KEENE HAZARD MITIGATION PLAN UPDATE 2018

Keene, New Hampshire

NH HSEM/FEMA Final Approval August 14, 2018

October 2005 Flood

Prepared by the:

City of Keene Hazard Mitigation Committee
&
Southwest Region Planning Commission

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Executive Summary

The Keene Hazard Mitigation Plan serves as a means to reduce future losses from natural or man-made hazard events before they occur. The Plan was developed by the Keene Hazard Mitigation Committee and contains statements of policy adopted by the City Council in Chapter 10.

Natural hazards are addressed as follows:

- Flooding
- Drought
- Extreme Heat
- Wildfire
- Lightning Strikes
- Tornado Wind, Downburst, Severe Wind
- Hurricane/Tropical Storm
- Earthquake
- Severe Winter Weather
- Erosion/Landslide
- Hazardous Materials Spills
- Dam Failure

The Keene Hazard Mitigation Committee identified "Critical Facilities" as follows:

Critical Facilities - Category 1

- Fire Stations
- Emergency Medical Services (EMS)
- Police Station
- Hospital
- Shelters
- Public Utilities
- Communications
- Emergency Operations Center (EOC) Public Works
- Water Supply/Treatment & Distribution Facility
- Sewer Treatment/Collection Facility
- Emergency Fuel
- Transportation
- Evacuation Routes
- Municipal Government Center

Critical Facilities - Category 2

- Schools
- Daycares
- High Population Concentrations
- Assisted, Elderly, Senior Facilities
- Healthcare Facilities
- Recreation Areas
- Historic Resources

The Keene Hazard Mitigation Committee identified existing hazard mitigation programs as follows:

- Emergency Operations Plan
- Zoning Ordinance
- Building Code
- Fire Code
- Natural Resources Protection Ordinance
- Elevation Certificates Maintained
- Community Rating System
- National Flood Insurance Program
- Floodplain Development Ordinance
- Emergency Notification System
- Land Development Regulations
- Public Improvement Standards
- Bridge Maintenance Program
- Storm Drain/Culvert Maintenance
- Dam Emergency Action Plans
- Shoreland Protection Program
- Hazard Materials Plan/Team
- Public Education Programs
- Tree Maintenance
- Comprehensive Master Plan (2010)
- Capital Improvements Program
- Shelters with Emergency Back-up Power
- Mitigation Grants
- Climate Change Adaptation Plan
- Climate Change Action Plan
- Water Emergency Plan
- Water Supply Shortage Plan

The 2018 Keene Hazard Mitigation Committee prioritized newly identified hazard mitigation strategies in the current plan. These need to be reviewed and updated as necessary.

Mitigation Priorities

- Develop and conduct public outreach on the inundation pathway for High Hazard Dams and develop emergency evacuation strategies for properties within the pathway.
- Continue to develop and sustain a community outreach program to discuss mitigation and emergency preparedness with schools, businesses, the hospital, and colleges.
- Road and Bridge Repair: 13 out of 22 bridges are red listed and need to be replaced. Repair or replace culverts & bridges associated with road flooding as identified by City Public Works Director (PWD).
- Continue outreach efforts to homeowners on the benefits of National Flood Insurance Program (NFIP) and encourage participation in the program.
- Continue to enforce NFIP by requiring elevation certificates.
- Tanglewood Estates: Develop a program to assess flood risks and potential secondary hazards for the approximate 80 mobile homes in the 100-year floodplain. Seek ways to fund a mobile home owner mitigation program to ensure mobile homes and fuel tanks are securely anchored in place.
- Develop strategies to acquire the necessary rights from the following properties for the purpose of protecting and preserving floodplain storage: Realities Inc. parcel (behind Hannaford), parcel along Ashuelot (south of Tanglewood), Beaver Brook north of NH 101, Pearl Street parcel, Silent Way/Lower Main Street parcel, Wyman Rd parcel, and Lower Production Ave.
- Collect additional data and install monitoring equipment at Three Mile Reservoir, Babbidge, Woodard and Robin Hood Dams.
- Evaluate and floodproof, if necessary, Court Street Lift Station, Bradco Lift Station and Well numbers one and four.
- Implement recommendations and projects identified in the Beaver Brook Escherichia coli Impairment Investigation and Remediation, and Habitat Restoration Project.
- Continue to review, update and obtain additional GIS data layers, specifically digital orthophoto, to be used for natural and human-caused hazard mitigation planning.
- Implement projects as identified in the Keene Comprehensive Master Plan.

- Develop a Continuity of Operations Plan (COOP) for the City.
- Continue Incident Command System (ICS) training for all staff.
- Conduct tabletops, drills and exercises for all hazards.
- Review and implement emergency notification systems (i.e. reverse notification, social media and City website).
- Update communications and data equipment to ensure inter-operability for all City personnel.
- Modification of Beaver Brook Bridges: In 1994, the Soil Conservation Service suggested that removal of flow constrictions caused by bridges could significantly reduce flooding, without causing additional problems downstream. Initial grant funds would be used for an engineering study to validate the impacts of this approach. Subsequent grants would be sought to fund bridge modification.
- Three Mile Reservoir: Existing impoundment at Three Mile Swamp is rated to mitigate against 10 to 25 year storm event. Assess feasibility to enlarge the storage capacity to reduce flood potential in the Beaver Brook watershed.
- Obtain alternative energy back-up systems for critical facilities and infrastructure.
- Evaluate the Storm Water Phase 2 plan.
- Continue ongoing update of the Hazardous Materials Plan and training of the team.
- Update the Emergency Operations Plan in 2021.
- Continue annual exercising & updating of all Dam Action Plans.
- Review the Climate Change Adaptation Plan and Action Plan, and implement strategies.
- Review and update the floodplain development ordinance as needed.
- Continue enforcement of building codes.
- Continue enforcement of fire codes.
- Review and update the Keene Fire Code in 2020.
- Review and update road and utility design standards.
- Develop and implement a citywide tree maintenance program.

CHAPTER 1
INTRODUCTION

Purpose

The Keene Hazard Mitigation Plan Update 2018 is a planning tool to be used by the City of Keene, as well as other local, state and federal governments, in their efforts to reduce the effects from natural and man-made hazards. By maintaining an updated Hazard Mitigation Plan, the city is eligible to receive grant funding for mitigation projects.

Authority

This Multi-Hazard Mitigation Plan was prepared pursuant to Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance 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. The development and periodic update of this plan satisfies the planning requirements of the Disaster Mitigation Act (DMA) of 2000 which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Funding Source

This Plan was funded by the NH Homeland Security and Emergency Management, with grants from FEMA's Pre-disaster Mitigation Program.

Scope of the Plan

The scope of this Plan includes the identification of past and potential natural and manmade hazards affecting the City of Keene, the determination of vulnerability of existing and future structures to the identified potential hazards, and the identification and discussion of new strategies aimed at mitigating the likely effects of potential hazards before they occur.

Methodology

Using the Local Hazard Mitigation Planning Handbook, the Keene Hazard Mitigation Committee developed the content of the Keene Hazard Mitigation Plan by following tasks set forth in the handbook. The Committee held meetings, open to the public, in order to develop the Plan.

Task 1: Determine the Planning Area & Resources: This task was conducted by city staff and the Regional Planning Commission. The results of this research were shared with the Committee and can be found in Chapter 2, "Community Profile".

Task 2: Building the Planning Team: Prior to the first public information meeting the Emergency Management Director invited City department heads, residents and business owners, requesting that they consider serving on the Committee.

Task 3: Create an Outreach Program: This task was used throughout the plan and is a vital part of the plan's success. Many of the proposed actions involve a community outreach component for individuals to use as a means to reduce the risk of loss of life and property from future natural and man-made hazards.

Task 4: Review Community Capabilities: The Committee brainstormed on the type of hazards and locations that have sustained or could be susceptible to each hazard within the city. The results were the Hazard Identification Map, which can be found at the end of the plan.

The Committee then identified and catalogued all of the critical facilities within the city. The result is found in Chapter 6 with a location map at the end of the plan.

Task 5: Conduct a Risk Assessment: The Committee conducted several assessments to help determine the gaps in coverage. These include Vulnerability Assessments and Assessing Probability, Severity, and Risk. In addition to the assessments, the existing mitigation strategies were reviewed to determine where gaps in coverage exist and areas that need improvement.

Task 6: Develop a Mitigation Strategy: The Committee identified plans and policies that are already in place to reduce the effects of man-made and natural hazards. Then the Committee evaluated the effectiveness of the existing measures to identify where they can be improved. The Committee then developed the Mitigation Action Plan, which is a clear strategy that outlines who is responsible for implementing each project, as well as when and how the actions will be implemented and the funding source.

Task 7: Keep the Plan Current: It is important to the City of Keene that this plan be monitored and updated annually or after a presidentially declared disaster. Chapter 10 addresses this issue.

Task 8: Review & Adopt the Plan: The Committee members reviewed and approved each section of the plan. After acceptance by the Committee, a final draft of this Plan was made available to the public for review and comment. The document was also provided to the NH Homeland Security and Emergency Management for their review and Approval Pending Adoption. At a public meeting, the City Council formally adopted the plan on August 2, 2018. The plan was then granted formal approval by HSEM August 14, 2018, and the Formal Approval letter from the Federal Emergency Management Agency (FEMA) was received on August 15, 2018.

Task 9: Create a Safe & Resilient Community: The committee discussed the mitigation actions in the Action Plan and the ways in which the implementation of the actions will be beneficial to the community. Annual reviews of the Action Plan by the committee are needed to maintain the timeframes identified for completion of activities. Incorporation of the plan into other land use plans and the Capital Improvement Plan help to ensure that the goals of the plan are met. Implementation of the actions prior to a hazardous event can be funded through a variety of resources found at the end of this plan in Appendix D.

Public Committee Meetings

Working committee meetings were held at Keene Department of Public Works on the following dates: November 28 and December 19, 2017 and January 9, 23, February 6, and March 13, 2018.

