Inspection Interval (Years)
High	Dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life.	1	2
Significant	Dam that has a significant hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no probable loss of lives but major economic loss to structures or property.	5	4
Low	Dam that has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life and low economic loss to structures/property.	5	6
Non-Menace	Dam that is not a menace because it is in a location and of a size that failure or misoperation of the dam would not result in probable loss of life or loss to property.	17	6

Vulnerable Structures and Potential Loss

Critical Facilities/Key Resources and Other Assets

It is important to identify the critical facilities and other structures that are most likely to be damaged by hazards. Table 3.2 lists CF/KRs, bridges, and dams that are located within past and potential hazard areas. The majority of these

structures are located within the 100-year floodplain or areas of past flooding, while one facility is located in an area that typically sees above-average negative impacts as a result of wind-related events.

Table 3.5

CF/KR and other Assets	Hazard	100% of Structure Value*
CF/KR		
Power Substation	Flooding - Located in 100 yr Floodplain	Value not available
Community Hall		$150,000
Northwood Lake Beach		N/A – land only
Woodman Park		N/A – land only
Town Fields		N/A – land only
Dry Hydrant - 59 Bennett Bridge Road		$4,000
Dry Hydrant - 59 Bennett Bridge Road	Flooding – Located in Past Flooding Area	$4,000
Dry Hydrant - 53 Cole Road		$4,000
Northwood Elementary School	Area at risk of, or previously impacted by, ice storms	$5,273,000
Ridge Fire Station		$154,500
Champions Before- and After-School		N/A – In Northwood Elementary
Free Will Baptist Church		$269,300
Magical Moments Daycare		$118,300
Path of Discovery Child Care		$58,200
Community Hall		$150,000
Old Post Office		$2,400
Tower View Mobile Home		$768,300
Mary Waldron Beach		N/A – land only
Bennetts Beach		N/A – land only
Dry Hydrant – 50 Temperance Hill Drive		$4,000
Dry Hydrant – 430 Bow Lake Road		$4,000
Dry Hydrant – 27 Angela Drive		$4,000
Cistern – 49 Knowles Way		$4,700
Cistern – 617 1st NH Turnpike		$4,700
Dry Hydrant – 303 Old Mountain Road	Area at risk of, or previously impacted by, large fires	$4,000
CF/KR Total		**$6,827,400**
Bridges*		
045/099 NH107 over Narrows Brook	Flooding – Located in 100 yr Floodplain	$246,000 (12.3’ x 20’ x $1,000)
045/100 Old Canterbury Road over Narrows Brook		$423,700 (19’ x 22.3’ x $1,000)
086/090 US4, US202, NH9 over Pedestrian Underpass		$200,000 (10’ x 20’ x $1,000)
102/081 US4, US202, NH9 over Tucker Brook		$642,600 (14’ x 45.9’ x $1,000)
142/046 NH43 over Trout Brook		$676,400 (19’ x 35.6’ x $1,000)
153/061 US202, NH9 over Unnamed Brook		$210,000 (10.5’ x 20 x $1,000)

Bennett Bridge Road over Bow Lake		$4,046,000 (238' x 17' x $1,000)
142/046 NH43 over Trout Brook	Flooding – Located in Past Flooding Area	$676,400 (19' x 35.6' x $1,000)
Bennett Bridge Road over Bow Lake		$4,046,000 (238' x 17' x $1,000)
095/113 Bow Lake Road over Sherburne Brook	Area at risk of, or previously impacted by, ice storms	$350,000 (14' x 25' x $1,000)
Bridges Total		**$6,794,700**
Dams		
Gulch Mountain Pond Dam	Flooding – Located in Past Flooding Area	The Dam Bureau at NHDES has looked into assessing values for state-owned dams with marginal success. They considered bond ratings, market value, and construction costs. They also developed a formula that calculated the cubic feet of water impounded as a monetary value. Because dams serve different purposes (recreational, hydro-power), assessed values are hard to estimate and cannot be determined.
Meadow Lake Dam	Area at risk of, or previously impacted by, large fires	
Total		**$13,622,100**
*The approximate assessed value for the bridges was calculated by multiplying $1,000.00 per square foot of bridge. This estimate was provided by the Bridge Design Bureau at NHDOT and includes all cost (engineering, consulting and in-house design, construction, etc.) to build a new bridge. Where no bridge width was available, square footage was calculated by multiplying the length of the bridge by 20 feet.		

In Northwood, 23 CF/KR, 8 bridges, and two dams were identified during the risk assessment as being located in potentially hazardous areas. The potential total loss of CF/KR and municipal bridges in at-risk locations is estimated at $13,622,100.

Buildings and Utilities

It is difficult to ascertain the amount of damage that could be caused by a natural or man-made hazard because the damage will depend on the hazard's extent and severity, making each hazard event somewhat unique. The assumption used here when calculating the damage to property is that a hazard may result in low (1% of structures damaged), medium (5% of structures damaged), or high (10% of structures damaged) economic loss depending on the nature of the hazard. Table 3.5 displays total assessed value and low, medium, and high economic loss.

Table 3.6

Local Assessed Valuation (2019)				
	Total Assessed Value (2019)	Economic Loss		
		Low (1%)	Medium (5%)	High (10%)
Buildings				
Residential	$216,554,376	$2,165,544	$10,827,719	$21,655,438
Manufactured Housing	$13,132,100	$131,321	$656,605	$1,313,210
Commercial Industrial	$44,768,600	$447,686	$2,238,430	$4,476,860
Total Buildings	**$267,778,801**	**$2,677,788**	**$13,722,754**	**$26,777,880**
Utilities				
Public Water	$0	$0	$0	$0
Electric	$6,697,300	$66,973	$334,865	$669,730
Other	0	0	0	0
Total Utilities	$6,697,300	$66,973	$334,865	$669,730
Net Valuation Buildings and Utilities	**$274,476,101**	**$2,744,761**	**$14,057,619**	**$27,447,610**

Source: NH Department of Revenue Administration. 2018 Annual Report. Assessed value does not include value of land or local exemptions. (https://www.revenue.nh.gov/publications/reports/documents/ar-2018.pdf)

The total local assessed value included in this analysis is $**274,476,101**, including **$267,778,801** for buildings and $6,697,300 for utilities. Based on this assumption, the potential loss from any of the identified hazards under a low, medium, and high damage scenario of buildings and utilities would range from **$0 to $2,744,761 (low)** or **$2,744,761 to $13,723,805 (moderate)** or **$13,723,805 to $27,447,610 (high)** based on the 2019 Northwood Town valuation.

In order to stay consistent, the Committee made the decision to use the results derived from the hazard vulnerability assessment tool (Table 5.1). There was consensus that the overall threat rankings (severity x probability) associated with each hazard were an equal indicator to the percentage of damage and were therefore used to determine the potential loss. Human loss of life was not included in the potential loss estimates, but could be expected to occur, depending on the severity and type of the hazard.

Chapter 4: National Flood Insurance Program

The NH Office of Strategic Initiatives (OSI) administers the National Flood Insurance Program (NFIP) in New Hampshire. The NFIP is a partnership between a community and the federal government. Communities that participate in the NFIP have adopted and enforce community floodplain regulations. One of the community's requirements is to require and obtain certain elevation data for all new and substantially improved structures located in a special flood hazard area. Community permitting officials must review this elevation data to ensure floodplain development complies with the regulations.[2]

Northwood National Flood Insurance Program (NFIP) Status & Compliance

Northwood has been a member of the National Flood Insurance Program (NFIP) since June 2003. The Town does have land in the 100-year floodplain along Bow and Pleasant Lakes, with more substantial floodplains around Northwood and Harvey lakes and their tributaries - Narrows, Kelsey, and Tucker Brooks. Lucas Pond and the perennial stream that feeds it also have floodplains in the eastern part of town. There are limited structures within this floodplain according to available GIS Flood Insurance Rate Map (FIRM) data and aerial imagery (2010). Northwood has no repetitive loss structures.

As noted in **Section X. Floodplain Management Ordinance**[3]:

> This ordinance, adopted pursuant to the authority of RSA 674:16, shall be known as the Town of Northwood Floodplain Management Ordinance. The regulations in this ordinance shall overlay and supplement the regulations in the Town of Northwood Zoning Ordinance, and shall be considered part of the Zoning Ordinance for purposes of administration and appeals under state law. If any provision of this ordinance differs or appears to conflict with any provision of the Zoning Ordinance or other ordinance or regulation, the provision imposing the greater restriction or more stringent standard shall be controlling.
>
> The following regulations in this ordinance shall apply to all lands designated as special flood hazard areas by the Federal Emergency Management Agency (FEMA) in its Flood Insurance Study for the County of Rockingham, NH", so titled as, and dated May 17, 2005 or as amended, together with the associated Flood Insurance Rate Maps, so titled as, and dated May 17, 2005 or as amended, which are declared to be a part of this ordinance and are hereby incorporated by reference. (Rev. 3/05)

The Town has worked with elected officials and FEMA to correct existing compliance issues. Northwood has continued communication with FEMA to discuss NFIP compliance issues and continues to monitor designated flood areas throughout the town. The Town continues to evaluate their floodplain management ordinance and will look to improve floodplain management in the community as needed. As of this update, FEMA is in the process of revising FIRM maps for the Piscataqua-Salmon Falls watershed, with preliminary maps expected to be released in 2020. The Town will need to

[2] https://www.nh.gov/oep/planning/programs/fmp/documents/fs-2-elevation-certificate.pdf

[3] Northwood Development Ordinance as amended March 13, 2018

update its zoning ordinance to refer to the new maps, once released, and should consider revising its floodplain management ordinance for consistency with the latest model ordinance, released by OSI in 2018.

Table 4.1 Northwood Insurance Zone Policies (Source: FEMA Community Information System)

Zone	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses	Adjustment Expense
A01-30 & AE Zones	0	$0	$0	0	$0.00	$0.00
A Zones	8	$19,159	$1,258,600	0	$0.00	$0.00
B, C & X Zone – Standard	0	$0	$0	0	$0.00	$0.00
B, C & X Zone – Preferred	6	$2,032	$1,560,000	1	$10,869.93	$750.00
Total	**15**	**$21,191**	**$2,818,600**	**1**	**$10,869.93**	**$750.00**

Chapter 5: Hazards & Mitigation Strategies

Overview

This section describes the location and extent of hazards that could impact the Town of Northwood, presents past hazard events in the town or elsewhere in New Hampshire, and discusses their rank order placement. The Multi-Hazard Mitigation Planning Committee investigated past and potential hazards using a variety of sources and techniques, including but not necessarily limited to interviewing town historians and other citizens; researching historical records; scanning old newspapers; reading published histories; consulting various hazard experts; and extracting data from the NH Hazard Mitigation Plan and other state and federal databases. Past and potential hazards were mapped where spatial data was available.

Rating Probability, Severity, and Overall Risk of Future Disasters

The nature of each hazard type and the quality and availability of corresponding data made the evaluation of hazard potential difficult. The Multi-Hazard Planning Committee considered what data was at hand and used its collective experience to formulate statements of impact or potential. Each hazard type was rated using a hazard vulnerability assessment tool (refer to Table 5.1). This tool estimates the probability of occurrence, severity, and overall risk of an event using a projected number system answering questions, which answer High (3), Moderate (2), and Low (1). A zero (0) score meant that there is no likelihood the hazard would impact the Town in the next 25 years. The ranges established for the average to determine severity were:

- **High** = 4 or higher
- **Moderate** = 2-3
- **Low** = 1 or below

The overall risk is a numeric indication developed by multiplying the total numbers of the probability and the severity.

Probability of Occurrence

Probability is based on a limited objective appraisal of a hazard's probability using information provided by relevant sources, observations and trends. The Planning Committee discussed and rated probability of each hazard.

- **High:** There is a very strong likelihood (67-100% chance) that Northwood will experience a hazardous event within the next 25 years. Score = 3
- **Moderate:** There is moderate likelihood (34-66% chance) that Northwood will experience a hazardous event within the next 25 years. Score = 2
- **Low:** There is little likelihood (0-33% chance) that Northwood will experience a hazardous event within the next 25 years. Score = 1

Severity

Severity is an estimate generally based on a hazard's impact human, property and business. The Planning Committee discussed the severity of each hazard. The severity was calculated by the average of human, property and business.

- **High:** The total population, property, commerce, infrastructure and services of the town are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst case scenario there could be a disaster of major to catastrophic proportions. Score = 3

- **Moderate:** The total population, property, commerce, infrastructure and services of the town are exposed to the effects of a hazard of moderate influence; or the total population, property, commerce, infrastructure and services of the community is exposed to the effects of a hazard, but not all to the same degree; or an important segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of moderate to major, though not catastrophic, proportions. Score = 2
- **Low:** A limited area or segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of minor to moderate proportions. Score = 1

Overall Risk

The risk number is one, which can help the town weigh the hazards against one another to determine which hazard is most detrimental. This is calculated by multiplying the ***Probability of Occurrence*** score by the average of the ***Severity*** score (human, property, and business impacts).

- **High:** There is a great risk of this hazard in Northwood. Score = 4 or greater
- **Moderate:** There is moderate risk of this hazard in Northwood. Score = 2-3
- **Low:** There is little risk of this hazard in Northwood. Score = 1 or less

Hazard Ratings in Northwood, NH

The Committee determined that the overall risk associated with the identified hazards is distributed as follows:

- 6 hazards rated as having a **High** overall risk in Northwood:
  - Tornado/Downburst
  - Severe Winter Weather
  - Earthquake/Landslide
  - Public Health Threats
  - Cyber Security
  - Solar Storms

- 6 hazards rated as having a **Moderate** overall risk in Northwood:
  - Flooding (Including Dam Breach)
  - Hurricanes and Tropical Storms
  - Severe Thunderstorms
  - Wildfire
  - Drought
  - Hazardous Materials/Human Induced Events

- 2 hazards rated as having a **Low** overall risk in Northwood:
  - Extreme Temperatures
  - Extended Power Outages

Table 5.1 is the town's vulnerability assessment tool, which provides more information on the multi-hazard threat analysis that was completed during a brainstorming session with the Planning Committee.

Table 5.2 documents all presidentially declared disasters that have impacted the Town of Northwood from 1990 through the preparation of this plan in 2017, including documentation of the local impacts of each event.
Table 5.3 documents all declarations of a state of emergency that have impacted the Town of Northwood from 1990 through the preparation of this plan in 2017, including documentation of the local impacts of each event.

Hazard Vulnerability Table

Table 5.1: Hazard Vulnerability Assessment Tool – Town of Northwood

Hazard Event	Human Impact	Property Impact	Business Impact	Severity	Probability	Overall Threat
Impact Rankings: 0 – N/a 1-Low 2-Moderate 3-High	*Probability of death or injury*	*Physical losses and damages*	*Interruption of service*	*Average of human, property, and business impacts*	*Likelihood this will occur within 25 years*	*(Severity x probability) (Rounded to the nearest whole number)* *Low = 0-1* *Moderate = 2-3* *High = 4<*
Flooding (Including Dam Breach)	1	1	1	1	3	3
Hurricanes and Tropical Storms	2	2	3	2.33	1	2.33
Tornado/Downburst	2	2	1	1.67	3	5
Severe Thunderstorms and Lightning	1	1	1	1	3	3
Wildfire	1	3	1	1.67	2	3.33
Severe Winter Weather	2	1	1	1.33	3	4
Earthquake/Landslide	2	2	2	2	2	4
Extreme Temperatures	1	0	0	0.33	3	1
Drought	1	1	1	1	2	2
Public Health Threats	2	0	2	1.33	3	4
Hazardous Materials/Human Induced Events	2	2	2	2	1	2
Extended Power Outages	1	1	1	1	1	1
Cyber Threats	1	2	2	1.67	3	5
Solar Storms	1	2	2	1.67	3	5

Declared Disasters and Emergency Declarations

Table 5.2: Presidentially Declared Disasters (DR) 1990- December 2019 impacting the Town of Northwood

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
September 9, 1991	Hurricane Bob	August 18-20, 1991	FEMA 917-DR	PA	$2,293,449	Severe storm and wind; no power; trees knocked down
October 29, 1996	Severe Storms & Flooding	Oct 20-23, 1996	FEMA 1144-DR	PA	$2,341,273	Severe storms, flooding
January 15, 1998	Ice Storm	January 7-35, 1998	FEMA 1199-DR	PA/IA	$12,446,202	Major tree damage, electric power interrupted for many days; schools were closed
May 25, 2006	Severe Storm & Flooding	May 12-23, 2006	FEMA 1643-DR	PA/IA	$17,691,586	Severe storm causing massive flooding, road closures, and evacuations
April 27, 2007	Severe Storm & Flooding	April 15-23, 2007	FEMA 1695-DR	PA/IA	$26,826,780	Severe storms and flooding.
August 11, 2008	Severe Storms, Tornado, & Flooding	July 24, 2008	FEMA 1782-DR	PA	$3,673,097	Severe storms and wind damage
January 2, 2009	Severe Winter Storm	December 11-23, 2008	FEMA 1812-DR	DFA/PA	$14,898,663	Winter storm; snow removal; some people without power for a week
March 29, 2010	Severe Winter Storm	February 23-March 3, 2010	FEMA 1892-DR	PA	$6,841,093	Severe winter storm; minor power outages; no major damage
September 3, 2011	Tropical Storm Irene	August 26 – Sept 6, 2011	FEMA 4026-DR	PA	$17,684,244	Minor impacts; heavy rain; minor flooding in some areas

March 19, 2013	Severe Snow and Blizzard	February 9-11, 2013	FEMA 4105-DR	PA	$6,153,471	This storm resulted in a significant and expensive snow removal effort. Branches down led to sporadic power outages throughout town.
March 25, 2015	Severe Snow & Snowstorm	January 26-29, 2015	FEMA 4209-DR	PA	$4,799,048	This storm resulted in a significant and expensive snow removal effort. Branches down led to sporadic power outages throughout town.
June 8, 2018	Severe Storm & Flooding	March 2-8 2018	FEMA 4370-DR	PA	$412,441	Severe storm; severe coastal flooding, but less severe impacts inland
June 8, 2018	Severe Winter Storm & Snowstorm	March 13-14 2018	FEMA 4371-DR	PA	$2,514,024	Severe winter storm; minor power outages; no major damage
13 declarations totaling approximately $14,635,935						
Program Key: **PA**: Public Assistance, **IA**: Individual Assistance, **DFA**: Direct Federal Assistance						

Table 5.3: Emergency Declaration (EM) 1990-March July 2017 impacting the Town of Northwood

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
March 16, 1993	Heavy Snow	March 13-17, 1993	FEMA 3101-EM	PA	$832,396	Snow removal.
March 28, 2001	Snow Emergency	March 5-7, 2001	FEMA 3166-EM	PA	$3,433,252	Snow removal.
March 11, 2003	Snow Emergency	February 17-18, 2003	FEMA 3177-EM	PA	$2,288,671	Snow removal.
March 30, 2005	Snow Emergency	January 22-23, 2005	FEMA 3207-EM	PA	$3,611,491	Snow removal. School closures.
December 13, 2008	Severe Winter Storm	December 11-23, 2008	FEMA 3297-EM	DFA/PA	$900,000	Snow removal. School closures.
November 1, 2011	Severe Winter Storm	October 29-30, 2011	FEMA 3344-EM	PA	Data not available	Statewide Category B Public Assistance.
October 30, 2012	Hurricane Sandy	October 26-31, 2012	FEMA 3360-EM	PA	$643,660	Strong Storm surge and heavy rains across New England, NYC and New Jersey caused significant damage resulting in an emergency declaration EM-3360 for Direct Federal Assistance and Category B (Emergency Protective Measures).
7 emergency declarations totaling approximately $11,709,470 **Program Key: PA: Public Assistance, DFA: Direct Federal Assistance**						

Flooding (River & Dam Breach)

Table 5.4 Hazard Overview

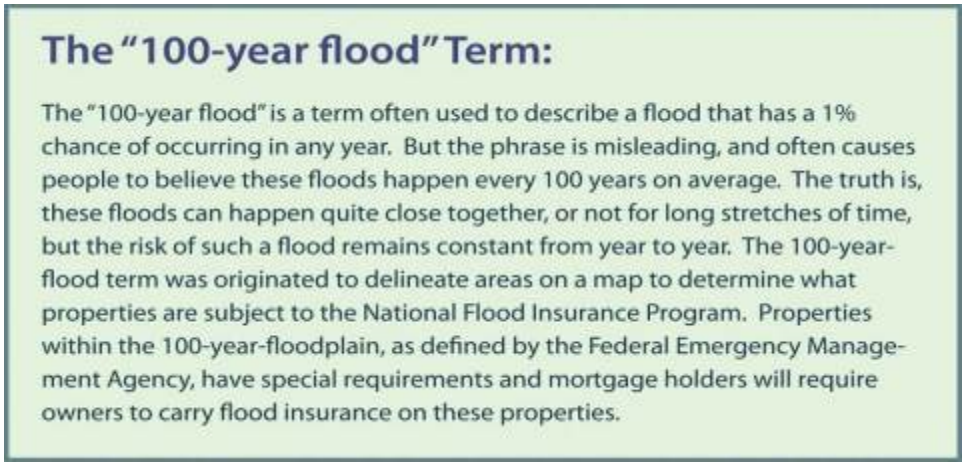
Hazard Type	Flooding
Location/Extent	Town-wide; Especially areas within the 100 year floodplain; other areas identified by committee
Vulnerability	
Severity	1
Probability	3
Overall Threat	3
Potential Loss	**$2,744,761 to $13,723,805 (moderate)**

Description of the Hazard

Riverine flooding is the most common natural disaster to impact New Hampshire. Riverine flooding occurs when surface water runoff introduced into streams and rivers exceeds the capacity of the natural or constructed channels to accommodate the flow. As a result, water overflows the river banks and spills out into adjacent low lying areas.[4] Floods are most likely to occur in the spring due to the increase in rainfall and the melting of snow; however, floods can occur at any time of the year because of heavy rains, hurricane, or a Nor'easter.