An email was sent to each committee member, prior to each meeting that contained an agenda (Appendix E), and information to be covered. Agendas were posted at the City Hall and on the SWRPC website to encourage public participation.

Public Participation:

In addition, an article was printed in the Southwest Region Planning Commission Newsletter prior to the first meeting to inform the members of the community as well as surrounding communities and other interested stakeholders in participating in this plan update. Copies of the newsletter were sent to the 34 towns within the

region, the Cheshire County Office, businesses, and other interested parties. It is also available on the Southwest Region Planning Commission website. In addition to the SWRPC newsletter and website, an email of the SWRPC Happenings was sent to approximately 430 addresses, including neighboring communities, county, businesses, and academia. The email contains notices of public meetings and events. A copy of this mailing is included in Appendix E.

The Public Meeting on the Plan was held on July 25th. There were no comments received at that meeting. The plan was also available at the City Hall until the City Council August 2nd meeting. No comments were received from the public during that period.

City Council adopted the plan on August 2nd and the City Manager was granted the authority to implement the plan.

Resources Used in Plan Preparation

In addition to the Handbook that was used as a framework for this plan, additional resources used included the Keene Hazard Mitigation Plan (2013), Keene Comprehensive Master Plan (2010), the FEMA Community Information System website (to obtain data about the town's National Flood Insurance Program status), the State of New Hampshire Multi-Hazard Mitigation Plan 2013, and a number of resources identified in **Appendix C.**

Resource List for the Hazard Mitigation Committee

Keene's Emergency Management Director (EMD), or designee, reviewed and coordinated with the following agencies in order to determine if any conflicts existed or if there were any potential areas for cooperation. Training support has been offered by some of those on this resource list.

New Hampshire Homeland Security and Emergency Management: 1-800-852-3792
110 Smokey Bear Boulevard
Concord, NH 03305

Field Representative: Heather Dunkerley
State Hazard Mitigation Planner: Kayla Henderson

New Hampshire Department of Transportation:
John Kallfelz (District 4) Swanzey, NH 352-2302

Eversource Utility:
Laurel Boivin Keene, NH 357-7309 Ext. 5115
1-800-662-7764

<u>Plan Updates</u>

During the planning process, the Committee reviewed relevant portions of the previous hazard mitigation plan and updated those portions accordingly. Unchanged sections were incorporated into the plan while other sections were amended to reflect changes. Particular attention was given to the previous mitigation strategies that have been completed to give a status update on those that remain on the list. The previous plan was used as a basis to begin the update. Amendments were made in each chapter to reflect changes that have occurred during the five year period. Included in the changes were:

Ch. 1 - Introduction - updated Methodology, Acknowledgements, etc., and added Plan Updates;
Ch. 2 - Community Profile - NFIP policies updated, added Continued Compliance with NFIP;

Ch. 3 - Hazard Identification - updated hazards and their location, updated the Hazards Map;
Ch. 4 - Assessing Probability, Severity, and Risk - updated risk assessment;
Ch. 5 - Vulnerability Assessment - estimated potential losses;
Ch. 6 - Critical Facilities - updated locations;
Ch. 7 - Existing Mitigation Strategies and Proposed Improvements - updated chart and other data, updated chart for Status of Previous Mitigation Action Items;
Ch. 8 - Proposed Mitigation Strategies - updated STAPLEE chart;
Ch. 9 - Prioritized Implementation Schedule - updated Action Plan;
Ch. 10 - Adoption, Implementation, Monitoring and Updates - Adoption certificate, updated information;
Appendices - agendas, resources, public documentation.

This update was prepared with assistance from professional planners at Southwest Region Planning Commission trained in Hazard Mitigation Planning. Data and maps used to prepare this plan are available at their office and are available to be used in preparing future updates.

Acknowledgements

The Keene City Council extends special thanks to the Keene Hazard Mitigation Committee as follows:

Kurt Blomquist, *Keene EMD, Public Works Dir.*
Mark Howard, *Keene Asst' EMD, Fire Chief*
Andy Bohannon, *Keene Parks, Recreation, & Facilities Dir.*
Jeffrey Chickering, *Keene Deputy Fire Chief*
Rhett Lamb, *Keene Planning Dir/Asst. City Manager*
Don Lussier, *Keene City Engineer*
Corinne Marcou, *Keene Administrative Asst.*
John Rogers, *Keene Acting Health/Code Director*
Duncan Watson, Keene *Asst' Public Works Dir.*

The Keene City Council offers thanks to the New Hampshire Homeland Security and Emergency Management for developing the State of New Hampshire Multi-Hazard Mitigation Plan Update 2013 (http://www.nh.gov/safety/divisions/hsem/HazardMitigation/documents/hazard-mitigation-plan.pdf) which served as a model for this plan. In addition, special thanks are extended to the staff of the Southwest Region Planning Commission for professional services, process facilitation and preparation of this document.

HSEM/FEMA Final Approval: August 14, 2018.

Keene Hazard Mitigation Goals

The Keene Hazard Mitigation Committee reviewed the goals set forth in the State of New Hampshire Multi-Hazard Mitigation Plan Update - 2013. The committee generally concurs with those goals and has amended them to better meet the goals of the city.

The overall Goals of the City of Keene with respect to Hazard Mitigation are stipulated here:

1. To improve upon the protection of the general population, the citizens of the City of Keene and visitors, from all natural and man-made hazards.

2. To reduce the potential impact of natural and man-made disasters on the City of Keene's emergency response services, critical facilities, and infrastructure.

3. To reduce the potential impact of natural and man-made disasters on the City of Keene's economy, natural resources, historic/cultural treasures, and private property.

4. To improve the City of Keene's emergency preparedness; disaster response and recovery capability; and continuity and interoperability.

5. To reduce the City of Keene's risk with respect to natural and man-made hazards through outreach and education.

6. To identify, introduce and implement cost-effective hazard mitigation measures so as to accomplish the City's Goals and Objectives and to raise the awareness of and acceptance of hazard mitigation opportunities generally.

7. To address the challenges posed by climate change as they pertain to increasing risks to Keene's infrastructure, economy, and natural environment.

8. To work in conjunction and cooperation with the surrounding communities and the State of New Hampshire's Hazard Mitigation Goals.

CHAPTER 2
COMMUNITY PROFILE

Community Description

The City of Keene is located in the central portion of Cheshire County in southwestern New Hampshire. It is bordered by the Towns of Surry and Gilsum to the north, the Town of Sullivan to the northeast, the Town of Roxbury to the east, the Town of Swanzey to the south, the Town of Chesterfield to the southwest, and the Town of Westmoreland to the west. Keene constitutes both the population and economic center of its region. The City is home to the regional hospital, Cheshire Medical Center/Dartmouth Hitchcock, maintains the regional middle school and high school, Supervisory Administrative Unit 29, serves as the County seat, hosts the regional correctional facility, and is home to Keene State College, Antioch University and River Valley Community College. Keene is also the economic center for the region and has four State highways, NH Rt 9/10/12/101, that converge within its borders.

The land of Keene is flat with surrounding hilly terrain and has been referred to as a "bathtub." The City is comprised of five watersheds, the Ashuelot River, Beaver Brook, Black Brook, Ash Swamp Brook and Otter Brook. The floodplain of the Ashuelot River and Beaver Brook has very heavy residential and commercial development. The drainage area of the city is extremely flat. There are two federal flood control projects and one flood control dam that affects the City of Keene. The Ashuelot River is the principal water body in Keene. It is controlled by Surry Mountain Lake Dam, which is a federal flood control dam. The dam is located north of Keene, just above the Keene-Surry boundary, and controls flood flows from a 100-square mile drainage area. The other federal flood control facility is the Otter Brook Dam which is located to the east in the Town of Roxbury. The third flood control project is the Three Mile Reservior Dam which is owned by the City of Keene and controls water in the Beaver Brook. The Ashuelot River flows south through Keene and collects runoff from Beaver Brook, an additional 13-square mile drainage area, before being joined by the Branch River. Ash Swamp Brook joins the Ashuelot River further downstream, south of the Keene-Swanzey boundary.

Disaster Risk

Keene can be impacted by a variety of natural and man-made hazards. These include: flooding, extreme heat, drought, wildfire, lightning strikes, tornado/downburst/severe wind, hurricane/tropical storm, severe winter weather, erosion/landslide, earthquakes, hazardous materials incidents, and dam failure/breach. The occurrence of other disasters such as avalanche and subsidence are not common and are, therefore, not included in this Plan. The hazards that carry a greater risk locally include flood, hurricane/tropical storm, severe winter weather, tornado/downburst/severe wind, lightning strikes, extreme heat, and hazardous materials spills. Additional information on the disaster risk to Keene is shown in the Hazard Vulnerability table in Chapter *4*.

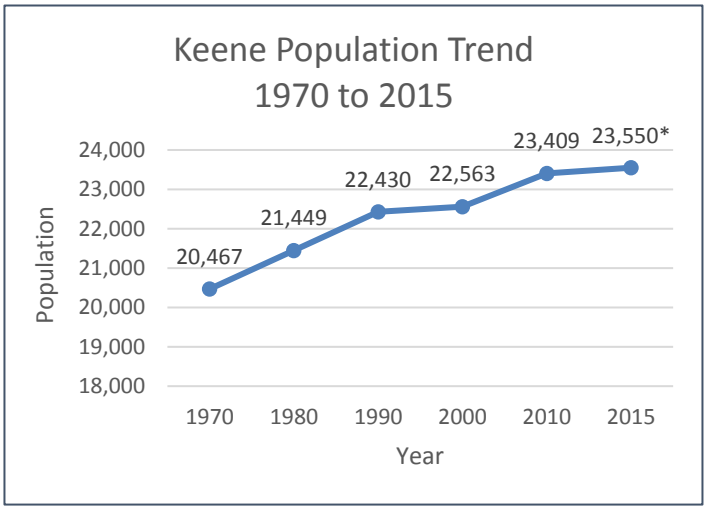
Population Trend

The next table and the corresponding chart show the population trend that has occurred in Keene between 1970 and 2015**.** It shows a steady increase between 1970 and 1990, followed by a decade of little to no growth. The rate picks back up between 2000 and 2010 to a similar rate as the previous growth period and again levels off between 2010 and 2015. It should be noted, however, that the last figure represents a 5 year period which is different from the other figures shown. A more accurate representation of the decade will be shown in the 2020 census.