New Hampshire's climate ranges from moderate coastal to severe continental, with annual precipitation ranging from about 35 inches in the Connecticut and Merrimack River valleys, to about 90 inches on top of Mount Washington. Localized street flooding occasionally results from severe thundershowers, or over larger areas, from more general rain such as tropical cyclones and coastal "nor'easters." More general and disastrous floods are rare, but some occur in the spring from large rainfall quantities combined with warm, humid winds that rapidly release water from the snowpack. Causes of flooding that could potentially affect Northwood include:

- 100-year rainstorm.
- Severe tropical storm (hurricane or tropical storm) that can bring torrential rainfall in excess of that from a 500-year storm.
- Rapid snow pack melt in spring can be a significant potential flooding source, given the northern, relatively cold location and climate of Northwood and has occurred multiple times in the past.
- River ice jams, which could occur although there are no records of ice jams in Northwood recorded in the USACE Ice Jam Database as of December 2019.
- Erosion and mudslide in steep slope areas or riverbanks resulting from heavy rainfall that can alter topology
- Dam breach or failure, resulting in release of water and resulting downstream flooding.



[Source: The Nurture Nature Center: Focus on Floods]

[4] FEMA Training Chapter 2 Types of Floods and Floodplains (https://training.fema.gov/hiedu/docs/fmc/chapter%202%20-%20types%20of%20floods%20and%20floodplains.pdf)

Extent of the Hazard

Based on extent of the floodplain as described in Chapter 4, Northwood has flooding potential in the 100-year floodplain along Bow and Pleasant Lakes, with more substantial floodplains around Northwood and Harvey lakes and their tributaries - Narrows, Kelsey, and Tucker Brooks. Lucas Pond and the perennial stream that feeds it also have floodplains in the eastern part of town. Overall, Northwood has approximately 358.2 acres of its land area in 100-yr. floodplain. In addition to these floodplains, significant historical flooding has occurred along Flat Meadow Brook, particularly in the vicinity of Old Turnpike Road. Floodplain in neighboring Deerfield along Northwood Lake, Pleasant Lake, and a stream running between the two poses a threat to Gulf Road, which serves as the only point of egress for many properties in Northwood adjacent to these lakes. Prior updates to this plan have indicated the presence of some structures in the floodplain, placing these structures at risk to flood damage.

Map 5.1 Past & Potential Inland Flood Hazard Areas

Although flooding of the full extent of this floodplain by definition would require a 100-year storm, smaller storms with a higher annual probability of occurrence could still flood significant portions of that floodplain. Some structures that could be impacted by a 100-year storm could also be affected by smaller, more frequent flooding. It is likely that the extent of the 100-year floodplain will change in area when flood maps are updated due to better mapping technology and current precipitation data. Updated floodplain maps for the greater Salmon Falls/Piscataqua watershed are expected to be released by FEMA in 2020; portions of Northwood not within this watershed will be updated as part of the greater Merrimack watershed update, which is expected to begin in 2019-2020.

Dams

No dam breaches are on record in Northwood, but the potential for flooding from dam breach or failure exists in Northwood. According to the New Hampshire Department of Environmental Services, the only dam required to have an emergency action plan is a Conservation Pond-Gulch Mountain Pond. The plan is not complete but the dam, however, has never breached. The probability of this particular flooding hazard occurring is quite small.

Table 5.5 Dams in Northwood by Classification

Dam Classification	Classification Definition	Number of Dams in Northwood	Inspection Interval (Years)
High	Dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life.	0	2
Significant	Dam that has a significant hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no probable loss of lives but major economic loss to structures or property.	1	4
Low	Dam that has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life and low economic loss to structures/property.	3	6

1) Non-menacing, exempt, or inactive dams were not included in the 2016 National Inventory of Dams dataset and were therefore excluded from this analysis.
2)Two dams (Lucas Pond Dam and Woodman Marsh Dam) were downgraded from Low hazard from 2015 to 2016 and were removed from the database
3) Two Low hazard dams (Pleasant Lake Dam in Deerfield, North River Pond Dam in Nottingham) are located immediately adjacent to the Northwood town line and could potentially impact the town in a breach event.

Past Events and Impacts

The most notable recent flood events were the "Mother's Day" floods of May 2006 and spring floods in April 2007. In both cases, severe rain and flooding damaged roads and caused road closures. Since the 2015 update, localized flooding has continued to occur in many risk areas, though no events have rivaled the severity of the 2006-2007 storms. For example, severe storms in March 2018 resulted in extreme flooding in coastal Rockingham County, but impacts in Northwood, which is inland and comparatively elevated, were more limited. No instance of dam breeching has occurred since 2015.

Potential Future Impacts on Community

The floods of 2006 and 2007 were estimated to be 100-year events, suggesting that there is approximately a 1% chance that equally disruptive flooding will occur in a given year. While the chance of dam failure can be difficult to predict, large amounts of rain increase the strain on dam infrastructure, making failure or planned release of water more likely.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to inland flooding is **$2,744,761 to $13,723,805 (moderate).**

Hurricanes and Tropical Storms

Table 5.6 Hazard Overview

Hazard Type	Hurricanes and Tropical Storms
Location/Extent	Town-wide
Vulnerability	
Severity	2.33
Probability	1
Overall Threat	2.33
Potential Loss	**$2,744,761 to $13,723,805 (moderate)**

Description of the Hazard

According to the State Hazard Mitigation Plan (2013) **tropical cyclones** with maximum sustained winds of less than 39 mph are called **tropical depressions**. Once the tropical cyclone reaches winds of at least 39 mph, they are typically called a **tropical storm** and assigned a name. If the winds reach 74 mph or greater, they are upgraded and called a **hurricane**. Tropical cyclones originate over tropical or subtropical waters and are characterized by organized deep convection and a closed surface wind circulation about a well-defined center. These events are called typhoons if they occur west of the International Dateline. Hurricane season in the Atlantic runs from June 1 to November 30.

Extent of the Hazard

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating system based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. Hurricanes may impact all areas of the town.

Scale Number (Category)	Sustained Winds (MPH)	Damage	Storm Surge
1	74-95	**Minimal:** Unanchored mobile homes, vegetation and signs.	4-5 feet
2	96-110	**Moderate:** All mobile homes, roofs, small crafts, flooding.	6-8 feet
3	111-130	**Extensive:** Small buildings, low-lying roads cut off.	9-12 feet
4	131-155	**Extreme:** Roofs destroyed, trees down, roads cut off, mobile homes destroyed. Beach homes flooded.	13-18 feet
5	More than 155	**Catastrophic:** Most buildings destroyed. Vegetation destroyed. Major roads cut off. Homes flooded.	Greater than 18 feet

Figure 5.7 Saffir-Simpson Hurricane Wind Scale

Past Events and Impacts

These severe tropical storms may occur anytime from early spring to late fall, and in general are less common than other storms, e.g. nor'easters. As wind events, historically hurricanes have caused damage in Nottingham, most notably in 1938 and 1954 (Hurricane Carol). Quite a few other hurricanes have impacted the Town, including Hurricane Donna, Gloria, and Bob, with high winds but relatively little damage.

The NOAA National Climatic Data Center's Storm Events database (NCDC 2016) does not list any Hurricanes as directly affecting Rockingham County from January 1, 2008 to September 30, 2016; however, Rockingham County did experience impacts from Hurricane Sandy. Hurricane Sandy was the last hurricane to hit the region during the period of October 26 to November 8, 2012. Northwood experienced minimal impacts associated with rain and wind.
The database does report one tropical storm event, which is detailed as follows:

> **Tropical Storm Iren**e (August 28, 2011) - brought a prolonged period of strong and gusty winds and heavy rain to the state. The high winds snapped or uprooted numerous trees throughout the state causing more than 160,000 customers to lose electrical and/or communication services. The heavy rains caused rivers and streams throughout the state to flood causing damage to bridges, roads, and property. The strongest winds across the state began Sunday morning in southern areas and spread northward during the day. Winds continued to be gusty overnight as the storm moved away from the area. Observed maximum wind gusts included 63 mph at Portsmouth, 52 mph at Concord, and 51 mph at Manchester. On the top of Mt. Washington, winds gusted to 104 mph as the storm approached and 120 mph as it moved away. The combination of wet soil and the prolonged period of strong and gusty winds brought down numerous trees throughout the state. One person was killed and three people were injured across the state due to falling trees or branches. Rainfall amounts across the state ranged from 1.5 to 3 inches across southeastern New Hampshire. Locally, there were minor impacts including, some brush removal. There were also some trees down resulting in sporadic power outages throughout town.

Other hurricanes have impacted the town — including Donna, Gloria, and Bob — bringing high winds but causing relatively little damage.

While portions of Northwood are very wooded, the utility companies have typically been proactive about trimming trees away from power lines, which has prevented any significant damage from recent storms, and no notable impacts have occurred in Northwood since the plan was last undated in 2015.

Potential Future Impacts on Community

Northwood is vulnerable to hurricane hazards including wind, tornadoes, heavy rainfall, and inland flooding. Recurrence potential of hurricane and tropical storm hazards in Northwood is moderate. It is likely that that the region will be impacted by a significant storm of tropical origin within the foreseeable future.

Based on historical data and statistical predictors, the Atlantic Basin averages approximately 12 total named storms per year. Six of those storms will become hurricanes with three becoming a category three or higher. With variability in sea-level pressure and sea-surface temperatures in the Atlantic Ocean, it is difficult to predict with certainty the number of storms in any given year. It is even more difficult to determine which of those storms will make landfall. Northwood is located inland from the New Hampshire coast, which may diminish wind speeds from their coastal strength. Any significant impact on the town would be dependent on the exact track of these concentrated storms.

Hurricanes and tropical storms will continue to affect Northwood and recurrence potential of hurricane and tropical storm hazards is, therefore, moderate. It is likely that the region will be impacted by a significant storm of tropical origin within the foreseeable future.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to severe thunderstorms and lightning is **$2,744,761 to $13,723,805 (moderate).**

Tornadoes and Downbursts

Table 5.8 Hazard Overview

Hazard Type	Tornadoes and Downbursts
Location/Extent	Town-wide
Vulnerability	
Severity	1.67
Probability	3
Overall Threat	5
Potential Loss	**$13,723,805 to $27,447,610 (high)**

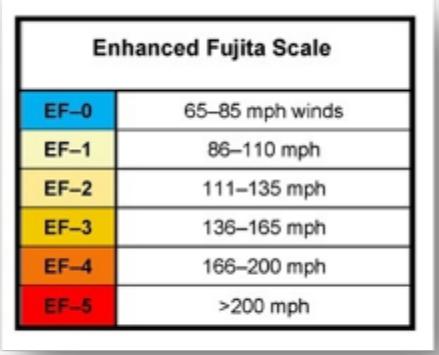
Description of the Hazard

A ***tornado*** is a violent windstorm characterized by a twisting, funnel shaped cloud with winds in excess of 200 mph, often accompanied by violent lightning, peripheral high winds, severe hail, and severe rain. Tornadoes develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down they become a force of destruction. Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Violent winds and debris slamming into buildings cause the most structural damage. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison to a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

A ***downburst*** is a severe localized wind blasting down from a thunderstorm. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris. Downbursts fall into two categories: microburst, which covers an area less than 2.5 miles in diameter and macroburst, which covers an area at least 2.5 miles in diameter.

Extent of the Hazard

The Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes. The scale measures wind speeds of 65 to greater than 200 miles per hour. The damage path of a tornado can be in excess of one mile wide and 50 miles long, whereas a downburst is typically less than 2.5 miles. Downbursts can have wind speeds of 150 miles per hour. Tornadoes, thunderstorms, and downbursts may impact all areas of town.



Enhanced Fujita Scale	
EF–0	65–85 mph winds
EF–1	86–110 mph
EF–2	111–135 mph
EF–3	136–165 mph
EF–4	166–200 mph
EF–5	>200 mph

Figure 5.9 Enhanced Fujita Scale

Past Events and Impacts

Between 1991 and 2010, the average annual number of tornadoes in New Hampshire was one.[5] Though the frequency of tornado events in New Hampshire is not great, the state has experienced large tornadoes throughout its history. An early example is the tornado that stuck the state in September 1821. This tornado was reported to have tracked from the Connecticut River, near Cornish, and terminating near Boscawen. When the skies cleared, 6 people were dead, hundreds injured and thousands homeless.

In 1998 an F2 tornado in Antrim, N.H. blew down a 45-foot by 12-foot section of the Great Brook Middle School. Witnesses reported seeing a funnel cloud, and the weather service, after an inspection, confirmed it was a tornado. According to the June 2, 1998 edition of the Eagle Tribune, John Jensenius from the National Weather Service in Gray, Maine estimated that the twister cut a path half a mile long, up to 100 yards wide, and was on the ground for several minutes.

In July 2008, an F2 tornado and high winds created a path of destruction through five New Hampshire counties that destroyed homes, displaced families, downed trees and forest lands and closed major state roadways. The impact to residents was extensive, with over 100 homes rendered uninhabitable. Phone and electric service was cut off to over 12,500 customers. One fatality is attributed to a building collapse, and local hospitals reported numerous physical injuries associated with this severe storm.[6]

Since the July 2008 tornado (through June 30, the most current data available at the time this chapter was drafted in October 2016), The NCDC Storm Events database reports that eight tornadoes have hit New Hampshire, however none have hit Strafford County. The most recent event occurred in July 2015 in Warner.

Downburst activity is very prevalent throughout the State. However, the majority downburst activity is mostly unrecognized unless a large amount of damage has occurred. Several of the more significant and recent events are highlighted below:

[5] NOAA. U.S. Tornado Climatology (https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology)
[6] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.

- Central, NH – July 6, 1999 –Two roofs blown off structures, downed trees, widespread power outages, and damaged utility poles and wires; two fatalities.
- Stratham, NH – August 18, 1991 –$2,498,974 worth of damages; five fatalities.
- Moultonborough, NH – July 26, 1994 –Downed trees, utility poles and wires. Approximately 1,800 homes without power and 50-60 homes damages.
- Bow, NH – September, 6, 2011 –City Auto in Bow had 15 campers damaged and estimated $200,000 in damage.

While tornadoes are not common, they would cause significant impacts in the town, especially to older structures or mobile homes that are not tied down properly. The probability of reoccurrence of a downburst may be higher. A tornado or downburst can impact the entire jurisdiction and may cause greater damage along Route 4.

Northwood has not experienced local damage as a result of a tornado, but has seen damage as a result of downbursts since 2014. This damage has primarily occurred along the leeward shore of Northwood Lake and Jenness Pond, but localized downburst activity has also occurred in the eastern part of town. While damage has mostly been limited to downed trees and tree limbs, a homeowner appeared before the Zoning Board of Adjustment in 2019 for a variance to rebuild a house that had been damaged by a collapsed tree falling through the roof.

Potential Future Impacts on Community

It is possible that a tornado could strike Northwood in the future and inflict significant damage to property, forest resources, and potentially cause injury to people. Downbursts are more likely to occur. Downbursts could cause downed trees that damage structures and property.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to tornadoes and downbursts is **$13,723,805 to $27,447,610 (high).**

Severe Winter Weather

Table 5.10 Hazard Overview

Hazard Type	Severe Winter Weather
Location/Extent	Town-wide
Vulnerability	
Severity	1
Probability	3
Overall Threat	3
Potential Loss	**$2,744,761 to $13,723,805 (moderate)**

Description of the Hazard

Winter snow and ice events are common in New Hampshire. The National Climatic Data Center (NCDC) Storm Events database reports 44 heavy snow events, 2 blizzards, 1 ice storm, and 6 winter storms (nor'easters) among large winter weather events impacting Strafford County from January, 1 2008 to December 31, 2017.[7] Heavy snow typically brings significant snow removal costs along with delays in transportation schedules. Wet snow can result in major infrastructure damage from heavy snow loads and has been the cause of human harm during long periods of shoveling,

[7] NOAA Storm Event Database (https://www.ncdc.noaa.gov/stormevents/)

including back injuries and in some cases heart attacks to older individuals. The most severe damage, though, often comes from ice storms and winter nor'easters.

- The State's Multi-Hazard Mitigation Plan Update 2018 identifies four types of winter storms:
- *Heavy snowstorms:* A storm that deposits four or more inches of snow (or 10 cm) in a twelve-hour period
- *Blizzards:* A violent snowstorm with winds blowing at a minimum speed of 35 miles (56 kilometers) per hour and visibility of less than one-quarter mile (400 meters) for three hours
- *Nor'easter:* A large weather system traveling from south to north, passing along the coast. As the storm's intensity increases, the resulting counterclockwise winds which impact the coast and inland areas in a Northeasterly direction. Winds from a Nor'easter can meet or exceed hurricane force winds.
- *Ice Storms:* An event that occurs when a mass of warm, moist air collides with a mass of cold, arctic air. The less dense warm air will rise and the moisture may precipitate out in the form of rain. When this rain falls through the colder, denser air and comes in contact with cold surfaces, ice will form and may continue to form until the ice is as thick as several inches.