1970	1980	1990	2000	2010	2015*
20,467	21,449	22,430	22,563	23,409	23,550
---	4.8%	4.6%	0.6%	3.7%	0.6%

Population Trend 1970 to 2015

*Source: NH Office of Strategic Initiatives *the 2015 figure is an estimate.It represents a 5 year period instead of a 10 year period.*



Population Projections

Population projections are an important component in planning for the future. Projections are beneficial to help communities begin to plan and budget for Capital Improvement Projects. Since population projections are based on a set of assumptions, changes can be significant if the assumptions used in the calculations are not met. For example, a tropical storm that destroys a large employer or causes infrastructure damages to that facility, can cause a significant economic hardship to the business that may ultimately result in its closure and loss of jobs. This can then result in an outward migration of residents from the community. Therefore, population projections should only be used as a basis to begin planning for the future.

The New Hampshire Office of Strategic Initiatives (NH OSI) prepares population projections every five years for each community in New Hampshire. The projections for Keene are presented below in five-year intervals up to the year 2040, beginning with the census count from the year 2010. Using these projections, Keene is expected to experience a slight increase in population with an overall change of 2.3% growth in population by 2040.

Keene Population Projections

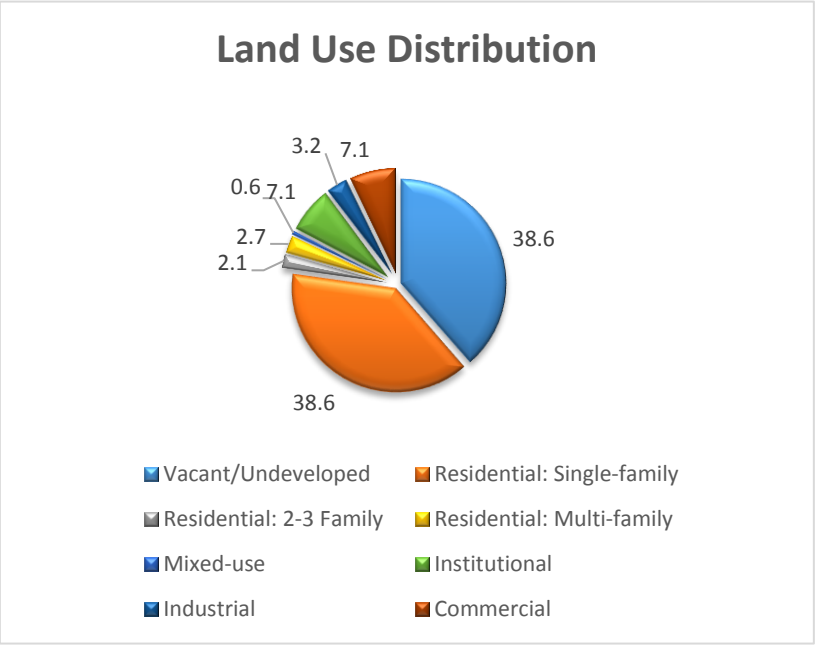
2010	2015	2020	2025	2030	2035	2040	% Change 2010-2040
23,409	23,550	23,641	23,743	23,839	23,909	23,954	2.3%

Source: NH Office of Strategic Initiatives

Current Development Trends

The City of Keene's land use distribution is shown in the pie chart. The overall land use distribution has not changed appreciably over the past decade. Brownfield development and redevelopment of vacant buildings has been a priority. Focus for commercial development has been on infill development around the downtown area.

The chart shows that single family housing has the largest proportion of land and is equal to the vacant or undeveloped land (both with 38.6%). The next greatest land use is institutional (schools, churches, gov't.) and commercial, both with 7.1% of the total land area. As noted in the Community Description, the City is home to 3 colleges/universities as well as public and private regional schools (pre-k through 12).



Source: Keene Comprehensive Master Plan

The next table shows the trend in the number of housing units in Keene between 1970 and 2010. The largest increase in the number of housing units occurred between 1970 and 1980 with a 20.3% increase. The rate of increase has been declining in each decade since then, with the slowest increase (4.6%) occurring between 2000 and 2010. This is a similar trend seen throughout the southwest region of New Hampshire.

Trend in Number of Housing Units 1970 - 2010 (US Census Data)

	1970	1980	1990	2000	2010	Change 1970-2010
Housing Units	6,597	7,934	8,841	9,295	9,719	3,122
% Change	-----	20.3%	10.3%	5.1%	4.6%	47.3%

Source: US Census Bureau

Consideration for Development

Several factors have played, and will continue to play, an important role in the development of Keene. These include: the existing development pattern and availability of land for future development; the present road network; physical factors such as steep slopes, floodplains, poor soil conditions, land set aside for conservation, and the availability of utilities such as public water and sanitary sewers. These factors have an impact, both individually and cumulatively, on where and how development occurs.

Future development in Keene should take into consideration the use of best management practices for all types of potential hazards. Included in this is proper site selection, erosion controls, underground utilities, access, building construction materials and methods, as well as others.

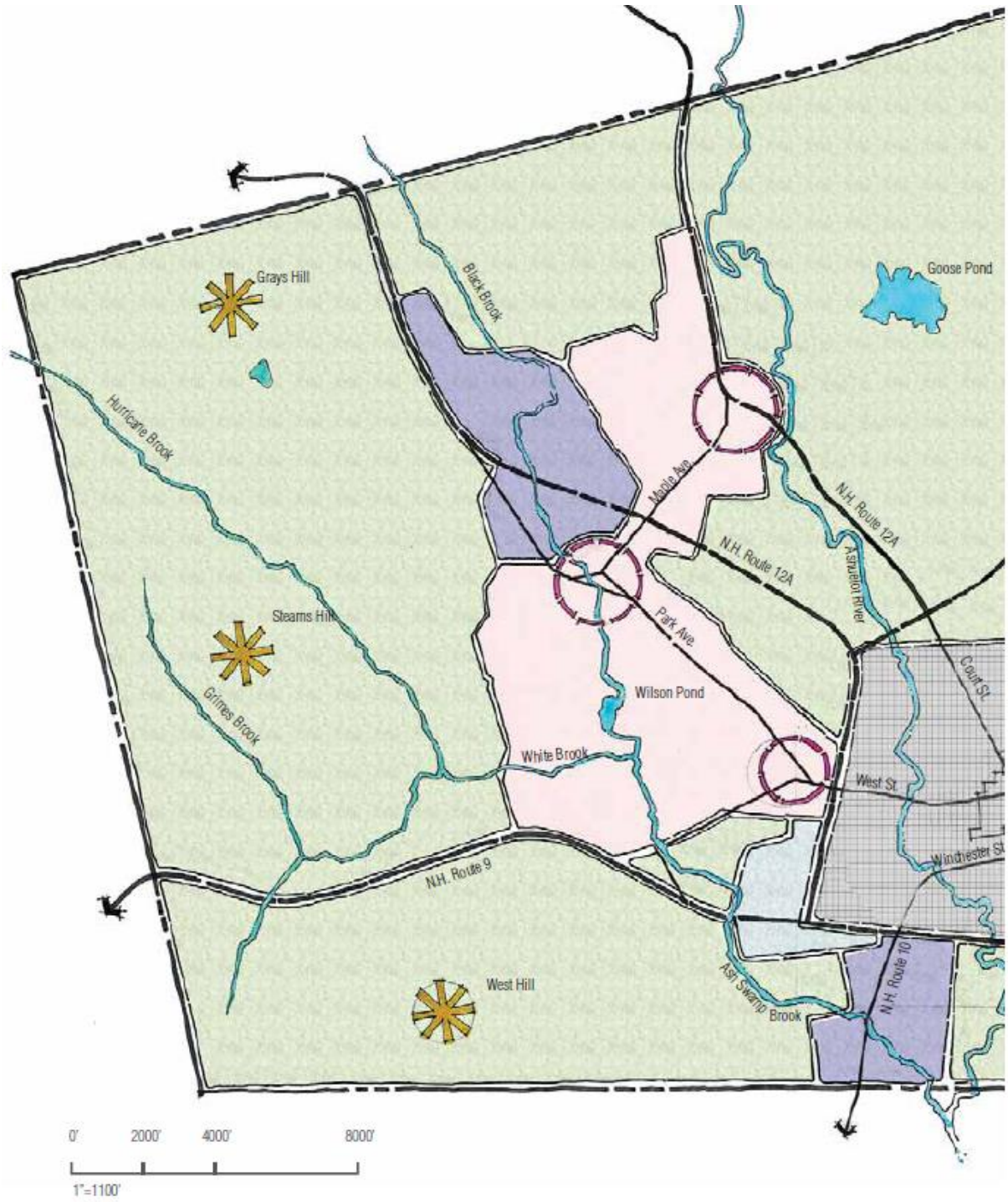
Future Land Use[1]

The Future Land Use Map is an illustrated community vision for the future that will guide Keene's physical growth and change. This map provides the city with a basis for making consistent decisions on capital investments, and it is a tool for potential developers to use in creating their development proposals.