Extent of the Hazard

The Sperry–Piltz Ice Accumulation Index, or SPIA Index, is a forward-looking, ice accumulation and ice damage prediction index that uses an algorithm of researched parameters that, when combined with National Weather Service forecast data, predicts the projected footprint, total ice accumulation, and resulting potential damage from approaching ice storms. It is a tool to be used for risk management and/or winter weather preparedness. Snow and ice storms are a town-wide hazard.

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	< 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Figure 5.11 Sperry-Piltz Ice Accumulation Index

Past Events and Impacts

Three events from the NCDC database are noteworthy for their severity:

The Ice Storm of 2008 (December 11th – 12th) was a major winter storm that brought a mixture of snow, sleet, and freezing rain. The greatest impact in the state was in southern and central New Hampshire where a significant ice storm occurred. Following the ice storm, recovery and restoration efforts were negatively impacted by additional winter weather events that passed through the state. The freezing rain and sleet ranged from 1 to 3 inches, ice accretion to trees and wires in these areas generally ranged from about a half inch to about an inch. The weight of the ice caused branches to snap, and trees to either snap or uproot, and brought down power lines and poles across the region. About 400 thousand utility customers lost power during the event, with some customers without power for two weeks. Property damage across northern, central and southeastern NH was estimated at over $5 million.

The Blizzard of 2013 – NEMO (February 8th-9th) was an area of low pressure developed rapidly off the Carolina coast late on the 7th and early on the 8th. The storm moved very slowly northeast during the 8th and 9th as it continued to intensify. By the morning of the 10th, the storm was located just to the east of Nova Scotia. The storm brought heavy snow, high winds, and blizzard conditions to the southeastern part of the state. Snowfall amounts were generally 18 inches or more in the southeast where blizzard conditions caused considerable blowing and drifting

snow. In western and northern sections, snowfall amounts were in the 4 to 18 inch range. Southeastern New Hampshire had blizzard conditions for about 3 to 10 hours.

According to the NOAA Northeast Snowfall Impact Scale (NESIS), which ranks storms that have large areas of 10 inch snowfall accumulations or greater based on a function of the area affected, the amount of snow, and the number of people living in the path of the storm, Nemo was ranked as a 'major' event (http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis).

The NCDC Regional Snowfall Index for the stations near Northwood reported between 18 and 24 inches of snow (Rochester and Nottingham) and 12 to 18 inches (between Epsom and Northwood) from February 8-February 10, 2013. According to the NH Union Leader, wind gusts of over 30-miles-per hour were expected to occur with the storm; however, the NH Electric Co-op reported only minor power outages.[8]

The Blizzard of 2015 – JUNO (January 26th – 28th) was area of low pressure developed off the Delmarva peninsula on Monday, January 26th, and intensified rapidly as it moved slowly northward through the 27th. Snow spread northward across the region Monday night and became heavy on Tuesday, the 27th. Winds became strong during the day Tuesday leading to blizzard conditions at times along and inland from the coast. The snow persisted into Tuesday night in many areas with blowing and drifting snow. Snowfall amounts ranged from 10 to more than 30 inches across much of the southeastern part of the state.

Juno was ranked on the NESIS as a 'major' event passed on the area affected, the amount of snow, and the number of people living in the path of the storm.

More recent events have been less severe. For example, winter storms in March 2018 led to a disaster declaration, but impacts in Northwood were generally limited to minor power outages and snow removal.

Extended power failure often occurs in conjunction with severe winter weather and has serious implications for lighting and visibility, heating, water supply, and communication during these events.

Potential Future Impacts on Community

Northwood will continue to receive impacts from severe, regional winter weather events. Due to its heavily forested nature, the town is most highly exposed in terms of damage to forest resources and the secondary impacts of those damages. Downed trees and extra plowing are likely the main concern associated with this hazard.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to severe winter weather is **$2,744,761 to $13,723,805 (moderate).**

[8] New Hampshire Union Leader. February 9, 2013.
http://www.unionleader.com/apps/pbcs.dll/article?AID=/20130209/NEWS1101/130209041/0/OPINION02

Severe Thunderstorms & Lightning

Table 5.12 Hazard Overview

Hazard Type	Severe Thunderstorms & Lightning
Location/Extent	Town-Wide
Vulnerability	
Severity	1
Probability	3
Overall Threat	3
Potential Loss	**$2,744,761 to $13,723,805 (moderate)**

Description of the Hazard

As defined by NOAA, a **thunderstorm** is a rain shower during which thunder is heard. Because thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is the result of convection, which is the upward atmospheric motion that transports whatever is in the air (such as moisture) with it. A thunderstorm is classified as *severe* if it has hail one inch or greater, winds gusting in excess of 50 knots (57.5 mph), or a tornado. Thunderstorm-related hazards that could impact Northwood include: high winds and downburst, lightning, hail, and, torrential rainfall. Thunderstorms and severe thunderstorms are a town-wide hazard. They are most likely to occur in spring and summer.

Extent of the Hazard

Severe storms are often accompanied by lightning, which heats air to a temperature of 50,000 degrees Fahrenheit and causes the air to expand and contract rapidly, producing thunder. The duration of individual lightning strikes is very brief, but strikes can occur many times during a single storm.

Table 5.13: Lightning Activity Scale

Lightning Activity Level (LAL)	Conditions
LAL1	No thunderstorms activity
LAL2	Isolated thunderstorms
LAL3	Widely scattered thunderstorms
LAL4	Scattered thunderstorms
LAL5	Numerous thunderstorms
LAL6	Widely scattered, scattered, or numerous DRY thunderstorms

Past Events and Impacts

Thunderstorms are common in New Hampshire but can be considered generally less severe than in other areas of the country, such as the Great Plains states. Severe thunderstorms do occur in New Hampshire, though. The NCDC database lists 41 reported events (over 22 different days) of severe thunderstorm winds in Strafford County from January 1, 2008 to December 31, 2016 (the most current data available at the time this chapter was drafted in May 2017).

Hail is a common part of thunderstorms in New Hampshire and can result in damage to cars and windows. The NCDC Storm Events database lists 23 reported hailstorms in Strafford County from January 1, 2008 to December 31, 2016 (the most current data available at the time this chapter was drafted in May 2017).

While the annual recurrence probability of thunderstorms in general is effectively 100%, the likelihood of severe thunderstorms is low. Northwood will continue to experience thunderstorms and should expect to sustain significant

damage periodically. While all thunderstorms have the potential for lightning-related damage, no known instances of notable lighting damage have occurred in Northwood since the last update.

Potential Future Impacts on Community

It is highly likely that Northwood will continue to experience thunderstorms and lightning, however the severity of those impacts is anticipated to be low to moderate depending on factors include the location of lightning strikes, wind, or other factors such as flash flooding or downbursts that may accompany a thunderstorm.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to severe thunderstorms and lightning is **$2,744,761 to $13,723,805 (moderate).**

Wildfire

Table 5.14 Hazard Overview

Hazard Type	Wildfire
Location/Extent	Town-wide; forested or densely developed areas may be more vulnerable
Vulnerability	
Severity	1.67
Probability	2
Overall Threat	3.33
Potential Loss	**$2,744,761 to $13,723,805 (moderate)**

Description of the Hazard

Wildfire is defined as an uncontrolled and rapidly spreading fire. A forest fire is an uncontrolled fire in a woody area. Forest fires occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassland areas. Northwood has large tracts of land that contribute to a predominantly forested landscape. Exposure to natural factors such as lightning that can cause wildfires is consequently high and can occur throughout the jurisdiction.

Extent of the Hazard

The National Wildfire Coordinating Group (NWCG) categorizes the size of a wildfire in six classes depending on acres burned, ranging from less than ¼ acre to greater than 5,000 acres (see box below). The US Forest Service's surface fire behavior fire characteristics chart illustrates primary fire behavior values including the spread rate and the intensity of the fire, which can be used to compare predicted and observed fire behavior and to describe potential fire behavior.[9]

Class A - one-fourth acre or less;
Class B - more than one-fourth acre, but less than 10 acres;
Class C - 10 acres or more, but less than 100 acres;
Class D - 100 acres or more, but less than 300 acres;
Class E - 300 acres or more, but less than 1,000 acres;
Class F - 1,000 acres or more, but less than 5,000 acres;
Class G - 5,000 acres or more.

[9] How to Generate and Interpret Fire Characteristics Charts for Surface and Crown Fire Behavior. (https://www.fs.fed.us/rm/pubs/rmrs_gtr253.pdf)

Past Impacts and Events

Wildfires in New Hampshire historically have tended to run in 50-yr cycles, which can be observed starting from the 1800s. This 50-year cycle is partially based upon human activities and, therefore, may not prove to be accurate into the future.[10] The peak in wildfires in the late 1940's and early 1950's is thought to be related to the increased fuel load from trees downed in the 1938 hurricane. Here, 60 years later, New Hampshire officials are again concerned about the high fuel load created by the 1998 and 2008 ice storms that hit New Hampshire. The NCDC Storm Events database lists no reported wildfires in Rockingham County from January 1, 2008 to December 31, 2018.

Potential Future Impacts on Community

The probability of occurrence of wildfires in the future is difficult to predict due to the dependence of wildfire on the occurrence of the causal hazards and the variability of numerous factors that affect the severity of a wildland fire. As indicated above, loading of dead brush and other fuels in forested areas can be cyclical, indicating that the risk of wildfire can grow over time if potential sources of fuel are not regularly removed.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to wildfire is **$2,744,761 to $13,723,805 (moderate).**

Earthquakes, Landslide & Subsidence

Table 5.15 Hazard Overview

Hazard Type	Earthquakes, Landslide, & Subsidence
Location/Extent	Town-wide, Areas of steep slopes or unstable soil may be more vulnerable to damage
Vulnerability	
Severity	2
Probability	2
Overall Threat	4
Potential Loss	**$13,723,805 to $27,447,610 (high)**

Description of the Hazard

The USGS defines an earthquake as a term used to describe both sudden slip on a fault, and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, avalanches, and tsunamis. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and are followed by vibrations of gradually diminishing force called aftershocks.[11] Earthquakes in the Northeast are not associated with specific know faults.

Due to the geology of the region, the area impacted by an earthquake in the Northeast can be up to 40 times greater than the same magnitude event occurring on the West coast. Earthquakes can occur at any time without warning. An

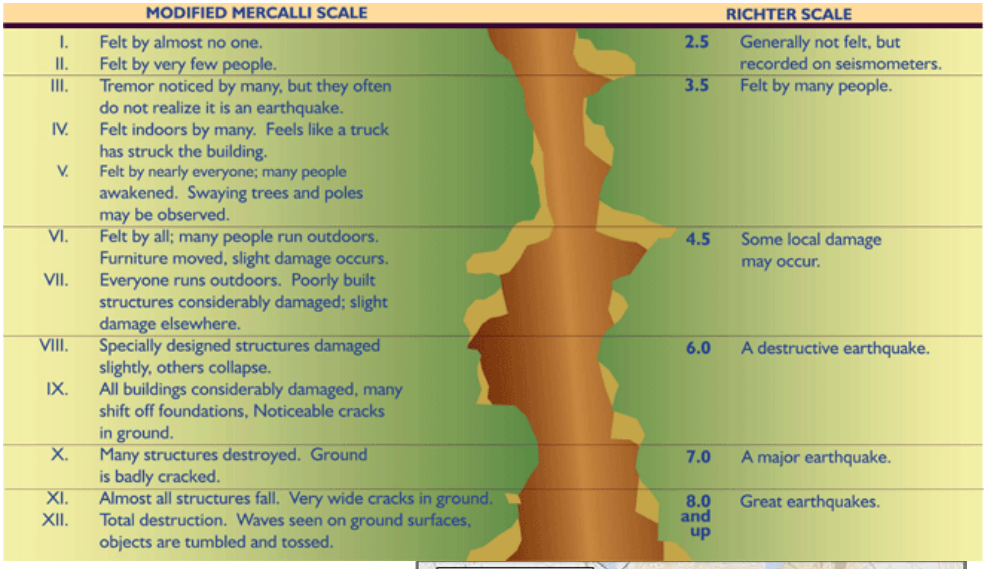
[10] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.
[11] The Northeast States Emergency Consortium Earthquake Hazards. http://nesec.org/earthquakes-hazards/. Viewed on 8/10/15

earthquake can impact all areas of the jurisdiction. People at greatest risk from earthquakes are those who live in unreinforced masonry buildings build on filled land or unstable soil.[12]

Land subsidence, the loss of surface elevation due to removal of subsurface support, occurs in nearly every state in the United States. Subsidence is one of the most diverse forms of ground failure, ranging from small or local collapses to broad regional lowering of the earth's surface. The causes (mostly due to human activities) of subsidence are as diverse as the forms of failure, and include dewatering of peat or organic soils, dissolution in limestone aquifers, first-time wetting of moisture-deficient, low-density soils (hydrocompaction), natural compaction, liquefaction, crystal deformation, subterranean mining, and withdrawal of fluids (ground water, petroleum, geothermal). Subsidence poses a greater risk to property than to life. Damage consists of direct structural damage, property loss, and depreciation of land values.

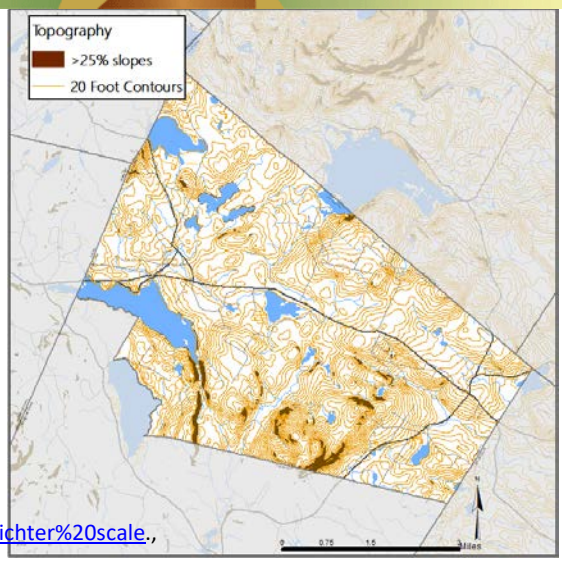
Extent of the Hazard

The magnitude and intensity of an earthquake is measured by the Richter scale and the Modified Mercalli Intensity (MMI) scale, respectively. The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes.[13]



The Modified Mercalli Intensity (MMI) scale was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects actually experienced at a given place and therefore has a more meaningful measure of severity.[13]

Landslides may be triggered by a variety of factors, but are most likely to occur in areas with steeper slopes. In Northwood this land tends to be concentrated in the southern part of town where the topography has prevented large scale development from occurring. Areas of the steepest slopes (i.e. slopes of greater than 25%) are identified in the map at right.



[12] http://nesec.org/earthquakes-hazards/
[13] USGS. Earthquake Hazard Program. http://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale., http://pubs.usgs.gov/gip/earthq4/severitygip.html.

Past Impacts and Events

Due to the state's location in an area of moderate seismic activity earthquakes are a common event in New Hampshire, but significantly damaging earthquakes are not. The Northeast States Emergency Consortium (NESEC, 2016) website presents a history of earthquake in the Northeast and documents that New Hampshire is an area of high earthquake probability. Three hundred and sixty earthquakes occurred in New Hampshire from 1638 to 2007. Approximately 40-50 earthquakes are detected in the Northeast annually.[12] However, New Hampshire has only experienced nine earthquakes of significant magnitude (Richter Magnitude 4.0 or greater) in that time period. Northwood has experienced no major earthquakes in recent years. Earthquakes are on average an annual occurrence but significant quakes have an annual probability of occurrence (based on the 1638 to 2007 period) of about 2.4%.

Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely in steep slope areas. However, these areas are extremely limited in scale. No local impacts of earthquakes or landslides have been reported for Northwood.

Table 5.17 Notable Historic Earthquakes in NH 1638-2007 (Magnitude 4.0 or Greater)

Location	Date	*Intensity MMI Scale*	Magnitude *Richter Scale*
Central New Hampshire	June 11, 1638	-	6.5
Portsmouth	November 10, 1810	V	4.0
Near Hampton	July 23, 1823	IV	4.1
Ossipee	October 9, 1925	VI	4.0
Ossipee	December 20, 1940	VII	5.5
Ossipee	December 24, 1940	VII	5.5
West of Laconia	January 19, 1982	-	4.7
Northeast of Berlin	October 20, 1988	-	4.0
Southeast of Berlin	April 6, 1989	-	4.1

Potential Future Impacts on Community

Landslides could occur in Northwood in areas with steep slopes, where soils and loose bedrock formations would tend to slough off and move en masse downhill under gravity. Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely quite high in steep slope areas. Areas of steep slopes are most prevalent in the southeastern portion of the town (see Map 5.2).

Map 5.2 Areas of Steep Slope

The USGS (1997) classifies landslide incidence regionally as very low (less than 1.5% of land area involved). The local probability in Northwood will depend on specific soil/rock types, localized deforestation/removal of vegetation, and upon the probability of initiating events. Potential impacts could include property damage, road closures, and increased erosion if forests were damaged.

Estimated Loss

Based the 2018 valuation and the hazard ranking, the estimated potential loss due to earthquakes and landslides is **$13,723,805 to $27,447,610 (high).**

Extreme Temperatures

Table 5.18 Hazard Overview

Hazard Type	Extreme Temperatures
Location/Extent	Town-wide
Vulnerability	
Severity	0.33
Probability	3
Overall Threat	1
Potential Loss	**$0 to $2,744,761 (low)**

Description of the Hazard

A *heat wave* is a prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region. Heat kills by pushing the human body beyond its limits. In extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."[14]

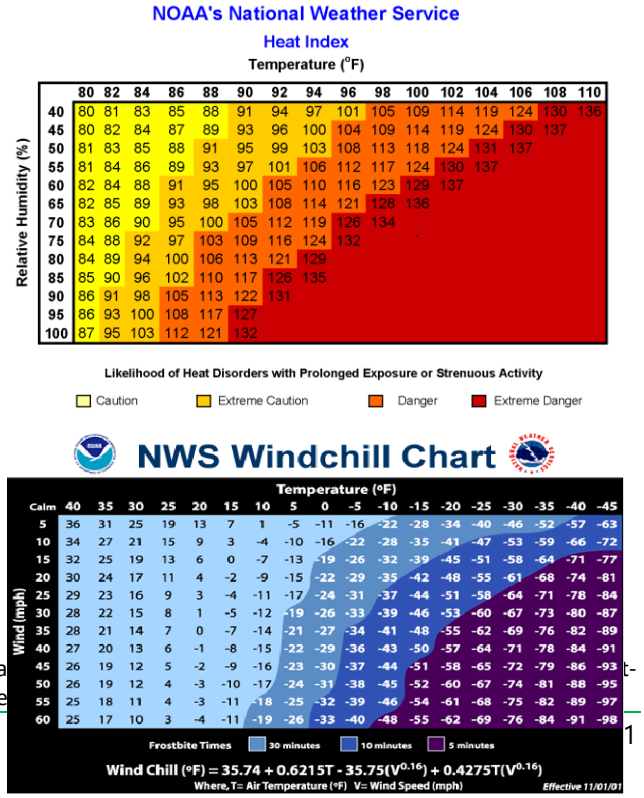
A *cold wave* can be both a prolonged period of excessively cold weather and the sudden invasion of very cold air over a large area. Along with frost it can cause damage to agriculture, infrastructure, and property. Cold waves, heavy snowfall and extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia.