The Future Land Use Map shows:

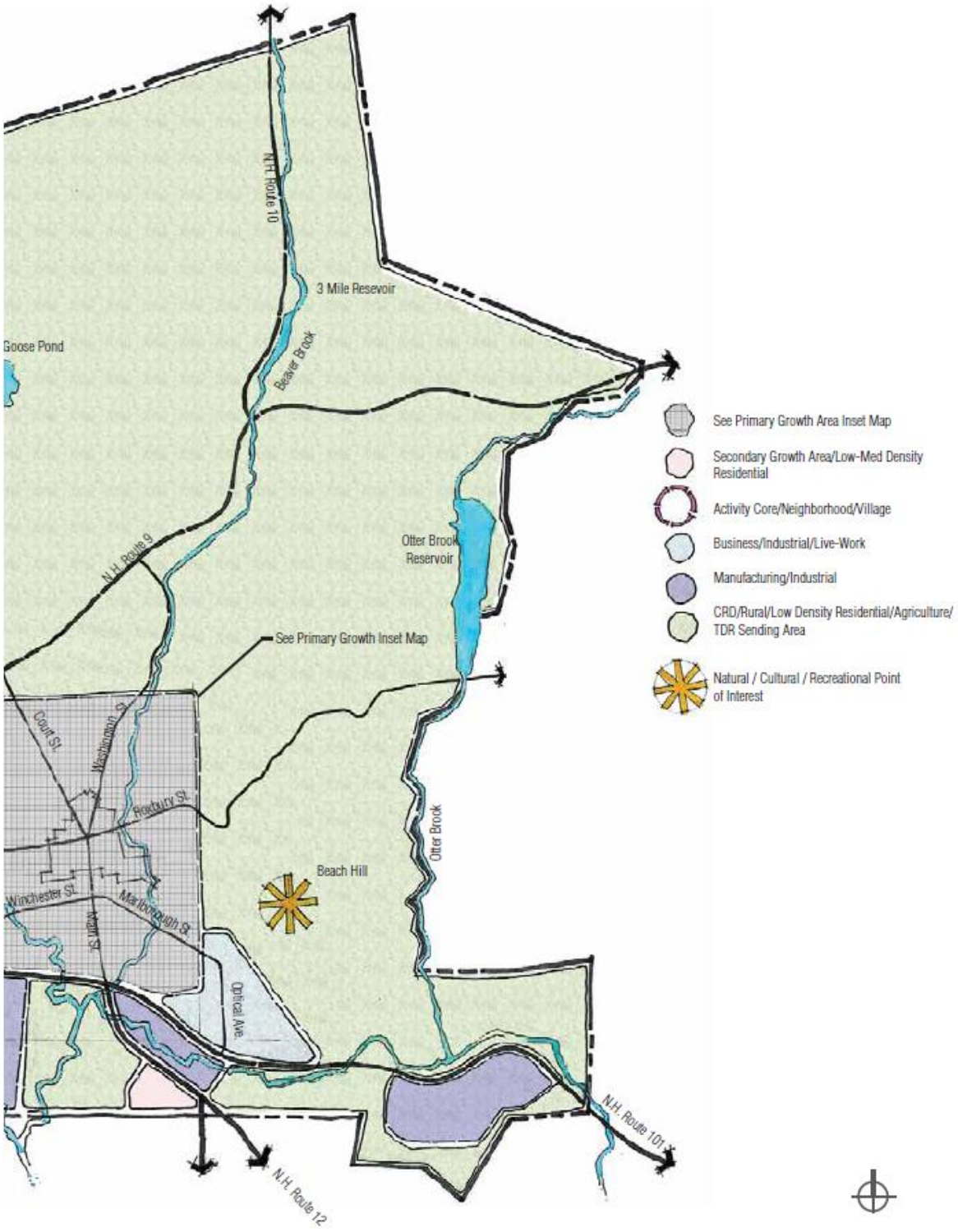
- The concentration of high-density, mixed-use development and high-to-medium density neighborhoods in the urbanized area within the Bypass; noted as the primary growth area on the map;
- Secondary growth areas that consist of single-family, low to medium density development; and
- Expansion of mixed-use areas for commercial and industrial economic development.

[1] Excerpt from the Keene Comprehensive Master Plan (2010)



FUTURE LAND USE MAP

City of Keene, NH


N.H. Route 10
3 Mile Resevoir
Goose Pond
Beaver Brook
N.H. Route 9
Otter Brook Reservoir
See Primary Growth Inset Map
Court St.
Washington St.
Roxbury St.
Winchester St.
Marlborough St.
Main St.
Beach Hill
Otter Brook
Optical Ave.
N.H. Route 101
N.H. Route 12
See Primary Growth Area Inset Map
Secondary Growth Area/Low-Med Density Residential
Activity Core/Neighborhood/Village
Business/Industrial/Live-Work
Manufacturing/Industrial
CRD/Rural/Low Density Residential/Agriculture/ TDR Sending Area
Natural / Cultural / Recreational Point of Interest

Development in Hazard Areas

Hazards identified in this plan are regional risks and, as such, all new development falls into the hazard area. The exception to this is flooding. While the population and number of housing units has increased since the previous hazard mitigation plan, it is anticipated that the disaster risk has not increased due to the efforts by the city to reduce flooding by replacing and upsizing some culverts, bridge replacement, tree removal, and other actions that have been taken to reduce the loss of life and property.

National Flood Insurance Program

The City is currently participating in the National Flood Insurance Program (NFIP). The community has digital Flood Insurance Rate Maps (FIRM) dated May 23, 2006. According to FEMA, there is a total of 303 NFIP policies including 80 single-family, 23 low density multi-family structures (2-4 family), 109 other residential), and 91 non-residential. There have been 120 paid losses totaling $5,370,563 since 1978. There are 245 policies for structures located in a 100-year floodplain. The most recent CAV was done on May 19, 2011.

The City has been a participating member of the Community Rating System (CRS) since 2002. The CRS is a voluntary program for NFIP participating communities. The goals of the CRS are to reduce flood damages to insurable property and strengthen and support the insurance aspects of the NFIP. The City is currently classified as a class 8, offering a 10% discount to all NFIP policy holders in the City of Keene. The City will continue to uphold programs and regulations in order to maintain this CRS classification.

Repetitive Loss

FEMA monitors properties that have been subject to continued flooding claims through the NFIP. These properties are designated as "Repetitive Loss" properties, which are defined as "a building covered by a contract for flood insurance that has incurred flood related damages on 2 occasions during a 10-year period ending on the date of the event for which a second claim is made, in which the cost of repairing the flood damage, on the average, equaled or exceeded 25% of the market value of the building at the time of each such flood event." The City of Keene currently has 15 repetitive loss structures and repetitive loss payments of $2,024,487. Fourteen of these are residential properties, and one is listed as non-residential.

Continued Compliance with NFIP Requirements

The City of Keene acknowledges the importance of maintaining requirements set forth in the NFIP. As such, the city took steps related to continued compliance with the program that will help to reduce or eliminate the potential for loss of life and property due to flooding. The following actions have been taken since the previous Hazard Mitigation Plan:

- removed debris and material to restore a wetland area on Beaver Street to increase flood storage;
- developed a program to assess flood risks and potential secondary hazards for the approximate 80 mobile homes in the 100-year floodplain;
- maintained and replaced undersized culverts;
- continued enforcement of the Floodplain Development Ordinance; and
- continued enforcement of the Building and Zoning Ordinances.

The implementation of these actions as well as others have helped improve Keene's risk of death or injury, and structural damage, from severe weather events. As the intensity in storm events increases, additional actions may need to be added during the annual review or the five year update.

Properties and Structures at Risk

The City of Keene has made extensive use of Geographic Information Systems to map municipal properties and a wide variety of other assets. To identify properties and structures at risk of flooding, SWRPC conducted a series of overlay analyses using City-provided tax parcels, building footprints, and the special flood hazard areas according to the May 23, 2006 FIRM maps. At least 2% (155) of parcels of land were found to be totally within the special flood hazard area and almost 19% (1,456) of all parcels of land within the City have at least some exposure to the special flood hazard area. To better understand the exposure of buildings at risk, SWRPC conducted a third analysis. This final model includes parcels with at least one building either partially or entirely within the special flood hazard area. A summary of the results of this analysis is indicated below.

Percentage of Parcels and Structures in the 100-Year Flood Plan

Description	# of Parcels	% of All Parcels	Land Area of Parcels (acres)	% of All Parcel Land Area
Parcels partially within the special flood hazard area	1,456	18.7%	4,815 ac.	21.8%
Parcels entirely within the special flood hazard area	155	2.0%	152 ac.	0.7%
Parcels with at least one building partially or entirely within the special flood hazard area	864	11.1%	1,945 ac.	8.8%
Not within the flood hazard area	5,303	68.2%	15,130 ac.	68.6%
All Parcels	7,778	100%	22,042 ac.	100%

Note: Figures rounded. GIS tax parcel (Tax16_17) and building footprint (kn15_Building) data provided by the City of Keene

Of the three methods above for evaluating the extent of properties at risk of flooding, the third model was selected for an analysis of land use and value. The following table presents a summary of the land use of parcels with at least one building partially or entirely within the special flood hazard area. Because assessment data is provided at the parcel level rather than for individual buildings, the table includes the total assessment for a given parcel regardless of whether or not each and every structure was within or partially within the special flood hazard area. The structures and properties included in this analysis are depicted on the Critical Facilities Map.

Summary of Parcels and Structures in 100-year Floodplain

Land Use	% of Parcels	Assessed Land Value	Assessed Building Value	Total Assessed Value	% of Total City Acres
Residential	6.3%	$57.2 million	$190.2 million	$247.4 million	9.5%
Commercial	1.3%	$59.4 million	$192.8 million	$262.1 million	1.2%
Industrial	1.2%	$16.2 million	$93.9 million	$116.56 million	2.9%
City-Owned	0.6%	$11.7 million	$0.5 million	$8.0 million	2.6%
Open Space	0.3%	$24.0 million	$3.1 million	$11.2 million	2.8%
Total	9.7%	$ 138.8 million	$480.5 million	$645.3 million	19.0%

Note: Based on Keene GIS Data, 2011 Tax Data and 2011 FEMA Data

CHAPTER 3
HAZARD IDENTIFICATION: PAST OCCURRENCES

Hazard events were researched using a wide variety of sources. Sources and techniques included input from City staff and long-time residents of Keene; gathering information from the State of New Hampshire Hazard Mitigation Plan; and gathering information from governmental and non-profit web sites. The following is a list of natural and manmade disasters, and the areas affected by them, that have occurred locally, regionally or within the state. The Past and Potential Hazards Map at the end of this plan reflects the contents of this list. A description/definition of each hazard type is found in **Appendix A** of this plan.