Extent of the Hazard

Extreme Heat

Extreme heat events can be described as periods with high temperatures of 90°F or above. The graph to the right displays the likelihood of heat disorders with prolonged exposure or strenuous activity.

Figure 5.19 National Weather Service Heat Index and Windchill Charts



Extreme Cold

What constitutes extreme cold varies by region. Characteristics of an extreme cold event in northern states include temperatures at or below zero for an extended period of time. According to the National Weather Service (NWS), extreme cold is a daily concern

[14] International Federation of Red Cross and Red Crescent Societies. Climatologica
we-do/disaster-management/about-disasters/definition-of-hazard/extreme-tempe

during the winter months for northern states. The NWS Windchill Temperature index calculates the dangers from winter winds and freezing temperatures (Source: NWS)

Past Impacts and Events

According to a 2014 study of climate change by Climate Solutions New England, Climate Change in Southern New Hampshire, from 1970 to 1999, southern New Hampshire experienced an average of seven days per year above 90°F each year. This is projected to increase to 22 days per year under a low emissions scenario to nearly 50 days per year under a high emissions scenario. Between 1980 and 2009, an average of one day per year reached 95°F in southern New Hampshire. By the end of the century, the number of days per year over 95°F is expected to increase as much as six to 22 days per year. Additionally, the average daytime maximum temperature on the hottest day is expected to increase to as much as 98°F to 102°F (depending on the emissions scenario), compared to the historical average of 93°F.[15] Between 1960 and 2012, there was an average of 8.3 days per year (or 0.8 days/decade) greater than 90°F recorded in Northwood. During this time the hottest day of the year averaged 95.0°F.[16]

Between 1960 and 2012, the average temperature of the coldest day of the year was -14.5°F in Durham, NH (nearest available weather station in the study)[17] Between 1980 and 2009, there were an average of 164 days per year under 32°F and 16 days per year under 0°F in southern New Hampshire. By the end of the century, southern New Hampshire is expected to see 20 fewer days below 32°F and only about 2 to 5 days per year under 0°F. Locally, the welfare department and fire department keep an updated list of potentially vulnerable individuals potentially impacted by extreme temperatures. No damage, injury, or loss of life as a result of extreme heat or cold has occurred since the plan was last updated.

Potential Future Impacts on Community

Annual average temperatures may increase on average by 3-5°F by 2050 and 4-8°F by 2100.[18] This rise in annual temperatures is likely to coincide with a rise in days per year above 90°F. While rising annual temperatures are expected to result in fewer days per year under 0°F, extreme cold is expected to continue to impact Northwood for the foreseeable future.

Estimated Loss Potential

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to extreme temperatures is **$0 to $2,744,761 (low).**

Drought

Table 5.20 Hazard Overview

Hazard Type	Drought
Location/Extent	Town-wide

[15] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014
[16] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014
[17] Ibid
[18] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014

Vulnerability	
Severity	1
Probability	2
Overall Threat	2
Potential Loss	**$2,744,761 to $13,723,805 (moderate)**

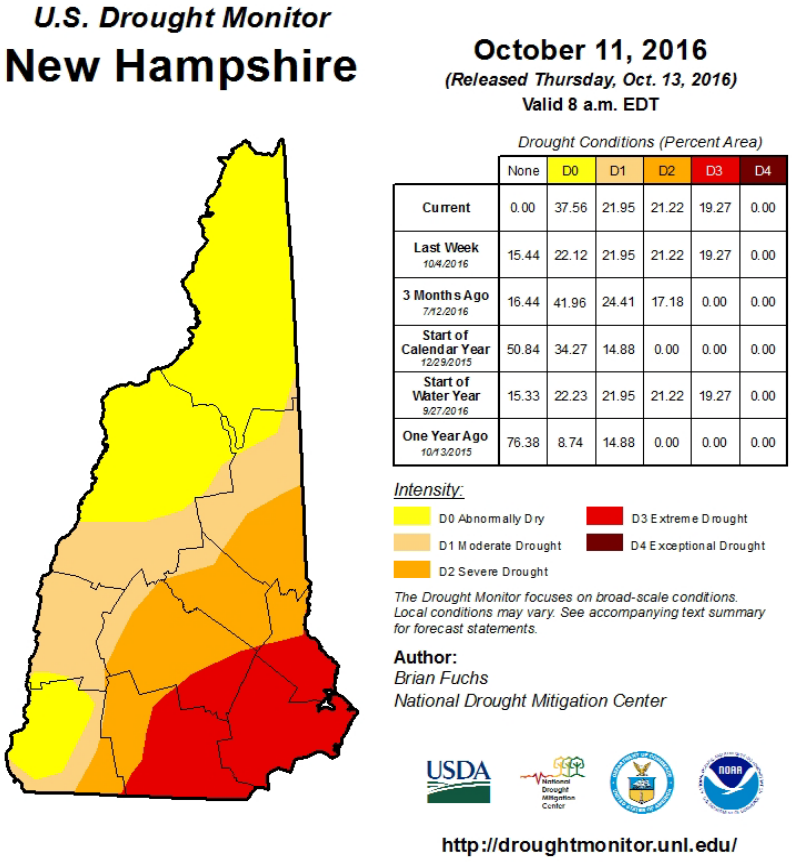
Description of the Hazard

A drought is defined as a long period of abnormally low precipitation, especially one that adversely affects growing or living conditions. The impacts of droughts are indicated through measurements of soil moisture, groundwater levels, and stream flow. The effect of drought on these indicators is variable during any particular event. For example, frequent minor rainstorms can replenish the soil moisture without raising groundwater levels or increasing streamflow. Low streamflow also correlates with low ground-water levels because ground water discharge to streams and rivers maintains streamflow during extended dry periods. Low streamflow and low ground-water levels commonly cause diminished water supply.

Extent of the Hazard

The National Drought Monitor classifies the duration and severity of the drought using precipitation, stream flow, and soil moisture data coupled with information provided on a weekly basis from local officials. There are five magnitudes of drought outlined in the New Hampshire State Drought Management Plan: Exceptional, Extreme, Severe, Moderate, and Abnormally Dry. Drought is a regional hazard and can impact the entire jurisdiction. Agricultural land and residents who use shallower individual wells may be more vulnerable to the effects of drought.

Figure 5.21 Peak Drought Conditions in NH, 2016



Past Impacts and Events

While the impacts of drought are typically not as damaging and disruptive as floods or storm events, the impacts of long term drought or near drought conditions can impact crops and the water supply. Periods of drought have occurred historically in New Hampshire. Six droughts of significant extent and duration were evident in the 20th century as noted below in Table 2.5. The most severe drought recorded in New Hampshire occurred from 1960 to 1969. This drought encompassed most of the northeastern United States (1956-1966). The drought of 1929-1936 was the second worst and coincided with severe drought conditions in large areas of the central and eastern United States. The drought

of 2001-2002 was the third worst on record.[19]

In more recent years, drought has again become a problem in New Hampshire. In 1999, a drought warning was issued by the Governor's Office. In March 2002, all counties in New Hampshire with the exception of Coos County were declared in Drought Emergency. This was the first time that low-water conditions had progressed beyond the Level Two, Drought Warning Stage. With extreme variation in environmental conditions due to global warming possibly on the rise, drought probability may grow in the future. Currently, drought possibility seems moderate. The large amount of water resources and relatively sparse population in New Hampshire have tended to minimize the impacts of drought events in the region, but this regional protection may be endangered in the future with increases in drought frequency or severity.

Normal precipitation for the state averages 40 inches per year. During the summer of 2015, most of central and southern New Hampshire experienced its most recent drought, the first since 2001 – 2002 (was the 3rd worst on record, exceeded only by the national droughts of 1956-1966 and 1941-1942). While many communities experienced record snowfall totals in the prior winter (2014-2015), the lack of rainfall and higher-than-average temperatures resulted in river and groundwater levels to be lower than average. This resulted in the implementation of local water conservation plans throughout the region.[20]

Drought conditions continued and intensified into 2016 in New Hampshire and in Southeast New Hampshire in particular. As of October 11, 2016, nearly 20% of the state was categorized as being in extreme drought. One hundred and sixty community water systems reported implementing a water restriction or ban, and 13 towns reported implementing voluntary or mandatory outdoor use bans in the state during the peak drought conditions. Conditions in New Hampshire largely returned to normal in the first half of 2017, with just over 2% of the state still experiencing abnormally dry conditions. This area covers the western part of Rockingham County, including the Town of Northwood, illustrating the extent to which local drought conditions can vary both geographically and over time. The vast majority of homes in Northwood rely on individual wells for water. As a result, the Town did not have to implement widespread water restrictions, but there were reports of shallow wells running dry or needing to be deepened during the peak drought conditions.

Table 5.22 New Hampshire Drought History & Conditions

Dates	Area Affected	Magnitude	Remarks
1929 – 1936	Statewide	-	Regional; recurrence interval 10 to > 25 years
1939 – 1944	Statewide	Severe Moderate	Severe in southeast NH and moderate elsewhere in the State. Recurrence interval 10 to > 25 years.
1947 – 1950	Statewide	Moderate	Recurrence interval 10 to >25 years
1960 – 1969	Statewide	Extreme	Longest recorded continuous spell of less than normal precipitation. Encompassed most of the northeast US. Recurrence interval >25 years.
2001 – 2002	Statewide	Severe	Recurrence interval 10 to >25 years
2015	Central & Southern NH	Moderate	Recurrence interval cannot yet be determined

Potential Future Impacts on Community

[19] NHDES. Drought Management Program. Publications. *NH Drought Historical Events*. Viewed on 8/10/15. http://des.nh.gov/organization/divisions/water/dam/drought/documents/historical.pdf

[20] See: http://des.nh.gov/organization/divisions/water/dwgb/water_conservation/documents/waterban.pdf.

The National Drought Mitigation Center website (NDMC 2004) emphasizes that reliable drought prediction for regions above 30°N latitude is effectively impossible. With extreme variation in environmental conditions due to climate change possibly on the rise, drought probability may grow in the future. Currently, drought possibility seems moderate. The large amount of water resources and relatively sparse population in New Hampshire have tended to minimize the impacts of drought events in the region, but this regional protection may be endangered in the future with increases in drought frequency or severity.

Historically, droughts in New Hampshire have had limited effect because of the plentiful water resources and sparse population. Since 1960, the population has more than doubled, which has increased demand for the State's water resources. Further droughts may have considerable effect on the State's densely populated areas along the seacoast and in the south-central area.

Estimated Loss Potential

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to extreme heat and drought is **$2,744,761 to $13,723,805 (moderate).**

Public Health Threats

Table 5.23 Hazard Overview

Hazard Type	Public Health Threats
Location/Extent	Town-wide; school population and families may be more susceptible to certain epidemics
Vulnerability	
Severity	1.33
Probability	3
Overall Threat	4
Potential Loss	**$13,723,805 to $27,447,610 (high)**

Description of the Hazard

Northwood is an active member of the Capital Public Health Network (CAPHN) - a coalition of municipalities and health and human service agencies in the Concord Hospital service area working together to improve local emergency preparedness. A public health emergency is broadly defined as the occurrence of an event that affects the public's health and can be caused by a variety of communicable disease outbreaks or contaminants.

Epidemic Disease

As defined by the CDC, and epidemic is "the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time."[21] In addition to being categorized by the type of transmission (point-source or propagated), epidemics may occur as outbreaks or pandemics. As defined in the State Hazard Mitigation Plan, an outbreak is a sudden increase of disease that is a type of epidemic focused to a specific area or group of individuals. A pandemic is an epidemic that spreads worldwide, or throughout a large geographic area.

Epidemics may be caused by infectious diseases, which can be transmitted through food, water, the environment or person-to-person or animal-to-person (zoonoses), and noninfectious diseases, such as a chemical exposure that causes increased rates of illness. Infectious disease that may cause an epidemic can be broadly categorized into the following groups[22]:

[21] Slate; http://www.slate.com/id/2092969/

[22] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.

- Foodborne (Salmonellosis, Ecoli)
- Water and Foodborne (Cholera, Giardiasis)
- Vaccine Preventable (Measles, Mumps)
- Sexually Transmitted (HIV, Syphilis)
- Person-to-Person (TB, Aseptic meningitis)
- Arthropodborne (Lyme, West Nile Virus)
- Zoonotic (Rabies, Psittacosis)
- Opportunistic fungal and fungal infections (Candidiasis).

An epidemic may also result from a bioterrorist event in which an infectious agent is released into a susceptible population, often through an enhanced mode of transmission, such as aerosolization (inhalation of small infectious disease particles).[23] The Multi-Agency Coordinating Entity plan is responsible for emergency vaccination planning. For the purposes of this Plan, widespread drug and substance abuse may also be considered epidemics. New Hampshire continues to experience an opioid epidemic that has impacted communities across the state.

Insect-Borne Diseases

Lyme disease, which is spread to humans by the bite of an infected tick, is a growing threat in New Hampshire. New Hampshire has one of the highest rates of Lyme disease in the U.S. Other tick-borne illnesses that could impact New Hampshire include Babesiosis, Anaplasmosis, and Rocky Mountain Spotted Fever.

Radon

Radon is a radioactive gas which is naturally occurring as a result of the typical decay of uranium commonly found in soil and rock (especially granite). Radon has carcinogenic properties and is a common problem in many states; New Hampshire has some isolated areas that are among the highest levels of radon in the United States according to the US Environmental Protection Agency (EPA). Whether or not a particular type of granite emanates radon is dependent on the geochemistry of that particular granite, some types are a problem and some are not. In other parts of the country, radon is associated with certain black shales, sandstones, and even limestones. The EPA has estimated that radon in indoor air is responsible for about 13,600 lung cancer deaths in this country each year (EPA document, EPA 811-R-94-001, 1994).[24]

Arsenic

Arsenic is a semi-metal element that is odorless and tasteless. Arsenic is a hazard because it can enter drinking water supplies, either from natural deposits in the earth or from agricultural and industrial practices.[25]

Wells drilled into New Hampshire's bedrock fractures have about a 1 in 5 probability of containing naturally occurring arsenic above 10 parts per billion. In addition, wells within short distances (~50 feet) can present very different water quality because of our highly fractured bedrock. Arsenic in water has no color or odor, even when present at elevated levels. Therefore, the only way to determine the arsenic level in your well water is by testing.

Extent of the Hazard

Public health threats are events or disasters that can affect an entire community.

[23] Ibid.
[24] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.
[25] EPA. Arsenic in Drinking Water. (http://water.epa.gov/lawsregs/rulesregs/sdwa/arsenic/index.cfm)

Past Impacts and Events

Epidemic Disease

The Public Health Emergency Preparedness and Response Plan identified the Coe Brown Academy as the Point of Dispensing (POD) site that administers vaccine or antibiotics as part of the response to infectious disease outbreaks of any magnitude. Previously, the New Hampshire Department of Safety and Health and Human Services conducted a Cities Readiness Full-Scale Strategic National Stockpile Exercise, using the Northwood POD as the point for the CAPHN. The exercise focused on medical supplies management and distribution, mass prophylaxis, emergency public information and warning, and emergency operations center capabilities. With the occurrence of worldwide pandemics such as SARS, H1N1 and Avian Flu, Northwood could be susceptible to an epidemic and subsequent quarantine. While all individuals are potentially vulnerable to the hazard of an epidemic, epidemics often occur among a specific age group or a group of individuals with similar risk factors and exposure.[24]

Insect-Borne Diseases

The number of New Hampshire residents diagnosed with Lyme disease has increased over the past 10 years, with significant increases occurring since 2005.[26] In 2009, the rate of cases of Lyme disease reported in New Hampshire residents was 108 cases per 100,000 persons, which is significantly higher than the Healthy People 2010 science-based 10-year national objective for improving the health of all Americans objective of 9.7 cases per 100,000 persons.[27] From 2009 to 2013, reported cases of Lyme disease in New Hampshire increased by approximately 20% from 1416 cases per year to 1691 cases per year.[28] From 2008-2009, there were 212 reported cases of Lyme disease in Rockingham County, which is the highest case count of any county in the state.[29] In August 2019, a horse in Northwood was diagnosed with eastern equine encephalitis ("EEE"), a mosquito-borne disease that has the potential to infect humans. As a result, state health officials raised the local risk level for EEE in Northwood to "High", and in surrounding towns from "Low" to "Moderate". This incident does not appear to have led to any human cases.[30]

Radon

Exposure is a significant hazard in New Hampshire. According to a NH Bureau of Environmental & Occupational Health (BEOH) study looking at >15,000 indoor radon test results in single-family dwellings, households in northern, eastern, and southeastern regions of New Hampshire especially tend to have nominally high concentrations of radon in air or water (BEOH 2004); however, values in excess of the US Environmental Protection Agency's 4.0 picocurie per liter (pCi/L) action guideline have been found in nearly every community in New Hampshire. Values exceeding 100 pCi/L have been recorded in at least eight of New Hampshire's ten counties. The highest indoor radon reading in New Hampshire known to NHDES is greater than 1200 pCi/L; higher values probably exist. The probability of significant radon exposure is apparently quite high. In the BEOH study, 44.0% of tests in Rockingham County exceeded the 4.0 pCi/L action level and 13.0% even exceeded 12.0 pCi/L.

Arsenic

From 1975 until 2001, the federal maximum contaminant limit (MCL) for arsenic in water supplied by public water systems was 50 parts per billion, because the health effects of exposure to lower concentrations was not recognized. Based on an exhaustive review of the new information about arsenic's health effects, in January 2001 EPA established a goal of zero arsenic in drinking water. At the same time, EPA adopted an enforceable MCL of 10 parts per billion (ppb)

[26] 2011 New Hampshire State Health Profile; Improving Health, Preventing Disease, Reducing Costs for All. NH Division of Public Health Services Department of Health and Human Services. http://www.dhhs.nh.gov/dphs/documents/2011statehealthprofile.pdf

[27] HealthyPeople.gov. About Healthy People. Accessed April 2014. Available at: http://healthypeople.gov/2020/about/default.aspx

[28] NHDHHS. State of New Hampshire Tickborne Disease Prevention Plan. March 31, 2015. http://www.dhhs.state.nh.us/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf)

[29] 2011 New Hampshire State Health Profile; Improving Health, Preventing Disease, Reducing Costs for All. NH Division of Public Health Services Department of Health and Human Services. http://www.dhhs.nh.gov/dphs/documents/2011statehealthprofile.pdf

[30] https://www.wmur.com/article/eee-found-in-horse-in-northwood/28849292#

based on balancing treatment costs and public health benefits. Studies have shown that chronic or repeated ingestion of water with arsenic over a person's lifetime is associated with increased risk of cancer (of the skin, bladder, lung, kidney, nasal passages, liver or prostate) and non-cancerous effects (diabetes, cardiovascular, immunological and neurological disorders). The same studies found that dermal absorption (skin exposure) of arsenic is not a significant exposure path; therefore, washing and bathing do not pose a known risk to human health.[31]

Potential Future Impacts on Community

Exposure to radon and arsenic will continue to be a concern in Northwood and throughout the state. It is likely that exposure to tick-borne diseases will increase in the future due to warmer temperatures. The spread of epidemics is also plausible.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to public health threats is **$13,723,805 to $27,447,610 (high).**

Hazardous Materials & Human Induced Events

Table 5.24 Hazard Overview

Hazard Type	Hazardous Materials
Location/Extent	Town-wide; Major transportation corridors likely to be most vulnerable
Vulnerability	
Severity	2
Probability	1
Overall Threat	2
Potential Loss	**$0 to $2,744,761 (low)**

Description of the Hazard

Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, property, and the environment. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Hazardous materials continue to evolve as new chemical formulas are created.