- Flooding
- Drought
- Extreme Heat
- Wildfires
- Lightning Strikes
- Tornadoes/Downburst/Severe Wind
- Hurricanes/Tropical Storms
- Earthquakes
- Severe Winter Weather
- Erosion/Landslides
- Hazardous Materials Spills
- Dam Failure/Breach

Hazard	Date	Location	Description of Areas Impacted
Flooding - Disaster Declarations			
Below is a listing of Disaster Declarations for flooding events within the State of New Hampshire. Several severe events have caused significant damage to structures and roadways within the Southwest Region.			
Flood	1927	Southern NH	Damage to Road Network. Caused many roads to wash out.
Flood	March 11 - 21, 1936	NH State	Damage to Road Network. Flooding caused by simultaneous heavy snowfall totals, heavy rains and warm weather.
Flood/ Severe Storm	August 27, 1986	Cheshire, Hillsborough Counties, NH	FEMA Disaster # 771-DR (Presidentially Declared Disaster) $1,005,000 in damage.
Flood/ Severe Storm	April 16, 1987	Cheshire, Carroll, Grafton, Hillsborough, Merrimack, Rockingham, & Sullivan Counties, NH	FEMA Disaster Declaration # 789-DR (Presidentially Declared Disaster). Flooding of low-lying areas along river caused by snowmelt and intense rain. $4,888,889 in damage.
Flood	August 7 - 11, 1990	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack & Sullivan Counties, NH	FEMA Disaster Declaration # 876. Flooding caused by a series of storm events with moderate to heavy rains. $2,297,777 in damage.
Flood	October 29, 1996	Grafton, Hillsborough, Merrimack, Rockingham, Strafford, Sullivan Counties, NH	FEMA Disaster Declaration #1144-DR. Flooding caused by heavy rains. $2,341,273 in damage.
Flood	July 2, 1998	Southern NH	FEMA Disaster Declaration # 1231. Severe storms and flooding.
Flood	July - Aug 2003	Cheshire & Sullivan Counties	FEMA Disaster Declaration # 1489. Severe storms and flooding. NH 12 washed out locally.
Flood	October 26, 2005	Cheshire, Grafton, Merrimack, Sullivan, and Hillsborough Counties, NH	FEMA Disaster Declaration # 1610. Severe storms and flooding.
Flood	October - November 2005	Cheshire, Grafton, Hillsborough, Merrimack, Rockingham, Strafford & Sullivan counties	FEMA Disaster Declaration # DR-1144- NH DR-1610 $12,314,320 assistance Statewide. Keene and several towns in the region were greatly impacted by this flooding. Additional details in *Flooding - Localized*.

Hazard	Date	Location	Description of Areas Impacted
Flooding - Disaster Declarations			
Flood	May 25, 2006	Several counties in NH	FEMA Disaster Declaration # 1643. Severe storms and flooding.
Flood	April 16, 2007	All counties in NH	FEMA Disaster Declaration # 1695. Severe storms and flooding.
Flood	May 26-30, 2011	Coos and Grafton County	FEMA Disaster Declaration # DR-4006; May flood event.
Flood	May 29-31, 2012	Cheshire County	FEMA Disaster Declaration # 4065; $3,046,189 (Statewide assistance). There were some road washouts. Local details provided under *Flooding-Localized* heading below.
Flood	June 26 - July 3, 2013	Cheshire, Sullivan and Grafton Counties	FEMA Disaster Declaration # 4139; $6,389,704 (Statewide assistance). NH 12 A was severely washed out and caused lengthy detours for 6 months. No damage to structures and no injuries.
Flood	July 1-2, 2017	Coos and Grafton Counties	FEMA Disaster Declaration # 4329; No damage to structures and no injuries.
Flood	Oct. 29-Nov. 1, 2017	Coos, Sullivan, Belknap, Carroll and Grafton Counties	FEMA Disaster Declaration # 4355; $72,739 (Statewide assistance). No damage to structures and no injuries.
Flood	Mar.2-8, 2018	Rockingham County	FEMA Disaster Declaration # 4370; Rockingham County, Severe storm and flooding. No local damage to structures and no injuries.
Flooding - Localized - Very High Risk			
The main flood season for the Ashuelot River is in the spring, usually resulting from rains combined with melting snow, which was characteristic of the March 1936 flood; however, two of the greatest floods (November 1927 and September 1938) occurred in the fall and were due entirely to rainfall. In addition, severe local thunderstorms can cause flash floods on the tributaries. Damaging floods were recorded in the Keene area as early as 1738. Floods causing significant damage have occurred in 1738, 1801, 1807, 1813, 1818, 1826, 1828, 1841, 1862, 1869, 1882, 1895, 1900, 1927, 1936, 1938, 1959, 1960, 1969, 1973, 1976, 1984, 1987, 2005, 2012, 2013, and 2014.			
Flood	September 18, 2004	Cheshire County	Heavy rainfall associated with the remnants of Ivan caused flash flooding in Cheshire County. Storm totals of 3 to 5 inches brought a tributary of the Branch Brook out of its banks and flooded a nearby roadway. Localized flooding on Church Street. No injuries were reported and damage to the City was minimal.
Flood	October 8, 2005	Southwest New Hampshire	The City of Keene evacuated 5,000 residents; there was 4’ to 8' of water on the east side of Main St. Emergency shelters were opened for five days and the City's EOC was opened for four days. The Keene Department of Public Works operated 24/7 for several weeks on debris clean up and repair of roads and bridges. The wastewater treatment plant had extensive damage.
Flood	May 29, 2012	City of Keene	The City experienced a significant rain event that resulted in significant damage to the City’s transportation infrastructure. Over 216 properties were affected. Flooding to basement and first floor was experienced. The City expended over $1.23M responding and recovering from the event. The roadways that experienced damage include: $422,569 for permanent repairs to Belvedere Road and $144,131 for permanent repairs to the following roadways: Hurricane Road, Old Walpole Road, Wyman Road, Gunn Road, Darling Road, Ferry Brook Road, Sullivan Road, May Avenue and Upper Knight Street. The damage expended approximately $928,890 for permanent repairs to transportation infrastructure.

Hazard	Date	Location	Description of Areas Impacted
Flooding – Localized cont.			
Flood	June 26-July 3, 2013	Cheshire, Sullivan, and Grafton Counties	NH 12 A was severely washed out and caused lengthy detours for 6 months. No damage to structures and no injuries.
Flood	September 12, 2013	City of Keene	The City experienced severe weather event with approximately 5.8" of rain over a 5 hour period. Storm was concentrated on the eastern side of the City, focused over Beech Hill and east and the City experienced limited street flooding in the central portion of the City. Type of damage resulting from the storm was roadside washouts resulting in pavement failure. A number of private properties along Eastern Avenue, Bellevue Avenue and Woodland Avenue experienced basement flooding and property erosion. The City expended over $150,000 in response and repairs to damage infrastructure.
Flood	July 15, 2014	City of Keene	The City experienced a severe storm event with approximately 2.5 inches of rain falling over a one hour period. This resulted in localized flooding and closure of streets with damage occurring to pavement, shoulders and ditches. The City responded performing settlement and debris removal on various City streets including; Stearns Road, Water St, Court St, Roxbury Road, Daniels Hill Road, Concord Road, and Washington Street extension. In addition to clean-up, barricades and warning devices on flooded and damaged streets were employed. Sand bags were used to protect properties from flood waters and emergency repairs were made to some streets. The work included the removal of sediments from ditches, stabilizing shoulders and banks, rip-rapping washed out areas. The streets involved included Ralston St., Rule St., Sullivan St., Stearns Rd., Water St., Court St., Roxbury Rd., Daniels Hill Rd., and Concord Rd. Over $35,000 was expended for the public efforts.
Drought - Medium Risk			
The drought in the summer of 2016 caused many private wells to run dry. Since these are private wells, there is no documentation on the number of wells affected. Periods of drought can add to the potential for wildfires, especially in areas of high recreational use, and depletes the water supply for firefighting. A greater emphasis is placed on responding to these hazards rather than mitigating for them. Outreach and education on methods of handling drought are important. The severity of droughts can be found by referring to the Palmer Drought Severity Index used by the Climate Prediction Center and can be viewed at: http://www.cpc.ncep.noaa.gov/products/monitoring https://www.drought.gov/drought			

Extreme Heat - High Risk

Extreme heat is characterized by abnormally high temperatures and/or longer than average time periods of high temperatures. These event conditions are townwide and are typically infrequent occurrences. When they do occur, however, they are usually in late July and August. The severity of extreme heat can be dangerous to those residents with medical conditions and the elderly. It is important to have cooling areas and a good supply of water available. Extreme heat can add to the potential for wildfires and depletion of the water supply for firefighting. There is no record of local impact and no dates given by the committee for recent events. The index below shows the severity/risk level by looking at the temperature and relative humidity together.

NWS Heat Index — Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution — Extreme Caution — Danger — Extreme Danger

Source: National Weather Service

Wildfires - Medium Risk

As timber harvesting is reduced, wood roads close, and debris builds up on the ground, the potential for wildfire increases town-wide. The entire town is at risk with minimal forest fire protection. Wildfires are classified according to size: 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. Surry Mountain experienced a large forest fire in the late 70's. Goose Pond had a fire for 3 days in the early 80s. There have been several minor arson incidents at the college and different parts of the City.

Hazard	Date	Location	Description of Areas Impacted
Wildfire	2016	Stoddard	An arsonist caused over 200 acres to burn resulting in extensive utility damage. Mutual Aid from numerous locations assisted.
Wildfire	2016	Keene	This was a drought year with very high fire risk. Several Class B fires occurred in the City. No injuries or structures lost.

Lightning Strikes - High Risk

Numerous lightning events take place, however, most go unrecorded. The committee is not aware of any official record of lightning strikes in Keene. The next table categorizes lightning hazards according to the Lightning Activity Level (LAL) using cloud conditions and precipitation, and an estimate of lightning strikes per every 15 minutes.