Transportation of chemicals and bio-hazardous materials to and from Canada or Maine by railroad or truck is a concern. Route 4 is a main highway from southeastern New Hampshire to the Concord region that passes through Northwood in the town's densest area. Traffic accidents occur on this highway regularly, and hazardous materials are routinely carried on this road. Additionally, the presence of multiple salvage facilities in Northwood could be a localized source of contamination due to the nature of their operations.

Extent of the Hazard

Incidents involving hazardous materials could potentially occur at any residence or business or along any road; however, it is more likely that a large-scale incident would occur in the form of a spill along the North Coast railway tracks or the

[31] New Hampshire Environmental Services. Drinking Water and Groundwater Bureau. Arsenic in Drinking Water Fact Sheet.

Spaulding Turnpike. A leak in the methane gas pipeline that extends along the Spaulding Turnpike from the Turnkey landfill to the University of New Hampshire in nearby Durham is also a possibility. Finally, multiple fuel storage facilities, many of which are listed as potential resources in the critical facilities inventory, could pose a potential threat if an accident were to occur. The extent of such an incident can be difficult to predict and would depend upon the type and volume of materials involved.

Past Impacts and Events

No disastrous accidents in Northwood have been recorded. Safety regulations and enforcement are fairly strict, so the likelihood of an accidental and seriously damaging release of harmful chemicals is quite small. If an accident does occur, the percentage of the population exposed to the hazard could be large. Northwood prefers to consider possible impacts proactively due to the presence of several facilities containing potentially hazardous materials, and transportation corridors.

Potential Future Impacts on Community

Safety regulations and enforcement are fairly strict, so the likelihood of an accidental and seriously damaging release of harmful chemicals in Northwood is quite small. If an accident does occur, though, especially close to downtown, the percentage of the population exposed to the hazard could be large.

Estimated Loss

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to hazardous materials is **$0 to $2,744,761 (low).**

Cyber Threats

Table 5.25 Hazard Overview

Hazard Type	Cyber Threats
Location/Extent	Town-wide
Vulnerability	
Severity	1.67
Probability	3
Overall Threat	5
Potential Loss	**$13,723,805 to $27,447,610 (high)**

Description of the Hazard

The field of cyber security is primarily concerned with protecting against damage and disruption to or theft of hardware, software, or information. Due to the variety of services they provide, local government organizations collect, store, and work with large amounts of personal data and other sensitive information. While the security of this information has always been important, increasing use of digital networks to store and transmit that information makes the security of those networks a priority. Furthermore, local governments provide critical services such as police, fire, utilities, and other services, and disruption to these services could be devastating for residents. Types of cyber threat include:[32]

[32] Sullivan, Megan. 8 Types of Cyber Attacks Your Business Needs to Avoid (http://quickbooks.intuit.com/r/technology-and-security/8-types-of-cyber-attacks-your-business-needs-to-avoid/)

- Malware: Malicious software that can damage computer systems, including monitoring system activity, transferring information, or even taking control of computers or accounts. This includes a wide variety of viruses, Trojans, ransomware, and other programs that are usually installed by clicking on infected links, files, or email attachments.
- Phishing: These attacks come in the form of emails, often disguised as a trusted or legitimate source, that attempt to extract personal data.
- Denial of Service: This is a large-scale attack designed to disrupt network service by overloading the system with connection requests. These attacks are more likely to impact large, high-profile organizations, but such attacks can occasionally have residual impacts on other organizations in the same network.
- Man in the Middle: By imitating an end user (e.g. an online bank), an attacker can extract information from a user. The attacker can then input that information to the end user to access additional information, including sensitive data such as personal or account information.
- Drive-by Downloads: Malware installed on a legitimate website causes a system to download a program simply by visiting that website. This program then downloads malware or other files directly to the user's system.
- Malvertising: This attack type downloads malware or other files to your computer when you click on an infected advertisement.
- Rogue Software: Attackers use pop-up windows to mimic legitimate anti-virus or other security software in order to trick users into clicking on links to download malware or other files.
- Sponsored Attacks: These threats, which could be perpetrated by state or non-state actors, include specific attacks to damage or disrupt infrastructure such as utilities or wastewater facilities.

Extent of the Hazard

Cyber threats are a town-wide hazard that have the potential to impact any location if critical services are disrupted, or any resident, business, contractor, or employee whose information is stored in town records in the event of a data breach. The severity of any impact depends upon the type of incident – targeted phishing attacks may be focused upon a single employee or account, while malware attacks could impact an entire department or gain access to an entire database of personal information.

Past Events and Impacts

A global ransomware attack began on May 12, 2017 that impacted more than 100,000 organizations in 150 countries.[33] Ransomware is a type of malware that encrypts a user's files, making them inaccessible, and demands a ransom to return access. While ransomware has existed for years, it is becoming more prevalent. An IBM study of the impacts of ransomware found that nearly 40% of all spam emails contain a ransomware attachment, up from 0.6% in 2015.[34] The FBI estimates that over $1 billion in ransoms were paid by businesses and consumers in 2016 compared to $24 million in 2015.[35]

Potential Future Impacts on Community

[33] http://www.npr.org/sections/thetwo-way/2017/05/14/528355526/repercussions-continue-from-global-ransomware-attack
[34] IBM X-Force. *Ransomware: How consumers and businesses value their data*. 2016
[35] http://www.nbcnews.com/tech/security/ransomware-now-billion-dollar-year-crime-growing-n704646

A municipality of Northwood's size is most likely to be at risk from malware, phishing, and other methods of acquiring personal information. These threats may be targeted, as in the case of phishing emails sent to employee accounts, or threats that individuals encounter during their regular computer usage. Cyber threats are also constantly evolving in order to find new weaknesses in anti-virus software and other network defenses. As noted above, ransomware has become an increasingly prevalent form of malware in recent years, and is likely to continue to be a threat in years to come.

Estimated Loss Potential

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to cyber threats is **$13,723,805 to $27,447,610 (high).**

Extended Power Outages

Table 5.26 Hazard Overview

Hazard Type	Extended Power Outages
Location/Extent	Town-wide
Vulnerability	
Severity	1
Probability	1
Overall Threat	1
Potential Loss	**$0 to $2,744,761 (low)**

Description of the Hazard

When discussing extended power failure in this plan, it is referring to power failure that can last for a period of days or weeks. Many things can cause power failure: downed power lines (due to storm, wind, accident, etc.); failure of public utilities to operate or failure of the national grid.

Extent of the Hazard

Extended power failure can negatively impact lighting, heating, water supply, and emergency services. In Durham, extended power failure is particularly hazardous for remote areas. Elderly populations and other populations to protect listed in Table 3.1 could also be particularly vulnerable if the extended power outage occurred in conjunction with extreme heat or severe winter weather.

Past Events and Impacts

Historically, power outages have coincided with storm and wind events due to impacts upon power lines. While power outages lasting multiple days in some areas have occurred, no significant impacts beyond repair of damaged lines have been reported.

Potential Future Impacts on Community

The likelihood of future power outage events can be difficult to predict, though the historic record in Northwood and elsewhere indicates that they will be highly correlated with high wind events such as thunderstorms and severe winter weather.

Estimated Loss Potential

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to extended power outages is **$0 to $2,744,761 (low).**

Solar Storms and Space Weather

Table 5.27 Hazard Overview

Hazard Type	Solar Storms and Space Weather
Location/Extent	Town-wide
Vulnerability	
Severity	1.67
Probability	3
Overall Threat	5
Potential Loss	**$13,723,805 to $27,447,610 (high)**

Description of the Hazard

Solar storms or solar activity refer to solar flares, coronal mass ejections, and other solar emissions that interact with the earth's upper atmosphere. These events typically involve release of gas and/or electromagnetic fields, and they may impact the earth for a period of several minutes to several hours, with potential for extreme releases to last for up to several days or weeks. "Space weather" is a recent term, and describes conditions in the earth's upper atmosphere and outer space environment, similar to how the terms "climate" and "weather" are used to describe conditions in the earth's lower atmosphere.

Extent of the Hazard

This is a town-wide hazard that could impact any location. Because the hazard involves electromagnetic emissions, electrical and telecommunications infrastructure (e.g. cell towers, radio communications) are most vulnerable to this hazard. Severity of this hazard is measured by the NOAA Space Weather Scales, which have been reproduced below as they relate to Geomagnetic Storms, Solar Radiation Storms, and Radio Blackouts.

Geomagnetic Storms

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
G 5	**Extreme**	**Power systems:** Widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle)
G 4	**Severe**	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** May experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
G 3	**Strong**	**Power systems:** Voltage corrections may be required, false alarms triggered on some protection devices. **Spacecraft operations:** Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).	Kp = 7	200 per cycle (130 days per cycle)
G 2	**Moderate**	**Power systems:** High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. **Spacecraft operations:** Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).	Kp = 6	600 per cycle (360 days per cycle)
G 1	**Minor**	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations possible. **Other systems:** Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle)

Solar Radiation Storms

Scale	Description	Effect	Physical measure (Flux level of >= 10 MeV particles)	Average Frequency (1 cycle = 11 years)
S 5	Extreme	**Biological:** Unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. **Other systems:** Complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S 4	Severe	**Biological:** Unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** May experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** Blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	10^4	3 per cycle
S 3	Strong	**Biological:** Radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** Degraded HF radio propagation through the polar regions and navigation position errors likely.	10^3	10 per cycle
S 2	Moderate	**Biological:** Passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk. **Satellite operations:** Infrequent single-event upsets possible. **Other systems:** Small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.	10^2	25 per cycle
S 1	Minor	**Biological:** None. **Satellite operations:** None. **Other systems:** Minor impacts on HF radio in the polar regions.	10	50 per cycle

Radio Blackouts

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
R 5	Extreme	**HF Radio:** Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Less than 1 per cycle
R 4	Severe	**HF Radio:** HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. **Navigation:** Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	Strong	**HF Radio:** Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. **Navigation:** Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	**HF Radio:** Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. **Navigation:** Degradation of low-frequency navigation signals for tens of minutes.	M5 (5×10^{-5})	350 per cycle (300 days per cycle)
R 1	Minor	**HF Radio:** Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. **Navigation:** Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

Past Events and Impacts

Northwood has no known historical impacts from this hazard.

Potential Future Impacts on Community

The likelihood and scope of future impacts can be difficult to predict. Most solar emissions occur on a scale that is too small to dramatically impact humans or technology. However, as society in general, including municipal first responders, becomes increasingly reliant on technology for daily life and operations the likelihood of disruptions due to solar emissions increases. Since impacts as a result of this hazard are most likely to result in loss of electrical or telecommunications service, this hazard is expected to be closely related to Extended Power Outages as described above, with similar potential impacts.

Estimated Loss Potential

Based on the 2018 valuation and the hazard ranking, the estimated potential loss due to solar storms and space weather is **$13,723,805 to $27,447,610 (high).**

Hazards Not Included in this Plan

The State of New Hampshire identifies avalanches as a hazard in the State Multi-Hazard Mitigation Plan Update of 2018. The 2019-2020 planning committee again decided not to include Avalanches in this Plan for the Town of Northwood. Avalanches were not identified by the present or past Planning Committee as a local hazard due to the fact that there are no significant mountains or topographical features where avalanches would be likely to occur. The Town will re-evaluate the need to include additional hazards to this Plan during subsequent updates of the Plan.

Chapter 6: Action Plan

Existing Programs and Policies

Table 6.1 displays existing, ongoing mitigation programs and policies in Durham. This matrix was updated by the Planning Committee during the preparation of this report. The matrix includes the type of existing protection (Column 1), a description of the existing protection (Column 2), the type of hazard (Column 3), the type of activity (Column 4), the area of town impacted (Column 5), enforcement (Column 6), effectiveness of the strategy (Column 7), and a status update in 2020 (Column 8).

Table 6.1 Ongoing Programs and Policies

Existing Program/Activity	Description	Type of Hazard	Type of Activity	Area of Town Covered	Enforcement	Effectiveness	2020 Update
Building Code / Permits	Requires builder to obtain all permits prior to action.	Multi-Hazard	Prevention	Town-wide	Building Inspector/ Code Enforcement	Average	
Elevation Certificates	Individual required on case by case from bank.	Multi-Hazard	Prevention	Potential Flood Areas	Building Inspector/ Code Enforcement	Good	
Emergency Operations Plan	Last adopted in 2012.	Multi-Hazard	Prevention	Town-wide	Emergency Management Director	Good	The "sheltering" section of the plan was updated in 2018. The remainder of the plan is on hold pending completion of the 2020 Hazard Mitigation update.
Storm Drain Maintenance	Open channel/culvert as needed.	Flooding	Town Planning	Town-wide, culverts not mandated.	Building Inspector, Road Agent, Planning and Zoning Board. Zoning to permit driveway variances granted, exiting of drainage wetland.	Good	Town operations on town-owned culverts are good, but the Town may need to conduct additional outreach and education to inform private property owners of their responsibilities for private culverts.
Road Design Standards	State minimum regulations.	Multi-Hazard	Prevention	Town-wide	Planning Board or Road Agent; Board of Selectmen for existing roads.	Excellent	Local boards and end users seem to have good awareness of the applicable standards
Tree maintenance	PSNH, Highway Dept. to remove dead trees as needed.	Multi-Hazard	Prevention	Town-wide	PSNH, Highway Department after event	Excellent	Local utility operators have been aggressive about maintenance. The Northwood Area Land Management Collaborative has completed a forest management plan that was used to guide cutting at the Northwood Meadows State Park. Maintenance may need to occur again soon, as Dashing Down Road is beginning to get overgrown.
Evacuation and Notification	Radio station, TV notification, reverse 911, privately owned vehicles, fire apparatus and loud speakers	Multi-Hazard	Emergency Preparedness	Town-wide	Emergency Management Director, Board of Selectmen	Good	The town has had both improvements and setbacks. Local communication towers radio communications have been improved. The Town has made some progress with social media, but the website still needs improvements.

Existing Program/Activity	Description	Type of Hazard	Type of Activity	Area of Town Covered	Enforcement	Effectiveness	2020 Update
Emergency Back-up Power	Generator at Town Hall and Police Station	Multi-Hazard	Emergency Preparedness	Town- wide	Road Agent, Fire Chief	Average to Poor	The Fire Department has adequate generators in place at their facilities, while generators at the Police station, Town Hall, and other locations need updates or repairs.
Shoreland Protection Act	Referenced in ordinances	Multi-Hazard	Prevention	Town-wide	Planning Board & Code Enforcement Officer	Good	
Best Management Practices	Required by State	Multi-Hazard	Town Planning	Town-wide	Planning Board & Code Enforcement Officer	Good	The Planning Board reviews the Northwood Development Ordinance and other land use policies regularly.
State Dam Program	Inspected by State	Flooding	Prevention	A (Town dam), B, and C	Public Works	Good	Accessible dams are inspected on schedule. Harvey Lake Dam is on private property and this owner has refused access for inspections in the past.
Hazardous Materials Response Team	Mutual response system with Capital Area for action.	Hazardous Materials	Emergency Preparedness	Town-wide	Fire Department and EMD	Good	Provided through mutual aid with the capital area.
Mutual Aid	Mutual Aid System with Police	Multi-Hazard	Emergency Preparedness	Northern Rockingham County and neighboring communities in Strafford & Merrimack counties	Police Departments	Excellent	Northwood is part of a contracted mutual aid system with the capital area and also has less formal agreements in place with providers in the lakes and seacoast regions.
Mutual Aid	Mutual Aid System with Fire.	Multi-Hazard	Emergency Preparedness	Agreements with Capital Area, Seacoast and Lakes Regions	Fire Departments	Excellent	Northwood is part of a contracted mutual aid system with the capital area and also has less formal agreements in place with providers in the lakes and seacoast regions.
Mutual Aid	Mutual Aid System with Highway Dept.	Multi-Hazard	Emergency Preparedness	State-wide	Highway Departments	Excellent	Northwood is part of a contracted mutual aid system with the capital area and also has less formal agreements in place with providers in the lakes and seacoast regions.

Existing Program/Activity	Description	Type of Hazard	Type of Activity	Area of Town Covered	Enforcement	Effectiveness	2020 Update
Floodplain Management Ordinance	FEMA maps and enforcement of limiting new building in 100-year floodplain	Flooding	Town Planning	Town-wide	Planning Board and Board of Selectmen	Good	The Town is awaiting the publication of new Flood Insurance Rate Maps for the Greater Piscataqua/Salmon Falls watershed (including a portion of Northwood) and will update the ordinance when they are available.
Fire Education Programs	Use local fire departments to conduct education programs in schools	Fire	Education and Outreach	Town-wide	Fire Department	Good	This is an activity that has previously been included on the list of strategies in Table 6.2 and has been conducted with great success for many years. The Committee sees this as a permanent recurring program, and therefore felt it was more appropriate to move the strategy to this table of ongoing programs.
Wind engineering and mitigation	Encourage engineering and construction methods that mitigate against the impact of high winds	Wind-related hazards	Regulation and Resiliency	Town-wide	Code Enforcement	Good	This is an activity that has previously been included on the list of strategies in Table 6.2 and is an ongoing responsibility of the Code Enforcement Officer. The Committee sees this as a permanent recurring item, and therefore felt it was more appropriate to move the strategy to this table of ongoing programs. The Town currently uses the 2009 edition of the International Building Code as required by state law, but could consider adopting a more recent edition if it wished to apply stricter standards for building code.
Outreach to at-risk populations	Identify specific at-risk populations that may be vulnerable in the event of long-term power outages.	Multi-Hazard	Outreach	Town-wide	Welfare officer	Good	This is an activity that has previously been included on the list of strategies in Table 6.2 and is an ongoing responsibility of the Welfare Officer. The Committee sees this as a permanent recurring item, and therefore felt it was more appropriate to move the strategy to this table of ongoing programs. The welfare officer keeps the list of vulnerable individuals up to date, with the most recent update in June 2019.

Effectiveness:

Excellent – The existing program works as intended and is exceeding its goals

Good – The existing program works as intended and meets its goals

Average – The existing program does not work as intended and/or does not meet its goals

Poor – This existing program is failing to do what it is intended to do and is negatively impacting the community

2020 Update:

Recommendations for improvement

Table 6.2 displays mitigation strategies identified during the development of Northwood's Multi-Hazard Mitigation Plan in 2007 and 2012. The Committee provided a status update for each mitigation strategy during the preparation of the current Plan. The Planning Committee members then ranked past mitigation actions from prior plan as high, medium, and low priority.

Table 6.2 Accomplishments since Prior Plan(s) Approval

Prior STAPLEE	Strategy	2019 Update
20	Continue to develop the use of social media including facebook, twitter, eblast alerts for emergency notification and distribution of information during emergencies.	Ongoing. The Town is making more frequent attempts to use social media, and it is becoming an increasingly effective communication strategy.
21	Have more emergency information that deal with natural/manmade disasters as well as links to existing resources on website, once the new design is completed.	Deferred. The Town still needs to work on its website. The Police Department currently distributes information it receives from NH Alerts.
21	Maintain transportation infrastructure by identifying and assessing potential areas (road/culverts) of concern and using the culvert inventory report produced by the Strafford Regional Planning Commission to prioritize replacement, repair, and upgrade schedules to mitigate future flooding.	Deferred. The Town had a culvert inventory conducted by Strafford Regional Planning Commission in 2013, but implementation of identified maintenance needs could be improved. The Town may need to consider updating the inventory report in the future, as the conditions described will be less accurate over time.
20	Promote conservation of open space to separate areas from high-hazard wildfire areas and identify other priorities for local conservation.	Ongoing. The Conservation Commission continues to promote conservation of land, but may need to consider opportunities for planning and outreach if it wishes to take a more active role in conserving land. Possible actions include a planning process to identify land characteristics that are important to conserve and co-occurrence mapping to identify land that possesses several of those qualities.
21	Using local fire departments to conduct education programs in schools.	Ongoing. This is considered a reoccurring program and will be moved to Table 6.1 for this and future iterations of this plan.
15	To deal with a flooding issue an undersized culvert replacement is needed on Old Turnpike Highway (Route 4). This project needs coordination with state NHDOT due to the road being a state road.	Deferred. This is a state culvert, meaning responsibility for repair/replacement is the responsibility of NH DOT. To date no progress has been made. The Town will continue to lobby NH DOT for replacement.
19	Purchase of portable message boards to display emergency notifications.	Deferred. The Town can borrow these from HSEM and mutual aid communities if necessary. However, borrowed signs may not always be available (for example, they may all be in use on busy travel weekends in the summer), so the Committee still wants to consider acquiring one for the Town if possible.
20	With the increase in fire load from past storms there is a need for a town-wide management plan for tree resources and track community vulnerability.	Ongoing. Public outreach and clearing of brush load on public lands are ongoing, but additional action is needed as there is still significant debris from recent ice storms.
18	A new public safety complex needs to be built.	Deferred. This is still a major item of need for the Town, but funding for the project was voted down at Town Meeting in 2019. The Town will continue to consider the best way forward for this project.
21	Identify specific at-risk populations that may be vulnerable in the event of long-term power	Ongoing. This is considered a reoccurring program and will be moved to Table 6.1 for this and future iterations of this plan.

	outages.	
21	Encourage wind engineering measures and construction techniques to better mitigate against high winds.	Ongoing. This is considered a reoccurring program and will be moved to Table 6.1 for this and future iterations of this plan.
21	With the Route 4 Corridor Study slated a potential project in the Ten-Year Plan, there will be a need for continued planning on design including: added center turning lanes, drainage improvements, and culvert replacements.	Deferred. DOT funding is expected to be available for approximately 1-2 corridor studies statewide beginning in 2021. The Town can continue to advocate for Route 4 to be a top priority for study once funding becomes available. The Town could also partner with adjacent communities and Strafford Regional Planning Commission to prepare an application for consideration once DOT makes selection criteria available.
18	There is a need for secondary access to residents living on Gulf Road. Currently, the emergency response time is insufficient.	Deferred. The Town continues to receive applications for subdivision or building permits on Gulf Road. The Planning Board will consider opportunities to study the scale of the problem (e.g. how many houses are accessed via Gulf Road) and use its other planning mechanisms, such as the Master Plan and CIP to advance this issue.

Status Update:

Completed Action – This program continues to be an implemented mitigation action item since the last updated plan was developed
Deferred Action – At the time of developing this plan, more time is required for completion
Removed Action – This existing program is no longer a priority to the Town
Ongoing Action – This program will occur throughout the life of the plan

New Mitigation Strategies

A technique known as a STAPLEE evaluation, which was developed by FEMA, was used to evaluate new mitigation strategies based on a set of criteria (see below). The STAPLEE method is commonly used by public administration officials and planners.

S	**Social:**	Is the proposed strategy socially acceptable to the community? Is there an equity issue involved that would result in one segment of the community being treated unfairly?
T	**Technical:**	Will the proposed strategy work? Will it create more problems than it solves?
A	**Administrative:**	Can the community implement the strategy? Is there someone to coordinate and lead the effort?
P	**Political:**	Is the strategy politically acceptable? Is there public support both to implement and to maintain the project?
L	**Legal:**	Is the community authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?
E	**Economic:**	What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
E	**Environmental:**	How will the strategy impact the environment? Will it need environmental regulatory approvals?

The Committee evaluated each mitigation strategy using the STAPLEE and ranked each of the criteria as poor, average, or good. These rankings were assigned the following scores: *Poor=1; Average=2; Good=3.*

The following questions were used to guide further prioritization and action:

- Does the action reduce damage?
- Does the action contribute to community objectives?
- Does the action meet existing regulations?
- Does the action protect historic structures?
- Can the action be implemented quickly?

The prioritization exercise helped the committee evaluate the new hazard mitigation strategies that they had brainstormed throughout the multi-hazard mitigation planning process. While all actions would help improve the Town's multi-hazard and responsiveness capability, funding availability will be a driving factor in determining what and when new mitigation strategies are implemented.

Table 6.3 displays new and ongoing mitigation strategies identified by the Planning Committee.

Table 6.3 Future Mitigation Actions & STAPLEE

New Mitigation Project	S	T	A	P	L	E	E	Total
Review floodplain ordinance for consistency with the latest OSI model ordinance (released in 2018) and to adopt the latest floodplain maps for the greater Piscataqua/Salmon Falls watershed (pending 2019-2020)	3	3	3	3	3	3	3	21
Continuation of Operations Plan including cyber events	3	3	3	3	3	3	3	21
Training of Town employees and officials to recognize common cyber threats	3	3	3	3	3	3	3	21
Ensure that all town facilities are equipped with in-line surge protectors	3	3	3	3	3	3	3	21
Investigate opportunities for regional collaboration for aquifer protection	2	3	3	2	3	3	3	19
Analysis of hydrant coverage and planning for repair, replacement, and improving coverage	3	3	3	3	3	3	3	21
Continue to develop the use of social media including facebook, twitter, eblast alerts for emergency notification and distribution of information during emergencies.	3	3	3	3	3	2 – small cost associated with upkeep	3	20*
Have more emergency information that deal with natural/manmade disasters as well as links to existing resources on website, once the new design is completed.	3	3	3	3	3	3	3	21*
Maintain transportation infrastructure by identifying and assessing potential road/culverts of concern and using the culvert inventory report produced by the Strafford Regional Planning Commission to prioritize replacement, repair, and upgrade schedules to mitigate flooding.	3	3	3	3	3	3	3	21*

Promote conservation of open space to separate areas from high-hazard wildfire areas.	2 – may lower tax base	3	3	3	3	3	3	20*
To deal with a flooding issue an undersized culvert replacement is needed on First NH Turnpike (Route 4). This project needs coordination with state NHDOT due to the road being a state road.	3	3	2	2 – DOT has jurisdiction, not town	2	1 – large cost	2 – possible environmental impacts during construction	15*
Purchase of portable message boards to display emergency notifications.	3	3	3	3	3	1 – potential large cost	3	19*
With the increase in fire load from past storms there is a need for a town-wide management plan for tree resources and track community vulnerability.	3	3	3	3	3	2 – potential cost for plan development	3	20*
A new public safety complex needs to be built to improve response times and adequate service for all hazards	3	3	3	3	3	1 – large cost	2 – possible minor environmental impacts	18*
Advocate for a Route 4 corridor study (potential funding in the Ten Year Plan beginning 2021) and provide local data and input to the planning process	3	3	3	3	3	3	3	21*
There is a need for secondary access to residents living on Gulf Road. Currently, the emergency response time is not sufficient.	3	3	3	3	3	1 – major cost for second access	2 – minor environmental impacts from installation	18*
* Descriptions of Ongoing and Deferred actions were updated to reflect current status and existing STAPLEE scores from the 2014 update were reaffirmed.								

Implementation Schedule for Prioritized Strategies

After reviewing the finalized STAPLEE numerical ratings, the Team prepared to develop the Implementation Plan (Table 21). To do this, the Team developed an implementation plan that outlined the following:

- ∴ Type of hazard
- ∴ Affected location
- ∴ Type of Activity
- ∴ Responsibility
- ∴ Funding
- ∴ Cost Effectiveness; and
- ∴ Timeframe

The following questions were asked in order to develop an implementation schedule for the identified priority mitigation strategies.

WHO? Who will lead the implementation efforts? Who will put together funding requests and applications?

WHEN? When will these actions be implemented, and in what order?

HOW? How will the community fund these projects? How will the community implement these projects? What resources will be needed to implement these projects?

In addition to the prioritized mitigation projects, Table 21, Implementation Plan, includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN).

Table 6.4 New and Ongoing Mitigation Strategies

New Mitigation Project	Type of Hazard	Affected Location	Type of Activity	Responsibility	Funding	Cost Effectiveness *Low = < $5,000* *Medium = $5,000 - $10,000* *High = > $10,000*	Timeframe **Ongoing/Continuous* *6 months - 1 year* *1 - 2 years* *2 - 5 years*
Review floodplain ordinance for consistency with the latest OSI model ordinance (released in 2018) and to adopt the latest floodplain maps for the greater Piscataqua/Salmon Falls watershed (pending 2019-2020)	Flooding	Town-Wide	Regulation	Planning Board	Operating Budget/ Volunteer Time	Low Cost = <$5,000	1-2 years
Continuation of Operations Plan including cyber events	Multiple, but emphasize including cyber threats	Town-Wide	Plan	Select Board/Town Administrator	Operating Budget	Low Cost = <$5,000	1-2 years
Training of Town employees and officials to recognize common cyber threats	Cyber Threats	Town Facilities	Training	Town Administrator/ Select Board/ Department Heads	Operating Budget	Low Cost = <$5,000	1-2 years
Ensure that all town facilities are equipped with in-line surge protectors	Storms/ solar flares	Town-Wide	Equipment	Town Administrator/ Select Board	Operating Budget	Low Cost = <$5,000	1-2 years
Investigate opportunities for regional collaboration for aquifer protection	Drought/ hazardous materials	Town-Wide	Studies and regulations	EMD/ Planning Board/ Conservation Commission	Grant Funding	High Cost = > $10,000	3-5 years

Analysis of hydrant coverage and replacement of out-of-order hydrants	Fire	Town-wide	Studies and Infrastructure	Fire Department	Operating Budget	High Cost = > $10,000	1-2 years
Enhance the use of social media including facebook, twitter, and eblast alerts for emergency information and distribution of mitigation techniques prior to an emergency	Multiple	Town-wide	Outreach and Education	EMD	No charge	Low Cost	1-2 years
Have more emergency information that deal with natural/manmade disasters as well as links to existing resources on website, once the new design is completed.	Multiple	Town-wide	Outreach and Education	EMD & Town Admin.	Town Funding & Volunteer	Medium	1-2 years
Maintain transportation infrastructure by identifying and assessing potential areas (road/culverts) of concern and using the culvert inventory report produced by the Strafford Regional Planning Commission to prioritize replacement, repair, and upgrade schedules to mitigate future flooding.	Flooding	Surface water crossings	Plan	Road Agent & Planning Board	No charge	Planning = Low Cost Culvert Replacement = High Cost	Continuous
Promote conservation of open space to separate areas from high-hazard wildfire areas.	Wildfire	Town-wide	Policies and Regulations	Conservation Commission	No charge	Promoting Conservation = Low Cost Town acquisition = High Cost	Continuous
To deal with a flooding issue an undersized culvert replacement is needed on First NH Turnpike (Route 4). This project needs coordination with state NHDOT due to the road being a state road.	Flooding	Old Turnpike Road and Route 4	Advocacy	NHDOT	State Funding	High Cost = > $5,000	1-2 years

Purchase of portable message boards to display emergency notifications and non-emergency outreach promoting mitigation strategies for common hazards	Multiple	Town-wide	Equipment, Outreach, and Communication	Select Board	Town Funding & EMPG Funding	High Cost	3-5 years
With the increase in fire load from past storms there is a need for a town-wide management plan for tree resources and track community vulnerability.	Wildfire	Wooded areas	Plan	Fire Department/ Conservation Commission	Town Funding & Grants	Medium	3-5 years
A new public safety complex needs to be built to improve response times and adequate service for all hazards	Multiple	Route 4	Infrastructure	Police & Fire Departments	Town Funding & Grants	High Cost = > $5,000	1-2 years
Advocate for a Route 4 corridor study (potential funding in the Ten Year Plan beginning 2021) and provide local data and input to the planning process	Multiple	Route 4	Plan	Planning Board & Highway Department	NHDOT & Local Funding	Study = High Cost Compiling local data and feedback = medium cost	3-5 years
Explore opportunities for a secondary access to Gulf Road area to improve emergency response times and provide an alternate evacuation route in the event that flooding, breach of the Gulf Road dam, or other hazards made the road impassable	Multiple, especially flood and dam breach	Gulf Road	Infrastructure	Board of Selectmen	CIP & Impact Fees	High Cost = > $5,000	3-5 years

Chapter 7: Monitoring, Evaluating, and Updating the Plan

Introduction

A good mitigation plan must allow for updates where and when necessary, particularly since communities may suffer budget cuts or experience personnel turnover during both the planning and implementation states. A good plan will incorporate periodic monitoring and evaluation mechanisms to allow for review of successes and failures or even just simple updates.

Multi-Hazard Plan Monitoring, Evaluation, and Updates

To track programs and update the mitigation strategies identified through this process, the Town will review the Plan annually and after a hazard event. Additionally, the Plan will undergo a formal review and update at least every five years and obtain FEMA approval for this update or any other major changes done in the Plan at any time. The Emergency Management Director is responsible for initiating the review and will consult with members of the Multi-Hazard Mitigation Planning Committee identified in this plan. The public will be encouraged to participate in any updates and will be given the opportunity to be engaged and provide feedback through such means as periodic presentations on the plan at town functions, annual questionnaires or surveys, and posting on social media/interactive websites. Public announcements will be made through advertisements in local papers, postings on the Town website, and posters disseminated throughout the Town. A formal public meeting will be held before reviews and updates are official.

Changes will be made to the Plan to accommodate projects that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities or funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, will be reviewed as well during the monitoring and update of the plan to determine feasibility of future implementation. In keeping with the process of adopting this Multi-Hazard Mitigation Plan, a public meeting to receive public comment on plan maintenance and updating will be held during the annual review period and before the final product is adopted by the administration. Chapter 8 contains a representation of a draft resolution for Northwood to use once a conditional approval is received from HSEM.

Integration with Other Plans

Previous iterations of the Multi-Hazard Mitigation Plan were used to supplement the Northwood Master Plan to identify key issues facing the town. The Planning Board is in the process of organizing an update to the master plan and will incorporate information on impacts to roads and other critical infrastructure from hazards in relevant master plan sections. Both the Multi-Hazard Mitigation Plan and Master Plan were also used during capital improvements planning updates. Information from the Town's Zoning Ordinance was utilized in the development of this Plan.

This Plan will only enhance mitigation if integrated with all other town plans and activities. Northwood will take the necessary steps to incorporate the mitigation strategies and other information contained in this plan with other town activities, plans and mechanisms, such as comprehensive land use planning, capital improvements planning, site plan regulations, and building codes to guide and control development in Northwood, when appropriate. The local government will refer to this Plan and the strategies identified when updating the Town's Master Plan, Capital Improvements Program, Zoning Ordinances and Regulations, and Emergency Operations Plan. The Select Board and the Multi-Hazard Mitigation Planning Committee will work with Town officials to incorporate elements of this Plan into

other planning mechanisms, when appropriate. In addition, the Town will review and make note of instances when this has been done and include it as part of their annual review of the Plan.

Chapter 8: Plan Adoption

Conditional Approval Letter from HSEM

Northwood, NH - Approvable Pending Adoption

Hazard Mitigation Planning <HazardMitigationPlanning@dos.nh.gov>
Thu 2/20/2020 12:48 PM

To: James Burdin <jburdin@strafford.org>; 'sbryer@northwoodnh.org' <sbryer@northwoodnh.org>; 'youngnorthwood@metrocast.net' <youngnorthwood@metrocast.net>
Cc: Welch, Whitney <Whitney.Welch@dos.nh.gov>; Marinaccio, Alexander <Alexander.Marinaccio@dos.nh.gov>

Good afternoon,

The Department of Safety, Division of Homeland Security & Emergency Management (HSEM) has completed its review of the Northwood, NH Hazard Mitigation Plan and found it approvable pending adoption. Congratulations on a job well done!

With this approval, the jurisdiction meets the local mitigation planning requirements under 44 CFR 201 **pending HSEM's receipt of electronic copies of the adoption documentation and the final plan**.

Acceptable electronic formats include Word or PDF files and must be submitted to us via email at HazardMitigationPlanning@dos.nh.gov. Upon HSEM's receipt of these documents, notification of formal approval will be issued, along with the final Checklist and Assessment.

The approved plan will be submitted to FEMA on the same day the community receives the formal approval notification from HSEM. FEMA will then issue a Letter of Formal Approval to HSEM for dissemination that will confirm the jurisdiction's eligibility to apply for mitigation grants administered by FEMA and identify related issues affecting eligibility, if any. If the plan is not adopted within one calendar year of HSEM's Approval Pending Adoption, the jurisdiction must update the entire plan and resubmit it for HSEM review. If you have questions or wish to discuss this determination further, please contact me at Kayla.Henderson@dos.nh.gov or 603-223-3650.

Thank you for submitting the Northwood, NH Hazard Mitigation Plan and again, congratulations on your successful community planning efforts.

Sincerely,

Kayla J. Henderson
NH Department of Safety – Division of Homeland Security & Emergency Management
Hazard Mitigation Planning

Hazard Mitigation Staff:
Kayla Henderson, State Hazard Mitigation Planner / Kayla.Henderson@dos.nh.gov / (603) 223 3650
Whitney Welch, Asst. Chief of Planning / Whitney.Welch@dos.nh.gov / (603) 223-3667

messages. He's trying to figure out what he can and can't do. She said other towns are stopping inspections so they're not entering homes. She said the Welfare officer had 6 calls last week and he's concerned about how to meet with people. She also said we're working on tracking COVID-19 expenditures. Chairman Kreider would like to set up a COVID subcommittee. Selectman Frye said we already did that where T.A. Thibodeau can authorize spending up to $2,500 and we put $20,000 into the fund. Chairman Kreider said that Selectman Hadley asked about an Easter Parade and he thinks the two departments: Recreation and Fire can work together for that, so he doesn't think the BOS need to make decisions for it. Selectwoman Boudreau said it's like the Santa Parade which coordinated with the rec and police department. She said you're in your cars so there should be no contact to have a concern with COVID-19. Selectman Frye said he's very comfortable with those departments making the decisions. Selectman Hadley was concerned about throwing candy and then people getting out and touching it, passing the virus. Selectman Frye said it's a drive and wave and people need this right now to have hope and fun but with social distancing. Selectman Frye said we haven't tackled continuity of government yet. The likelihood that one or all get sick. Bob Young thinks we should tackle this sooner than later. Chairman Kreider motioned that in the event the BOS are incapacitated, the remaining members may make decisions with those still present. Bob and the T.A. wanted to check with legal first. Bob said he knows something is going to come out about how to run governmental procedures during COVID-19. The board agreed that we should wait for legal advice and for the information that Bob spoke about to come out.