LAL	Cloud & Storm Development	Lightning Strikes/15 min
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	

Source: NOAA

Tornados, Downbursts, and Severe Wind - High Risk

The City is at risk from severe localized blasting winds. Structural damage potential; such events cause small blocks of downed timber. High elevations are at greatest risk. Old trees along roads are at risk of falling and causing damage to structures during wind events. There is a potential for loss of electricity. Downbursts are sometimes mistaken for tornados and can cause very similar damage. The committee did not identify any new weather events of tornadoes, downbursts, or severe wind events since the previous mitigation plan.

The **Enhanced Fujita Scale** is used to rate the intensity of a tornado by examining the damage caused by the tornado once it has passed. (see scale below).

EF - Scale Number, Wind Speed, Frequency, and Type of damage

EF - 0

Wind Speed: 65-85 mph; Frequency: 53.5%

Minor or no damage. Some damage to gutters, siding and roofs; breaks branches off trees; pushes over shallow-rooted trees.

EF - 1

Wind Speed: 86-110 mph; Frequency: 31.6%

Moderate damage. Roofs severely stripped; mobile homes damaged or overturned; windows and glass broken, loss of exterior doors.

EF - 2

Wind Speed: 111-135 mph; Frequency: 10.7%

Considerable damage. Roofs torn off well constructed homes; foundations of framed homes shifted; mobile homes demolished; large trees snapped or uprooted; light object missiles generated; cars lifted off of ground.

EF - 3

Wind Speed: 136-165 mph; Frequency: 3.4%

Severe Damage. Entire stories of well-constructed houses destroyed; severe damage to large building and malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown.

EF - 4

Wind Speed: 166-200 mph; Frequency: 0.7%

Extreme Damage. Well-constructed houses completely leveled; cars thrown and large missiles generated.

EF - 5
Wind Speed: >200 mph; Frequency <0.1%
Total Destruction. Strong frame houses lifted off foundations and carried considerable distances to disintegrate; steel reinforced concrete structures are critically damaged; tall buildings collapse.
Source: http://www.tornadoproject.com/fscale/fscale.htm

Tornados, Downbursts, and Severe Wind (cont.)

Hazard	Date	Location	Description of Areas Impacted
Tornado	Sept. 15, 1922	Cheshire County	F2
Tornado	Sept. 13, 1928	Cheshire County	F2
Tornado	August 13, 1963	Cheshire County	F2
Tornado	June 6, 1963	Cheshire County	F2
Tornado	July 3, 1997	Swanzey, NH	An F1 tornado caused severe tree loss in Swanzey, destroyed a building and damaged the stables at the Cheshire Fairgrounds. No injuries reported locally.
Tornado	July 3, 1997	Greenfield, NH	An F2 Tornado caused damage to a summer camp, the recycling center and completely destroyed a lumber facility.
Tornado	May 23, 1998	Hillsborough County	F2. No significant damage or injuries reported locally.
Severe Wind	Dec. 1, 2006	Cheshire County	A line of severe thunderstorms moved through Cheshire County ahead of a strong cold front and caused significant damage. Two trees were downed onto houses in Keene, one on Allen Court and one on New Acres Road. The house on New Acres Road was completely destroyed.
Tornado	July 24, 2008	Deerfield/Northwood	EF2. No significant damage or injuries reported locally.
Downburst	June 2012	Harrisville, NH	A microburst hit Harrisville and caused many downed trees, but no significant damage to structures was recorded. Some residents lost power for several days. No local impact to Keene.

Hurricanes (Category given if known) and Tropical Storms - Very High Risk

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. In the western North Pacific, the term "super typhoon" is used for tropical cyclones with sustained winds exceeding 150 mph.

Saffir-Simpson Hurricane Wind Scale
Category, Sustained Winds, and Types of Damage
Category 1
Wind Speed: 74-95 mph, 64-82 kts.
Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.

Category 2
Wind Speed: 96-110 mph, 83-95 kts.
Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
Category 3
Wind Speed: 111-129 mph, 96-112 kts.
Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
Category 4
Wind Speed: 130-156 mph, 113-136 kts.
Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
Category 5
Wind Speed: 157 mph or higher, 137 kts. or higher
Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
Source: http://www.nhc.noaa.gov/aboutsshws.php

Hurricanes and Tropical Storms (cont.)

Hazard	Date	Location	Description of Areas Impacted
Hurricane	September 21, 1938	Southern New England	Flooding caused damage to road network and structures. 13 deaths, 494 injured throughout NH. Disruption of electric and telephone services for weeks. Two billion feet of marketable lumber blown down. Total storm losses of $12,337,643 (1938 dollars). 186 mph maximum winds.
Hurricane (Carol)	August 31, 1954	Southern New England	Category 3, winds 111-130 mph. Tree and crop damage in NH, localized flooding.
Hurricane (Edna)	September 11, 1954	Southern New England	Category 3 in Massachusetts. This Hurricane moved off shore but still cost 21 lives and $40.5 million in damages throughout New England.
Hurricane (Donna)	September 12, 1960	Southern and Central NH	Category 3 (Category 1 in NH). Heavy flooding in some parts of the State.
Tropical Storm	October 7, 1962	Coastal NH	Heavy swell and flooding along the coast.
Tropical Storm	August 28, 1971	New Hampshire	Center passed over NH resulting in heavy rain and damaging winds.
Hurricane (Belle)	August 10, 1976	Southern New England	Category 1, primarily rain with resulting flooding in NH.
Hurricane (Gloria)	Sept. 1985	Southern New England	Category 2, winds 96-110 mph. Electric structures damaged; tree damages. This Hurricane fell apart upon striking Long Island with heavy rains, localized flooding, and minor wind damage in NH.
Hurricane (Bob)	Aug. 19, 1991	Southern New England	Structural and electrical damage in region from fallen trees. Three people were killed and $2.5 million in damages were suffered along coastal New Hampshire. Federal Disaster FEMA-917-DR.
Hurricane (Edouard)	Sept.1, 1996	Southern New England	Winds in NH up to 38 mph and 1 inch of rain along the coast. Roads and electrical lines damaged.

Hurricanes and Tropical Storms (cont.)			
Hazard	**Date**	**Location**	**Description of Areas Impacted**
Tropical Storm (Floyd)	Sept. 16-18, 1999	Southern New England	FEMA DR-1305-NH. Heavy Rains.
Tropical Storm (Tammy)	Oct. 5-13, 2005	East Coast of US	Remnants of Tammy contributed to the October 2005 floods which dropped 20 inches of rain in some places in NH.
Tropical Storm (Irene)	Aug. 26-Sept. 26, 2011	New England states	FEMA Disaster Declaration # DR-4026 and EM- 3333. No significant local damage to structures and no services needed. There were some local power outages for 1-2 days and some debris.
Tropical Storm (Sandy)	Oct. 26 to Nov. 8, 2012	Eastern United States	FEMA Disaster Declaration # DR 4095; NH Counties that received the most damage were Belknap, Carroll, Coos, Grafton, Rockingham, and Sullivan. No significant local damage to structures and no services needed. Some minor power outages were noted.

Earthquake - Low Risk

There have been no reported injuries or structural damage from earthquakes in Keene in recent years. However, on December 20, 1940, an earthquake of 5.5 on the Richter Scale occurred in Ossipee which cracked walls in the Keene Police Station 80 miles away. The 2002 Plattsburg, NY earthquake, like many other larger tri-state area earthquakes, caused several water leaks and cracked a wall in the fire station as well as other buildings. The table below is used to categorize earthquakes using two different scales: Mercalli Scale and Richter Scale. The Richter Scale is more scientific and is based on the magnitude (amplitude of the largest seismic wave). The Mercalli Scale is based on observations by people who experienced the earthquake to describe its intensity.

Modified Mercalli Scale vs. Richter Scale		
Mercalli Intensity	**Mercalli Observations**	**Richter Magnitude**
I	Not felt by people	1-2
II	Felt by only a few people, especially on upper floors of buildings	3
III	Felt by people lying down, seated on hard surface, or in tall buildings	3.5
IV	Felt indoors by many, dishes and windows rattle	4
V	Generally felt by everyone; may wake from sleep	4.5
VI	Trees sway, objects fall from walls & tables	5
VII	Walls crack, some structural damage	5.5
VIII	Building damage noticeable	6
IX	Some buildings collapse	6.5
X	Ground cracks and landslides	7
XI	Few buildings survive, bridge damage, severe landslide	7.5
XII	Total Destruction, objects thrown into the air	8

Source: USGS Hazards Program

Earthquake (cont.)			
Hazard	**Date**	**Location**	**Description of Areas Impacted**
Earthquake	1638	Central New Hampshire	6.5-7
Earthquake	October 29, 1727	Off NH/MA coast	Widespread damage Massachusetts to Maine.
Earthquake	Dec. 29, 1727	Off NH/MA coast	Widespread damage Massachusetts to Maine.
Earthquake	Nov. 18, 1755	Cape Ann, MA	6.0, much damage.
Earthquake	1800s	Statewide- NH	83 felt earthquakes in New Hampshire.
Earthquake	1900s	Statewide- NH	200 felt earthquakes in New Hampshire.
Earthquake	March 18, 1926	Manchester, NH	Felt in Hillsborough County.
Earthquake	December 20 & 24, 1940	Near Ossipee, NH	Both earthquakes of magnitude 5.5, both felt for 400,000 sq. miles, structural damage to homes, damage in Boston, MA, water main rupture.
Earthquake	Dec. 28, 1947	Dover-Foxcroft, ME	4.5
Earthquake	June 10, 1951	Kingston, RI	4.6
Earthquake	April 26, 1957	Portland, ME	4.7
Earthquake	April 10, 1962	Middlebury, VT	4.2
Earthquake	June 15, 1973	Near NH Quebec Border, NH	4.8
Earthquake	January 19, 1982	Gaza (west of Laconia), NH	4.5, walls and chimneys cracked, damage up to 15 miles away in Concord.
Earthquake	October 20, 1988	Near Berlin, NH	4
Earthquake	January 3, 2011	Northwest of Laconia	2.5. No damage locally.
Earthquake	August 23, 2011	Travelled up the east coast from Virginia to New Hampshire	5.8. No damage locally.
Earthquake	September 18, 2012	Southern New Hampshire	1.2 No damage locally.
Earthquake	October 16, 2012	Felt throughout most of the New England states; centered in Maine	4.0. No damage locally.
Earthquake	October 11, 2013	Concord	2.3. No damage locally.
Earthquake	2014	New Hampshire	9 small earthquakes ranging from 1.3 - 2.7*. No damage or impact locally. (*data from Weston Observatory, Boston College).
Earthquake	2015	New Hampshire	16 small earthquakes ranging from 1.0 - 2.5*. No damage or impact locally. (*data from Weston Observatory, Boston College).
Earthquake	2016	New Hampshire	9 small earthquakes ranging from 1.3 - 2.5*. No damage or impact locally. (*data from Weston Observatory, Boston College).