Hazard Mitigation Plan

James Burdin, our contracted Town Planner and he also works for the Strafford Regional Planning Commission spoke about the Hazard Mitigation Plan. He said this plan is paid by grant to SRPC from NH Homeland Security & Emergency Management. The plan finds ways to mitigate hazards that may attack the town, and also if they attack the town, ways to decrease the loss of life, property, etc. Having a Hazard Mitigation Plan makes the town eligible for funding through FEMA and NH Homeland Security & Emergency Management. The plan must be updated once every 5 years and we're up for our 5-year renewal. The plan needed to update old hazards and be consistent with the NH Homeland Security hazard plans also. We're currently in the adoption process with 3 steps. James will submit the draft he currently has once the BOS sign it and return to him the Certificate of Adoption. He said the final approval from the State is quick and we will receive a letter from FEMA approving our Hazard Mitigation Plan. He said the draft at any point is public.

MOTION: "To adopt the Hazard Mitigation Plan draft presented by James Burdin as written."

Motion: H. Kreider
Seconded: M. Frye
Discussion: Selectman Colby questioned correcting the old BOS names. James said that this has to be recorded this way because of when it was written and there will be more turnover in the next 5 years, so the names are correct for when it was written. This will be good for 5 years. James says it's okay to sign separately and send to both Bob and James.
Motion Passes: 5 – Yes, 0 – No

James said he is in contact with FEMA and USEDA about the economic recovery due to COVID-19. He is going to be compiling any information qualitative/quantitative about how the business community is/was affected by COVID-19. Chairman Kreider would like a COVID-19 tracking on the next agenda.

CITIZEN'S FORUM: None

CERTIFICATE OF ADOPTION

Town of Northwood New Hampshire
Board of Selectmen
A Resolution Adopting the Northwood, NH Multi-Hazard Mitigation Plan Update 2020

Conditionally Approved: February 20, 2020

WHEREAS, the Town of Northwood authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and received funding from the NH Office of Homeland Security and Emergency Management under a Pre-Disaster Mitigation (PDM) grant and assistance from Strafford Regional Planning Commission in the preparation of the Northwood, NH Multi-Hazard Mitigation Plan Update 2020; and

WHEREAS, several public planning meetings were held between March 14, 2019 and June 27, 2019 regarding the development and review of the Northwood, NH Multi-Hazard Mitigation Plan Update 2020; and

WHEREAS, the Northwood, NH Multi-Hazard Mitigation Plan Update 2020 contains several potential future projects to mitigate hazard damage in the Town of Northwood; and

WHEREAS, a duly-noticed public meeting was held by the Northwood Board of Selectmen on March 31, 2020 to formally approve and adopt the Northwood, NH Multi-Hazard Mitigation Plan Update 2020.

NOW, THEREFORE BE IT RESOLVED that the Northwood Board of Selectmen adopts the Northwood, NH Multi-Hazard Mitigation Plan Update 2020.

ADOPTED AND SIGNED this 31 day of MAR, 2020.

Northwood Board of Selectmen, Chair

Northwood Board of Selectmen

Northwood Board of Selectmen

Northwood Board of Selectmen

Northwood Board of Selectmen

WHEREAS, the Town of Northwood authorizes respons
and/or agencies to execute their responsibilities demonstı
and received funding from the NH Office of Homela
Emergency Management under a Pre-Disaster Mitigation
assistance from Strafford Regional Planning Comı
preparation of the Northwood, NH Multi-Hazard Mitigat
2020; and

WHEREAS, several public planning meetings were held
14, 2019 and June 27, 2019 regarding the development a
Northwood, NH Multi-Hazard Mitigation Plan Update 20

WHEREAS, the Northwood, NH Multi-Hazard Mitigat
2020 contains several potential future projects to mitigat
in the Town of Northwood; and

WHEREAS, a duly-noticed public meeting was held by
Board of Selectmen on March 31, 2020 to formally appro
Northwood, NH Multi-Hazard Mitigation Plan Update 20

NOW, THEREFORE BE IT RESOLVED that the Nort
Selectmen adopts the Northwood, NH Multi-Hazard
Update 2020.

ADOPTED AND SIGNED this day of _____

_____

Northwood Board of Selectmen,
Chair

_____

Northwood Board of Select

_____

Northwood Board of Selectmen

_____

Northwood Board of Selectmen

Beth Boudreau

_____

Northwood Board of Selectmen

CERTIFICATE OF ADOPTION

Town of Northwood New Hampshire
Board of Selectmen
A Resolution Adopting the Northwood, NH Multi-Hazard Mitigation Plan Update 2020

Conditionally Approved: February 20, 2020

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WHEREAS, the Northwood, NH Multi-Hazard Mitigation Plan Update 2020 contains several potential future projects to mitigate hazard damage in the Town of Northwood; and

WHEREAS, a duly-noticed public meeting was held by the Northwood Board of Selectmen on March 31, 2020 to formally approve and adopt the Northwood, NH Multi-Hazard Mitigation Plan Update 2020.

NOW, THEREFORE BE IT RESOLVED that the Northwood Board of Selectmen adopts the Northwood, NH Multi-Hazard Mitigation Plan Update 2020.

ADOPTED AND SIGNED this day of March 31, 2020.

_____
Northwood Board of Selectmen, Chair

_____
Northwood Board of Selectmen

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Northwood Board of Selectmen

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Northwood Board of Selectmen

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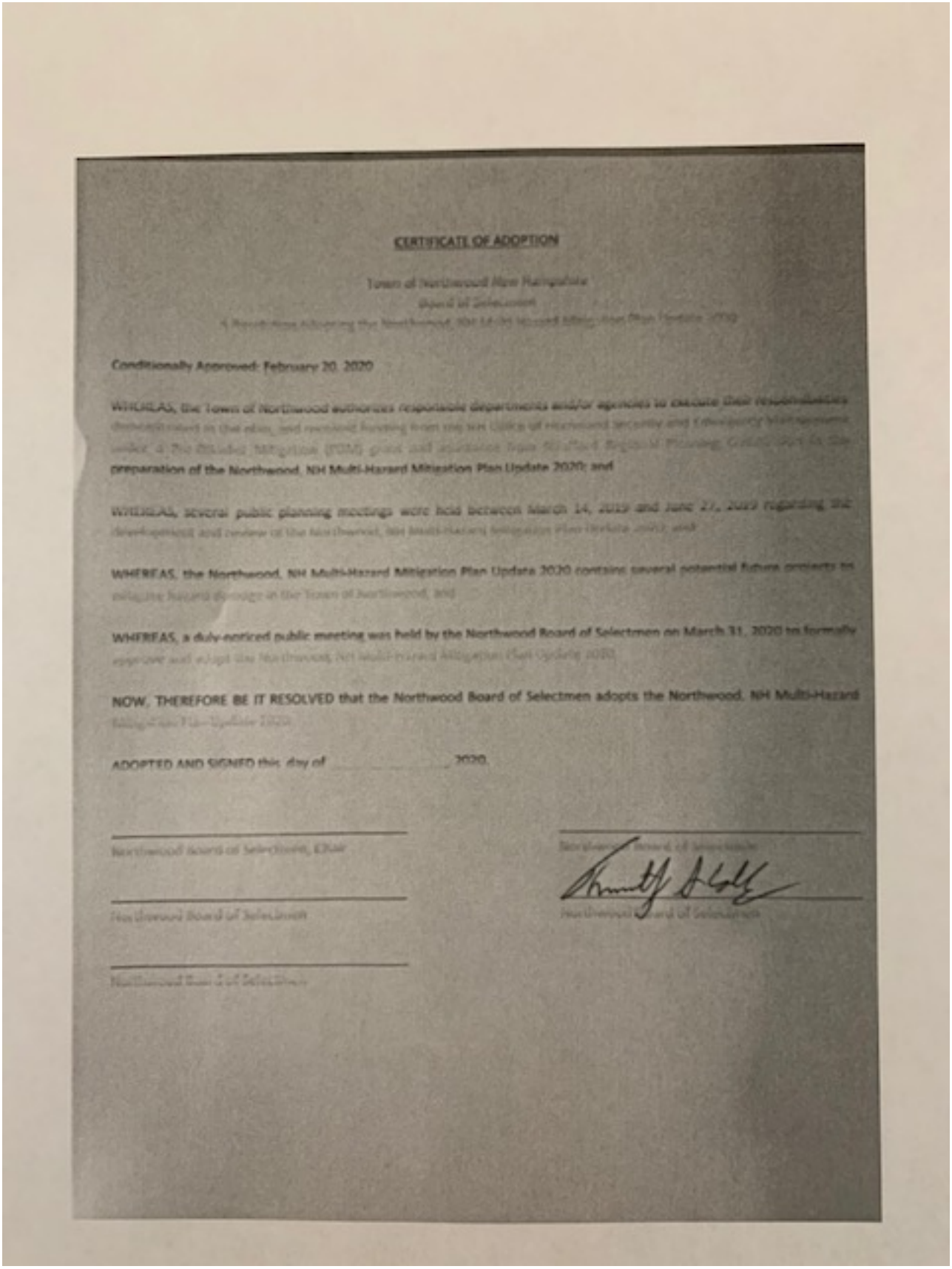
Northwood Board of Selectmen



CERTIFICATE OF ADOPTION

Conditionally Approved: February 20, 2020

preparation of the Northwood, NH Multi-Hazard Mitigation Plan Update 2020; and

NOW, THEREFORE BE IT RESOLVED that the Northwood Board of Selectmen adopts the Northwood, NH Multi-Hazard

ADOPTED AND SIGNED this day of 2020.

CERTIFICATE OF ADOPTION

Town of Northwood New Hampshire
Board of Selectmen
A Resolution Adopting the Northwood, NH Multi-Hazard Mitigation Plan Update 2020

Conditionally Approved: February 20, 2020

WHEREAS, the Town of Northwood authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and received funding from the NH Office of Homeland Security and Emergency Management under a Pre-Disaster Mitigation (PDM) grant and assistance from Strafford Regional Planning Commission in the preparation of the Northwood, NH Multi-Hazard Mitigation Plan Update 2020; and

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WHEREAS, the Northwood, NH Multi-Hazard Mitigation Plan Update 2020 contains several potential future projects to mitigate hazard damage in the Town of Northwood; and

WHEREAS, a duly-noticed public meeting was held by the Northwood Board of Selectmen on March 31, 2020 to formally approve and adopt the Northwood, NH Multi-Hazard Mitigation Plan Update 2020.

NOW, THEREFORE BE IT RESOLVED that the Northwood Board of Selectmen adopts the Northwood, NH Multi-Hazard Mitigation Plan Update 2020.

ADOPTED AND SIGNED this day of _____, 2020.

_____
Northwood Board of Selectmen, Chair

_____
Northwood Board of Selectmen

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Northwood Board of Selectmen

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Northwood Board of Selectmen

_____
Northwood Board of Selectmen

Final Approval Letter from FEMA

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

FEMA

Meghan Wells, State Hazard Mitigation Planner
New Hampshire Department of Safety, Homeland Security and Emergency Management
33 Hazen Drive
Concord, New Hampshire 03303

Dear Ms. Wells:

As outlined in the FEMA-State Agreement for FEMA-DR-4457, your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. Our Agency has been notified that your office completed its review of the Multi-Hazard Mitigation Plan Update 2020 Town of Northwood, NH and approved it effective **July 27, 2020** through **July 26, 2025** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

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

The plan must be updated and resubmitted to the FEMA Region I Mitigation Division for approval every five years to remain eligible for FEMA mitigation grant funding.

Thank you for your continued commitment and dedication to risk reduction demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please contact Melissa Surette at (617) 956-7559 or Melissa.Surette@fema.dhs.gov.

Sincerely,

PAUL F FORD Digitally signed by PAUL F FORD
Date: 2020.07.28 09:13:12 -04'00'

Captain W. Russ Webster, USCG (Ret.), CEM
Regional Administrator
FEMA Region I

WRW:ms

cc: Fallon Reed, Chief of Planning, New Hampshire

Appendices

Appendix A: Bibliography

Appendix B: Planning Process Documentation

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

Appendix D: Technical and Financial Assistance for All-Hazard Mitigation
- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

Appendix A: Bibliography

Documents

- Local Mitigation Plan Review Guide, FEMA, October 1, 2011
- Multi-Hazard Mitigation Plans
    - Town of Northwood, 2014
    - Town of Nottingham, 2017
    - Town of Durham, 2017
    - City of Rochester, 2018
- State of New Hampshire Multi-Hazard Mitigation Plan (2013) - State Hazard Mitigation Goals
- Disaster Mitigation Act (DMA) of 2000, Section 101, b1 & b2 and Section 322a http://www.fema.gov/library/viewRecord.do?id=1935
- Economic & Labor Market Information Bureau, NH Employment Security, 2015; Census 2010 and Revenue Information
- NCDC [National Climatic Data Center, National Oceanic and Atmospheric Administration]. 2017. Storm Events

Appendix B: Planning Process Documentation

Agendas

Town of Northwood, New Hampshire

Hazard Mitigation Committee Meeting #1

March 14, 2019
4:30PM – 6:15PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Agenda

1. Introductions
2. Update process, in-kind match documentation, and the steps towards successful adoption
3. Review 2014 Excerpt – Critical Facilities List (Handout)
4. Review 2014 Excerpt – Past Mitigation Programs and Strategies (Excel Sheet)
    a. What is the current status?
    b. How effective have these actions and strategies been?
5. Review 2014 hazard types (Handout)
6. Review Chapter 4: National Flood Insurance Program (Handout)
7. Review Chapter 2: Community Profile (if time)
8. Adjourn

Town of Northwood, New Hampshire

Hazard Mitigation Committee Meeting #2

April 11, 2019
4:30PM – 6:30PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Agenda

1. Introductions
2. Review Chapter 4: National Flood Insurance Program (Handout)
3. Review Chapter 5: Hazard Descriptions (Handout)
4. Adjourn

Town of Northwood, New Hampshire

Hazard Mitigation Committee Meeting #3

May 9, 2019
4:30PM – 6:30PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Agenda

1. Introductions
2. Hazard description/rating for Cyber Threats and Space Weather
3. Brainstorm New Actions/Review Updated Profile for ongoing actions
4. STAPLEE for new actions
5. Adjourn

Town of Northwood, New Hampshire

Hazard Mitigation Committee Meeting #4

June 27, 2019
4:30PM – 6:30PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Agenda

1. Introductions
2. Brainstorm any final New Actions/Review Updated Profile for ongoing actions
3. STAPLEE for new actions/confirm STAPLEE for prior actions
4. Draft comments and next steps
5. Adjourn

Town of Northwood, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #1

March 14, 2019
4:30PM – 6:15PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
James Bundin	SRPC	JBundin@strafforday	—	Yes/No
Peter Elliott	Highway dept			Yes/No
Lee Baldwin	Planning Board	craftenjama@gmail.com		Yes/No
Greg LeBlanc	Deputy Chief F/D	gleblanc@townofnorthwood.nh.us		Yes/No
Betsy Colburn	Fire, School Town Historian	emsbac67@metrocast.net		Yes/No
Bob Young	EMD			Yes/No
Glen Drolet	Police Chief ~~Deputy~~ EMD	gdrolet@northwoodpolice.org		Yes/No
Shane Wells	Lieutenant	swells@northwoodpolice.org		Yes/No
BOB STROBEL	PLANNING BOARD	RSTROBEL@METROCAST.NET		Yes/No
Heather Thibodeau	TA			Yes/No
Linda Smith	Land Use	lsmith@northwoodnh.org		Yes/No
				Yes/No
				Yes/No
				Yes/No

Town of Northwood, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #2

April 11, 2019
4:30PM – 6:30PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
Wini Young	Northwood Cons Com	winiyoung@aol.com	1 hr	Yes/No
[illegible]	Northwood Planning Bd	craftenjunn@gmail.com	1 hr	Yes/No
Peter Elliott	Highway Dept			Yes/No
Betsy Colburn	Town School, Bus, Fire	emsbackup@metrocast.net	1 hr	Yes/No
Kayla Henderson	NH HSEM State Hazard Mitigation Planner	Kayla.Henderson@dos.nh.gov		Yes/No
Bob Young	Northwood EMD	youngnorthwood1@metrocast.net	1 hr	Yes/No
[illegible]	PLANNING BOARD	[illegible]	1 hr	Yes/No
~~Heather Thibodeau~~ Heather Thibodeau	Heather Thibodeau		2 hr	Yes/No
Linda Smith	Land Use Administrator	lsmith@northwoodnh.org	1 hr	Yes/No
Shane Wells	Northwood Police	swells@northwoodpolice.org	30min	Yes/No
Greg LeBlanc	Northwood Fire	gleblanc@[illegible].us	1 hr.	Yes/No
James Bunding	SRPC	JBunding@[illegible].org	—	Yes/No
				Yes/No
				Yes/No

Town of Northwood, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #3

May 9, 2019
4:30PM – 6:30PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
Peter Elliott	Highway Dept		1 hr	Yes/No
Greg LeBlanc	Fire Dept		1 hr.	Yes/No
Bob Young	EMD		6 hrs.	Yes/No
Lee Baldwin	planning board		1 hr	Yes/No
Shelley Frost	Conservation Commission		—	Yes/No
ROB STROUT	PLANNING BOARD		1 HR	Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No

Town of Northwood, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #4

June 27, 2019
4:30PM – 6:30PM

Northwood Town Hall
818 First NH Turnpike
Northwood, NH 03261

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
James Burdic	SRPC	———	———	Yes/No
Peter Elliott	Highway		1 hr	Yes/(No)
Scott R Borgia	Selectman			Yes/(No)
Bob Young	EMD		6 hrs	Yes/(No)
Linda Smith	Land Use Dept.		2 hrs	Yes/(No)
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

I. RIVERINE MITIGATION

A. Prevention

Prevention measures are intended to keep the problem from occurring in the first place, and/or keep it from getting worse. Future development should not increase flood damage. Building, zoning, planning, and/or code enforcement personnel usually administer preventative measures.

1. **Planning and Zoning[36] -** Land use plans are put in place to guide future development, recommending where - and where not - development should occur and where it should not. Sensitive and vulnerable lands can be designated for uses that would not be incompatible with occasional flood events - such as parks or wildlife refugees. A Capital Improvements Program (CIP) can recommend the setting aside of funds for public acquisition of these designated lands. The zoning ordinance can regulate development in these sensitive areas by limiting or preventing some or all development - for example, by designating floodplain overlay, conservation, or agricultural districts.

2. **Open Space Preservation -** Preserving open space is the best way to prevent flooding and flood damage. Open space preservation should not, however, be limited to the floodplain, since other areas within the watershed may contribute to controlling the runoff that exacerbates flooding. Land Use and Capital Improvement Plans should identify areas to be preserved by acquisition and other means, such as purchasing easements. Aside from outright purchase, open space can also be protected through maintenance agreements with the landowners, or by requiring developers to dedicate land for flood flow, drainage and storage.