Severe Winter Weather - High Risk

Three types of winter events are heavy snow, ice storms and extreme cold. Occasionally heavy snow will collapse buildings. Ice storms have disrupted power and communication services. Extreme cold affects the elderly. The chart below is an indicator of the severity of ice storms and can assist emergency management officials in predicting the length of power outages based on wind speed and amount of ice accumulation during the storm. This index is similar to those that are used to predict the severity of tornados and hurricanes. Planning ahead will mitigate the damage and prepare communities for severe ice events days in advance.

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	

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

Source: SPIA Index.com

Hazard	Date	Location	Description of Areas Impacted
Ice Storm	Dec. 17-20, 1929	New Hampshire	Unprecedented disruption and damage to telephone, telegraph and power system.
Blizzard	Feb. 14-17, 1958	New Hampshire	20-30 inches of snow in parts of NH.
Snow Storm	March 18-21, 1958	New Hampshire	Up to 22 inches of snow in south central NH.
Snow Storm	Jan. 18-20, 1961	New Hampshire	Up to 25 inches of snow in southern NH.
Snow Storm	Feb. 2-5, 1961	New Hampshire	Up to 18 inches of snow in southern NH.
Snow Storm	Jan. 11-16, 1964	New Hampshire	Up to 12 inches of snow in southern NH.
Blizzard	Jan. 29-31, 1966	New Hampshire	Third and most severe storm of 3 that occurred over a 10-day period. Up to 10" of snow across central NH.
Snow Storm	Dec. 26-28, 1969	New Hampshire	Up to 41 inches of snow in west central NH.

Severe Winter Weather - (cont.)			
Hazard	**Date**	**Location**	**Description of Areas Impacted**
Snow Storm	Feb. 18-20, 1972	New Hampshire	Up to 19 inches of snow in southern NH.
Snow Storm	Jan. 19-21, 1978	New Hampshire	Up to 16 inches of snow in southern NH.
Blizzard	Feb. 5-7, 1978	New Hampshire	New England-wide. Up to 25 inches of snow in central NH.
Snow Storm	Feb. 1979	New Hampshire	President's Day storm.
Ice Storm	Jan. 8-25, 1979	New Hampshire	Major disruptions to power and transportation.
Snow Storm	April 5-7, 1982	New Hampshire	Up to 18 inches of snow in southern NH.
Ice Storm	Feb. 14, 1986	New Hampshire	Fiercest ice storm in 30 years in the higher elevations in the Monadnock region. It covered a swath about 10 miles wide from the MA border to New London, NH.
Extreme Cold	Nov - Dec, 1988	New Hampshire	Temperature was below 0 degrees F for a month.
Ice Storm	March 3-6, 1991	New Hampshire	Numerous outages from ice-laden power lines in southern NH.
Snow Storm	1997	New Hampshire	Power outages throughout NH due to heavy snowfall.
Ice Storm	Jan. 15, 1998	New Hampshire	Federal disaster declaration # DR-1199-NH, 20 major road closures, 67,586 without electricity statewide, 2,310 without phone service, $17+ million in damages to Public Service of NH alone.
Snow Storm	Feb. 2006	New Hampshire	Trees down and power outages due to heavy snowfall.
Ice Storm	Dec. 11, 2008	New Hampshire	Many downed trees and power lines throughout the state.
Snow Storm	Oct. 29-30, 2011	New Hampshire	FEMA Disaster Declaration # DR-4049 (Hillsborough and Rockingham Counties). Severe snowstorm event. Snowfall 34" in a 24 hour period.
Snow Storm	Feb. 8-10, 2013	New Hampshire	February blizzard "Nemo", exceeded previous snow fall amounts; category B Declaration # DR4105. Local – no injuries or structures damaged.
Snow Strom	November 2014	New Hampshire	"Thanksgiving Storm"- was declared the 4th largest power outage in NH history. Many communities received over 12" of snow. Local – no injuries or structures damaged.
Snow Storm	January 2015	New Hampshire	FEMA Disaster Declaration # DR-4209. (Hillsborough, Rockingham, and Strafford Counties). Several successive snow storms that dumped in excess of 10" each. Local – no injuries or structures damaged.
Snow Storm	March 14-15, 2017	New Hampshire	FEMA Disaster Declaration #DR-4316. (Belknap and Carroll Counties) Local – no injuries or structures damaged.
Snow Storm	March 13-14, 2018	New Hampshire	FEMA Disaster Declaration #DR-4371. (Carroll, Strafford, and Rockingham Counties) Local – no injuries or structures damaged.

Erosion/Landslide - Very Low Risk
The extent of erosion occurs over time and is exacerbated by heavy rains. Road embankments may experience erosion during heavy rain events which could undermine the road and cause damage to the surface leaving the road to be impassable. The extent of landslides can be measured by the steepness/grade of a slope, the geographical area, measured in square feet (or yards or other measurement) or measured using LIDAR/GIS. No specific areas of erosion or landslide were noted by the committee.
Hazardous Materials Spills - High Risk
Transportation of chemicals and bio-hazardous materials through the city by truck is a concern. The severity of such an event greatly varies depending on the type of hazardous material, location, and response time, as well as other contributing factors such as wind and rain. Hazardous spills can contaminate the air, land, and water and cause serious health hazards or death. The city experiences approximately 2 industrial hazardous materials incidents per year but they usually do not exceed the building. There are also approximately 10-12 road related incidents that are also contained. No current record of injury or structural damage.
Dam Failure/Breach - Low Risk
The town has not experienced any dam failures, however, if one occurred it could potentially cause death, injury, or structural damage. The Table below shows the dams in Keene that are registered with the State of New Hampshire. The State of New Hampshire classifies dams into the following four categories: NM - Non-menace S - Significant hazard Blank - Non-Active L - Low hazard H - High Hazard Detailed description of classification terms: **Non-Menace structure** means a 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, provided the dam is: • Less than six feet in height if it has a storage capacity greater than 50 acre-feet; or • Less than 25 feet in height if it has a storage capacity of 15 to 50 acre-feet. **Low Hazard structure** means a 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 any of the following: • No possible loss of life. • Low economic loss to structures or property. • Structural damage to a town or city road or private road accessing property other than the dam owner's that could render the road impassable or otherwise interrupt public safety services. • The release of liquid industrial, agricultural, or commercial wastes, septage, or contaminated sediment if the storage capacity is less than 2 acre-feet and is located more than 250 feet from a water body or water course. • Reversible environmental losses to environmentally-sensitive sites. **Significant Hazard structure** means a 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 any of the following: • No probable loss of lives. • Major economic loss to structures or property. • Structural damage to a Class I or Class II road that could render the road impassable or otherwise interrupt public safety services. • Major environmental or public health losses, including one or more of the following: • Damage to a public water system, as defined by RSA 485:1-a, XV, which will take longer than 48 hours to repair. • The release of liquid industrial, agricultural, or commercial wastes, septage, sewage, or contaminated sediments if the storage capacity is 2 acre-feet or more. • Damage to an environmentally-sensitive site that does not meet the definition of reversible environmental losses.

High Hazard means a 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 as a result of:

- Water levels and velocities causing the structural failure of a foundation of a habitable residential structure or commercial or industrial structure, which is occupied under normal conditions.
- Water levels rising above the first floor elevation of a habitable residential structure or a commercial or industrial structure, which is occupied under normal conditions when the rise due to dam failure is greater than one foot.
- Structural damage to an interstate highway, which could render the roadway impassable or otherwise interrupt public safety services.
- The release of a quantity and concentration of material, which qualify as "hazardous waste" as defined by RSA 147-A:2 VII.
- Any other circumstance that would more likely than not cause one or more deaths.

Generally, all Class H dams need to have Emergency Action Plans, and most Class S dams also require them. There are 6 Class H dams within the City of Keene and no Class S dams according to the Department of Environmental Services Dam Bureau.