3. **Floodplain Development Regulations -** Floodplain development regulations typically do not prohibit development in the special flood hazard area, but they do impose construction standards on what is built there. The intent is to protect roads and structures from flood damage and to prevent the development from aggravating the flood potential. Floodplain development regulations are generally incorporated into subdivision regulations, building codes, and floodplain ordinances.
    a. **Subdivision Regulations:** These regulations govern how land will be divided into separate lots or sites. They should require that any flood hazard areas be shown on the plat, and that every lot has a buildable area that is above the base flood elevation.
    b. **Building Codes**: Standards can be incorporated into building codes that address flood proofing for all new and improved or repaired buildings.
    c. **Floodplain Ordinances:** Communities that participate in the National Flood Insurance Program are required to adopt the minimum floodplain management regulations, as developed by FEMA. The regulations set minimum standards for subdivision regulations and building codes. Communities may adopt more stringent standards than those set forth by FEMA.
4. **Stormwater Management** - Development outside of a floodplain can contribute significantly to flooding by covering impervious surfaces, which increases storm water runoff. Storm water management is usually addressed in subdivision regulations. Developers are typically required to build retention or detention basins to

[36] All zoning should be carefully reviewed on a consistent basis by municipal officials to make sure guidelines are up-to-date and towns are acting in accordance with best management practices.

minimize any increase in runoff caused by new or expanded impervious surfaces, or new drainage systems. Generally, there is a prohibition against storm water leaving the site at a rate higher than it did before the development. One technique is to use wet basins as part of the landscaping plan of a development. It might even be possible to site these basins based on a watershed analysis. Since detention only controls the runoff rates and not volumes, other measures must be employed for storm water infiltration - for example, swales, infiltration trenches, vegetative filter strips, and permeable paving blocks.

5. **Drainage System Maintenance -** Ongoing maintenance of channel and detention basins is necessary if these facilities are to function effectively and efficiently over time. A maintenance program should include regulations that prevent dumping in or altering water courses or storage basins; regrading and filling should also be regulated. Any maintenance program should include a public education component, so that the public becomes aware of the reasons for the regulations. Many people do not realize the consequences of filling in a ditch or wetland, or regrading.

B. Property Protection

Property protection measures are used to modify buildings subject to flood damage, rather than to keep floodwaters away. These may be less expensive to implement, as they are often carried out on a cost-sharing basis. In addition, many of these measures do not affect a building's appearance or use, which makes them particularly suitable for historical sites and landmarks.

1. **Relocation -** Moving structures out of the floodplain is the surest and safest way to protect against damage. Relocation is expensive, however, so this approach will probably not be used except in extreme circumstances. Communities that have areas subject to severe storm surges, ice jams, etc. might want to consider establishing a relocation program, incorporating available assistance.

2. **Acquisition -** Acquisition by a governmental entity of land in a floodplain serves two main purposes: 1) it ensures that the problem of structures in the floodplain will be addressed; and 2) it has the potential to convert problem areas into community assets, with accompanying environmental benefits. Acquisition is more cost effective than relocation in those areas that are subject to storm surges, ice jams, or flash flooding. Acquisition, followed by demolition, is the most appropriate strategy for those buildings that are simply too expensive to move, as well as for dilapidated structures that are not worth saving or protecting. Acquisition and subsequent relocation can be expensive, however, there are government grants and loans that can be applied toward such efforts.

3. **Building Elevation -** Elevating a building above the base flood elevation is the best on-site protection strategy. The building could be raised to allow water to run underneath it, or fill could be brought in to elevate the site on which the building sits. This approach is cheaper than relocation, and tends to be less disruptive to a neighborhood. Elevation is required by law for new and substantially improved residences in a floodplain, and is commonly practiced in flood hazard areas nationwide.

4. **Floodproofing -** If a building cannot be relocated or elevated, it may be floodproofed. This approach works well in areas of low flood threat. Floodproofing can be accomplished through barriers to flooding, or by treatment to the structure itself.
    a. **Barriers:** Levees, floodwalls and berms can keep floodwaters from reaching a building. These are useful, however, only in areas subject to shallow flooding.
    b. **Dry Floodproofing:** This method seals a building against the water by coating the walls with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, etc. are closed either permanently with removable shields or with sandbags.

c. **Wet Floodproofing:** This technique is usually considered a last resort measure, since water is intentionally allowed into the building in order to minimize pressure on the structure. Approaches range from moving valuable items to higher floors to rebuilding the floodable area. An advantage over other approaches is that simply by moving household goods out of the range of floodwaters, thousands of dollars can be saved in damages.

5. **Sewer Backup Protection -** Storm water overloads can cause backup into basements through sanitary sewer lines. Houses that have any kind of connection to a sanitary sewer system - whether it is downspouts, footing drain tile, and/or sump pumps, can be flooded during a heavy rain event. To prevent this, there should be no such connections to the system, and all rain and ground water should be directed onto the ground, away from the building. Other protections include:
    a. Floor drain plugs and floor drain standpipe, which keep water from flowing out of the lowest opening in the house.
    b. Overhead sewer - keeps water in the sewer line during a backup.
    c. Backup valve - allows sewage to flow out while preventing backups from flowing into the house.

6. **Insurance** - Above and beyond standard homeowner insurance, there is other coverage a homeowner can purchase to protect against flood hazard. Two of the most common are National Flood Insurance and basement backup insurance.
    a. ***National Flood Insurance:*** When a community participates in the National Flood Insurance Program, any local insurance agent is able to sell separate flood insurance policies under rules and rates set by FEMA. Rates do not change after claims are paid because they are set on a national basis.
    b. ***Basement Backup Insurance:*** National Flood Insurance offers an additional deductible for seepage and sewer backup, provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet. Most exclude damage from surface flooding that would be covered by the NFIP.

C. Natural Resource Protection

Preserving or restoring natural areas or the natural functions of floodplain and watershed areas provide the benefits of eliminating or minimizing losses from floods, as well as improving water quality and wildlife habitats. Parks, recreation, or conservation agencies usually implement such activities. Protection can also be provided through various zoning measures that are specifically designed to protect natural resources.

1. **Wetlands Protection** - Wetlands are capable of storing large amounts of floodwaters, slowing and reducing downstream flows, and filtering the water. Any development that is proposed in a wetland is regulated by either federal and/or state agencies. Depending on the location, the project might fall under the jurisdiction of the U.S. Army Corps of Engineers, which in turn, calls upon several other agencies to review the proposal. In New Hampshire, the N.H. Wetlands Board must approve any project that impacts a wetland. Many communities in New Hampshire also have local wetland ordinances.

   Generally, the goal is to protect wetlands by preventing development that would adversely affect them. Mitigation techniques are often employed, which might consist of creating a wetland on another site to replace what would be lost through the development. This is not an ideal practice since it takes many years for a new wetland to achieve the same level of quality as an existing one, if it can at all.

2. **Erosion and Sedimentation Control -** Controlling erosion and sediment runoff during construction and on farmland is important, since eroding soil will typically end up in downstream waterways. Because sediment tends to settle where the water flow is slower, it will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters.

3. **Best Management Practices -** Best Management Practices (BMPs) are measures that reduce non-point source pollutants that enter waterways. Non-point source pollutants are carried by storm water to waterways, and include such things as lawn fertilizers, pesticides, farm chemicals, and oils from street surfaces and industrial sites. BMPs can be incorporated into many aspects of new developments and ongoing land use practices. In New Hampshire, the Department of Environmental Services has developed Best Management Practices for a range of activities, from farming to earth excavations.

D. Emergency Services

Emergency services protect people during and after a flood. Many communities in New Hampshire have emergency management programs in place, administered by an emergency management director (very often the local police or fire chief).

1. **Flood Warning -** On large rivers, the National Weather Service handles early recognition. Communities on smaller rivers must develop their own warning systems. Warnings may be disseminated in a variety of ways, such as sirens, radio, television, mobile public address systems, or door-to-door contact. It seems that multiple or redundant systems are the most effective, giving people more than one opportunity to be warned.
2. **Flood Response -** Flood response refers to actions that are designed to prevent or reduce damage or injury, once a flood threat is recognized. Such actions and the appropriate parties include:
   a. Activating the emergency operations center (emergency director)
   b. Sandbagging designated areas (Highway Department)
   c. Closing streets and bridges (police department)
   d. Shutting off power to threatened areas (public service)
   e. Releasing children from school (school district)

f. Ordering an evacuation (emergency director)
g. Opening evacuation shelters (churches, schools, Red Cross, municipal facilities)

These actions should be part of a flood response plan, which should be developed in coordination with the persons and agencies that share the responsibilities. Drills and exercises should be conducted so that the key participants know what they are supposed to do.

3. **Critical Facilities Protection -** Protecting critical facilities is vital, since expending efforts on these facilities can draw workers and resources away from protecting other parts of town. Critical facilities fall into two categories:
    a. **Buildings or locations vital to the flood response effort:**
        i. Emergency operations centers
        ii. Police and fire stations
        iii. Highway garages
        iv. Selected roads and bridges
        v. Evacuation routes
    b. **Buildings or locations that, if flooded, would create disasters:**
        i. Hazardous materials facilities
        ii. Schools

All such facilities should have their own flood response plan that is coordinated with the community's plan. Schools will typically be required by the state to have emergency response plans in place.

4. **Health and Safety Maintenance -** The flood response plan should identify appropriate measures to prevent danger to health and safety. Such measures include:
    a. Patrolling evacuated areas to prevent looting
    b. Vaccinating residents for tetanus
    c. Clearing streets
    d. Cleaning up debris

The Plan should also identify which agencies will be responsible for carrying out the identified measures. A public information program can be helpful to educate residents on the benefits of taking health and safety precautions.

E. Structural Projects

Structural projects are used to prevent floodwaters from reaching properties. These are all man-made structures, and can be grouped into the six types discussed below. The shortcomings of structural approaches are:

- Can be very expensive
- Disturb the land, disrupt natural water flows, & destroy natural habitats.
- Are built to an anticipated flood event, and may be exceeded by a greater-than expected flood
- Can create a false sense of security.

1. **Diversions -** A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the stream spills over the diversion channel or tunnel, which carries the excess water to the receiving lake or river. Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the flood prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography

and land use are not favorable, a more expensive tunnel is needed. In either case, care must be taken to ensure that the diversion does not create a flooding problem somewhere else.

2. **Levees/Floodwalls -** Probably the best known structural flood control measure is either a levee (a barrier of earth) or a floodwall made of steel or concrete erected between the watercourse and the land. If space is a consideration, floodwalls are typically used, since levees need more space. Levees and floodwalls should be set back out of the floodway, so that they will not divert floodwater onto other properties.

3. **Reservoirs -** Reservoirs control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate the river downstream can handle. Reservoirs are suitable for protecting existing development, and they may be the only flood control measure that can protect development close to a watercourse. They are most efficient in deeper valleys or on smaller rivers where there is less water to store. Reservoirs might consist of man-made holes dug to hold the approximate amount of floodwaters, or even abandoned quarries. As with other structural projects, reservoirs:
    a. are expensive
    b. occupy a lot of land
    c. require periodic maintenance
    d. may fail to prevent damage from floods that exceed their design levels
    e. may eliminate the natural and beneficial functions of the floodplain.

4. **Channel Modifications -** Channel modifications include making a channel wider, deeper, smoother, or straighter. These techniques will result in more water being carried away, but, as with other techniques mentioned, it is important to ensure that the modifications do not create or increase a flooding problem downstream.

5. **Dredging:** Dredging is often cost-prohibitive because the dredged material must be disposed of in another location; the stream will usually fill back in with sediment. Dredging is usually undertaken only on larger rivers, and then only to maintain a navigation channel.

6. **Drainage Modifications:** These include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainage ways may be safer or more attractive. These approaches are usually designed to carry the runoff from smaller, more frequent storms.

7. **Storm Sewers -** Mitigation techniques for storm sewers include installing new sewers, enlarging small pipes, street improvements, and preventing back flow. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding. In many developments, streets are used as part of the drainage system, to carry or hold water from larger, less frequent storms. The streets collect runoff and convey it to a receiving sewer, ditch, or stream. Allowing water to stand in the streets and then draining it slowly can be a more effective and less expensive measure than enlarging sewers and ditches.

F. Public Information

Public information activities are intended to advise property owners, potential property owners, and visitors about the particular hazards associated with a property, ways to protect people and property from these hazards, and the natural and beneficial functions of a floodplain.

1. **Map Information -** Flood maps developed by FEMA outline the boundaries of the flood hazard areas. These maps can be used by anyone interested in a particular property to determine if it is flood-prone. These maps are

available from FEMA, the NH Homeland Security and Emergency Management (HSEM), the NH Office of Strategic Initiatives (OSI), or your regional planning commission.

2. **Outreach Projects -** Outreach projects are proactive; they give the public information even if they have not asked for it. Outreach projects are designed to encourage people to seek out more information and take steps to protect themselves and their properties. Examples of outreach activities include:
    a. Presentations at meetings of neighborhood groups
    b. Mass mailings or newsletters to all residents
    c. Notices directed to floodplain residents
    d. Displays in public buildings, malls, etc.
    e. Newspaper articles and special sections
    f. Radio and TV news releases and interview shows
    g. A local flood proofing video for cable TV programs and to loan to organizations
    h. A detailed property owner handbook tailored for local conditions. Research has shown that outreach programs work, although awareness is not enough. People need to know what they can do about the hazards, so projects should include information on protection measures. Research also shows that locally designed and run programs are much more effective than national advertising.
3. **Real Estate Disclosure -** Disclosure of information regarding flood-prone properties is important if potential buyers are to be in a position to mitigate damage. Federally regulated lending institutions are required to advise applicants that a property is in the floodplain. However, this requirement needs to be met only five days prior to closing, and by that time, the applicant is typically committed to the purchase. State laws and local real estate practice can help by making this information available to prospective buyers early in the process.

4. **Library -** Your local library can serve as a repository for pertinent information on flooding and flood protection. Some libraries also maintain their own public information campaigns, augmenting the activities of the various governmental agencies involved in flood mitigation.

5. **Technical Assistance -** Certain types of technical assistance are available from the NFIP Coordinator, FEMA, and the Natural Resources Conservation District. Community officials can also set up a service delivery program to provide one-on-one sessions with property owners. An example of technical assistance is the *flood audit*, in which a specialist visits a property. Following the visit, the owner is provided with a written report detailing the past and potential flood depths and recommending alternative protection measures.

6. **Environmental Education -** Education can be a great mitigating tool if people can learn what not to do before damage occurs. The sooner the education begins the better. Environmental education programs for children can be taught in the schools, park and recreation departments, conservation associations, or youth organizations. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river. Education programs do not have to be limited to children. Adults can benefit from knowledge of flooding and mitigation measures; decision makers, armed with this knowledge, can make a difference in their communities
    .

II. EARTHQUAKES

A. Preventive

1. Planning/zoning to keep critical facilities away from fault lines
2. Planning, zoning and building codes to avoid areas below steep slopes or soils subject to liquefaction
3. Building codes to prohibit loose masonry overhangs, etc.

B. Property Protection

1. Acquire and clear hazard areas
2. Retrofitting to add braces, remove overhangs
3. Apply Mylar to windows and glass surfaces to protect from shattering glass
4. Tie down major appliances, provide flexible utility connections
5. Earthquake insurance riders

C. Emergency Services

1. Earthquake response plans to account for secondary problems, such as fires and hazardous material spills

D. Structural Projects

1. Slope stabilization

III. DAM FAILURE

A. Preventive

1. Dam failure inundation maps
2. Planning/zoning/open space preservation to keep area clear
3. Building codes with flood elevation based on dam failure
4. Dam safety inspections
5. Draining the reservoir when conditions appear unsafe

B. Property Protection

1. Acquisition of buildings in the path of a dam breach flood
2. Flood insurance

C. Emergency Services

1. Dam condition monitoring
2. Warning and evacuation plans based on dam failure

D. Structural Projects

1. Dam improvements, spillway enlargements
2. Remove unsafe dams

IV. WILDFIRES

A. Preventive

1. Zoning districts to reflect fire risk zones
2. Planning and zoning to restrict development in areas near fire protection and water resources
3. Requiring new subdivisions to space buildings, provide firebreaks, on-site water storage, wide roads, multiple accesses
4. Building code standards for roof materials and spark arrestors
5. Maintenance programs to clear dead and dry brush, trees
6. Regulation on open fires

B. Property Protection

1. Retrofitting of roofs and adding spark arrestors
2. Landscaping to keep bushes and trees away from structures

3. Insurance rates based on distance from fire protection

C. Natural Resource Protection

1. Prohibit development in high-risk areas

D. Emergency Services

1. Fire Fighting

V. WINTER STORMS

A. Prevention

1. Building code standards for light frame construction, especially for wind-resistant roofs

B. Property Protection

1. Storm shutters and windows
2. Hurricane straps on roofs and overhangs
3. Seal outside and inside of storm windows and check seals in spring and fall
4. Family and/or company severe weather action plan & drills:
    a. include a NOAA Weather Radio
    b. designate a shelter area or location
    c. keep a disaster supply kit, including stored food and water
    d. keep snow removal equipment in good repair; have extra shovels, sand, rock, salt and gas
    e. know how to turn off water, gas, and electricity at home or work

C. Natural Resource Protection

1. Maintenance program for trimming trees and shrubs

D. Emergency Services

1. Early warning systems/NOAA Weather Radio
2. Evacuation plans

Appendix D: Technical & Financial Assistance for All-Hazard Mitigation

FEMA's Hazard Mitigation Assistance (HMA) grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs[37]:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

FEMA's HMA grants are provided to eligible Applicants (States/Tribes/Territories) that, in turn, provide sub-grants to local governments and communities. The Applicant selects and prioritizes subapplications developed and submitted to them by subapplicants. These subapplications are submitted to FEMA for consideration of funding. Prospective subapplicants should consult the office designated as their Applicant for further information regarding specific program and application requirements. Contact information for the FEMA Regional Offices and State Hazard Mitigation Officers is available on the FEMA website, www.fema.gov.

HMA Grant Programs

The HMA grant programs provide funding opportunities for pre- and post-disaster mitigation. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to Natural Hazards. Brief descriptions of the HMA grant programs can be found below. For more information on the individual programs, or to see information related to a specific Fiscal Year, please click on one of the program links.

A. Hazard Mitigation Grant Program (HMGP)

HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.

What is the Hazard Mitigation Grant Program?

The Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. Authorized under Section 404 of the Stafford Act and administered by FEMA, HMGP was created to reduce the loss of life and property due to natural disasters. The program enables mitigation measures to be implemented during the immediate recovery from a disaster.

Who is eligible to apply?

Hazard Mitigation Grant Program funding is only available to applicants that reside within a presidentially declared disaster area. Eligible applicants are:

- State and local governments
- Indian tribes or other tribal organizations
- Certain non-profit organizations

[37] Information in Appendix E is taken from the following website and links to specific programs unless otherwise noted; http://www.fema.gov/government/grant/hma/index.shtm

Individual homeowners and businesses may not apply directly to the program; however a community may apply on their behalf.

How are potential projects selected and identified?
The State's administrative plan governs how projects are selected for funding. However, proposed projects must meet certain minimum criteria. These criteria are designed to ensure that the most cost-effective and appropriate projects are selected for funding. Both the law and the regulations require that the projects are part of an overall mitigation strategy for the disaster area.

The State prioritizes and selects project applications developed and submitted by local jurisdictions. The State forwards applications consistent with State mitigation planning objectives to FEMA for eligibility review. Funding for this grant program is limited and States and local communities must make difficult decisions as to the most effective use of grant funds.

For more information on the **Hazard Mitigation Grant Program (HMGP),** go to:
http://www.fema.gov/government/grant/hmgp/index.shtm

B. Pre-Disaster Mitigation (PDM)
PDM provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from actual disaster declarations.

Program Overview
The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event.

Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.

C. Flood Mitigation Assistance (FMA)
FMA provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program.

Program Overview

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP).

FEMA provides FMA funds to assist States and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program.

Types of FMA Grants

Three types of FMA grants are available to States and communities:

- Planning Grants to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grants
- Project Grants to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.
- Technical Assistance Grants for the State to help administer the FMA program and activities. Up to ten percent (10%) of Project grants may be awarded to States for Technical Assistance Grants