Dam Number	Class	Status	Name	River	Height	Impound-ment	Owner
D126001	L	Active	Ashuelot River Dam	Ashuelot River	15.5	34	Keene Public Works
D126002	L	Active	Wilson Pond Dam	Ash Swamp Br	8	10	Keene School District
D126003	H	Active/ multiple	Goose Pond Dam	Tr. Ashuelot River	22	51	Keene Public Works
D126004	NM	Active	Kate Tyler Ravine Dam	Kate Tyler Brook	14	3	Private
D126005	NM	Active	Kate Tyler Ravine	Kate Tyler Brook	9.5	2	Keene
D126006	---	Ruins	Beaver Brook Dam	Beaver Brook	4.5	---	Private
D126007	---	Ruins	Beaver Brook Mill Dam	Beaver Brook	6	---	Private
D126008	---	Ruins	Beaver Brook Dam	Beaver Brook	---	---	Private
D126009	H	Active	Three Mile Res. Dam	Beaver Brook	20	8.6	Keene Public Works
D126010	H	Active	Otter Brook Dam	Otter Brook	133	70	US Army Corps of Eng.
D126011	---	Ruins	Minnewawa	Minnewawa Brook	---	---	Unknown
D126012	NM	Active	Branch River Dam	Minnewawa Brook	9.5	2	Private
D126013	L	Active	Ferry Brook Dam	Ferry Brook	11.27	3.3	Cheshire Co. Fish & Game Club, Inc.
D126014	---	Ruins	Otter Brook Dam	Otter Brook	---	---	Private
D126015	NM	Active	Nameless Brook	Tr. Ashuelot River	10	0.25	Private
D126016	---	Ruins	Mill Pond Dam	Beaver Brook	9	---	Private
D126017	H	Breached	Black Brook Dam	Black Brook	5	4	Private
D126018	H	Ruins	Branch Brook	Minnewawa Brook	---	---	Unknown
D126019	---	Exempt	Kate Tyler Ravine	Unnamed Stream	3.5	0.25	Dartmouth Hitchcock Hospital
D126020	---	Exempt	Coates Dam	Ferry Brook	4	0.25	Private
D126021	NM	Active	Farm Pond	Unnamed Stream	12	0.25	Private

Dam Number	Class	Status	Name	River	Height	Impound-ment	Owner
D126022	NM	Active	Farm Pond	Unnamed Stream	6	0.25	Private
D126023	---	Breached	Wildlife Pond Dam	Sturtevant Brook	7	1.5	Private
D126024	---	Ruins	City Landfill Dike	Runoff	---	---	Keene
D126025	H	Active	Robinhood Park Reservoir Dam	Tr. Beaver Brook	18	7	Keene Parks Dept.
D126026	---	Exempt	Recreation Pond	Tr. Grimes Brook	4.8	0.13	Private
D126027	---	Exempt	Coates Farm Pond Dam	Unnamed Stream	5.6	0.13	Private
D126028	---	Exempt	Masiello Det. Pond	Intermittent Stream	3.5	3.4	Private
D126029	---	Exempt	Wright Estate Detention Pond #1	Runoff	5	.06	Private
D126030	---	Active	Wright Estate Detention Pond #2	Runoff	6	0	Private
D126031	NM	Active	Wright Estate Detention Pond #3	Runoff	6	.26	Private
D126032	NM	Exempt	Woodgate Det. Pond	Runoff	11	.7	Private
D126033	L	Active/ multiple	Goose Pond Dike	Tr. Ashuelot River	8	51	Keene
D126034	---	Exempt	Landfill Det. Pond	Runoff	6	.5	Keene
D126035	---	Exempt	Stone Arch Village Detention Pond	Runoff	8.5	.16	Private
D126036	---	Exempt	Stone Arch Village Detention Pond	Runoff	4.8	.17	Private
D126037	---	Pending	Bretwood Golf	Tr. Ashuelot River	8.5	.5	Private

Source: Department of Environmental Services Dam Bureau- 2017

Chapter 4
Assessing Probability, Severity, and Risk

The vulnerability and risk assessment provides information to enable the city to identify and prioritize appropriate mitigation actions to reduce losses from the identified natural hazards. For each hazard type shown in the table below, the committee assigned a value (1-5) to reflect the Human, Property and Business impact of each hazard to determine the vulnerability. Then, the committee assigned a probability value (1-5) reflecting the likelihood that this hazard will occur in the next 25 years. The severity and risk was calculated from the inputted values. The final column indicates the risk of each hazard, allowing the committee to see which hazards pose the greatest risk to the community. Very Low to Very High risk was assigned as shown below.

Human Impact, Property Impact, Business Impact and Probability rating scale:

Potential Hazard	Human Impact	Property Impact	Business Impact	Probability	Severity	Risk	Risk Level
	Probability of death or injury	Physical losses and damages	Interruption of service	Likelihood this will occur in 25 years	Average of human, property, business impacts	Severity x Probability	
Flooding	4	5	5	5	4.7	24	Very High
Drought	2	3	3	5	2.7	14	Medium
Extreme Heat	4	2	4	5	3.3	17	High
Wild Fire	2	3	3	5	2.7	14	Medium
Lightning Strikes	3	4	3	5	3.3	17	High
Tornado/downburst/wind	4	4	4	5	4	20	High
Hurricane/tropical storm	4	5	4	5	4.3	22	Very High
Earthquake	4	4	4	2	4	8	Low
Severe Winter Weather	4	2	4	5	3.3	17	High
Erosion/Landslide	2	2	2	2	2	4	Very Low
HazMat Spills	3	3	4	5	3.3	17	High
Dam Failure	4	4	4	2	4	8	Low

Natural Hazard Risk Assessment Table

Risk Level: 1-5 Very Low 6-10 Low 11-15 Medium 16-20 High 21-25 Very High

Human Caused Risks: In addition to the risk potential from naturally occurring hazards, the Keene Hazard Mitigation Committee identified human caused hazards that pose a risk to the city. For each hazard type shown in the table below, the committee assigned a value (0-4) to reflect the potential severity of each hazard if it were to occur in Keene. Then, the committee assigned a probability value (0-4) reflecting the likelihood that this hazard will occur in the next 25 years. The risk was calculated based on the severity and probability values. The final column indicates the risk of each hazard, allowing the committee to see which hazards pose the greatest risk to the community. *Low* to *Severe* risk was assigned as shown below.

Human Caused Hazards	**Severity** 0: n/a 1: Low 2: Moderate 3: High 4: Catastrophic	**Probability*** *In 25 years* 0: Improbable 1: Remote 2: Occasional 3: Probable 4: Frequent	**Risk** *Severity x Probability*	**Risk Level** 0-5: Low Hazard 6-11: Moderate Hazard 12-16: High Hazard
Haz Mat (Transport)	3	3	9	Moderate Risk
Utility Interruption	3	3	9	Moderate Risk
Haz Mat (Fixed)	3	3	9	Moderate Risk
Mass Casualty (Trauma or Medical)	3	3	9	Moderate Risk
Transport Incident *(plane, auto, etc.)*	2	3	6	Moderate Risk
Urban Fire	3	2	6	Moderate Risk
Armed Attack (assault, sniper)	4	1	4	Low Risk
Bomb/Explosion	4	1	4	Low Risk
Civil Disorder	1	2	2	Low Risk
Radiological	2	1	2	Low Risk
Biological Terrorism	4	1	4	Low Risk
Terrorist Attack (WMD)	4	1	4	Low Risk

CHAPTER 5
POTENTIAL HAZARDS and VULNERABILITY ASSESSMENT

Existing and future structures have the potential of being affected by some of the hazards identified in this plan. Some hazards identified in this plan are regional or citywide risks and, as such, all structures, infrastructure and critical facilities fall into the hazard area.

In order to determine estimated losses due to natural and man-made hazards in Keene, each hazard area was analyzed; results are shown below. Human losses were not calculated during this exercise, but could be expected to occur depending on the type and severity of the hazard. These figures exclude both the land value and contents of the structure. The value of all structures, including exempt structures such as schools and churches, is $1,876,512,800, according to the City Assessing records as of March 8, 2018, and the median value of a home in Keene is $183,300. The data below was calculated using FEMA's Understanding Your Risks: Identifying Hazards and Estimating Losses. Since hazard vulnerability assessment is dependent on a range of variables, such as the type, magnitude and precise location of a future hazard, these assessments are far from an exact science. Therefore, it is understood that the monetary values arrived at through these assessments represent gross estimates.

Flood - Very High Risk: There is great potential for annual flood incidents in Keene due to the community's topography and numerous watercourses and water bodies. The City of Keene is a very complex hydrologic system. The City's floodplain, due to its size and complexity, may be one of the most important in New England. The complexity arises from the fact that 12 steep rivers and streams from 6 major watersheds eventually drain into the City. The outlet of the Keene floodplain is a flat stretch of river, which does not gain any significant slope for about 25 miles at the Town of Winchester. The result of having large volumes of water flowing into a flat bowl is frequent flooding. During major region-wide rainstorms or during spring snowmelt there can be basin-wide flooding. Since only so much water can flow past Winchester and Hinsdale to the Connecticut River, the City has experienced backwater flooding, as water backs up from Winchester and Swanzey northward into the Keene basin. However, flooding can occur along any one of the rivers or brooks, and there may be significant flooding on the east side of Keene (due to a local rainstorm in the Beaver Brook watershed, for example), while there is no flooding on the west side of the City. That is why the Keene floodplain is so complex, in terms of forecasting and in terms of management. The area most susceptible to major flooding is that portion of the City which extends southward from the Colony dam just north of West Street (next to Starbucks Coffee) down into Swanzey, and in a swath along each of the rivers and streams. The general extent of the floodplain is shown on the Hazard Identification Map at the end of this plan. In total, the 100-year floodplain extends over 1,400 acres. The extent of damage caused by any flood depends on the depth and duration of flooding, the topography of the area flooded, velocity of flow, rate of rise, and the amount and form of development in the floodplain. Deep floodwater carrying floating debris would create hazardous conditions for people and vehicles attempting to cross flooded areas. In depths of greater than 3 feet or in areas where the flow attains faster velocity, an adult could be swept off balance creating the danger of injury or drowning. Damaged sewer lines or septic systems could pollute floodwaters, creating a health hazard or contaminating City well fields. Hazardous or toxic materials could be released, causing pollution or injury. The provision of emergency medical, fire or police assistance could be seriously restricted or delayed due to obstructed access routes. Death or injury could occur. There could be significant damage to buildings. Many utilities could be damaged, including gas, electric, drainage, telephone, sewer and water lines. A major electrical substation and local propane gas company on Emerald Street are located within the floodplain. Many people could be out of work as the result of damage to local businesses and industries. In general, a major flood could affect the whole city, either directly or indirectly. In 1989, the U.S. Army Corps of Engineers estimated that a 100-

year flood could cause at least $5 million worth of damage in Keene, and that a 500-year flood could result in at least $10.5 million worth of damage. Using an inflation calculator, these amounts in 2018 currency would be approximately $10,062,661 (100-year flood) and $21,131,590 (500-year flood).

Flooding on the Branch River, Beaver Brook, and Ash Swamp Brook may be caused by runoff from the upstream drainage areas and by backwater flooding from the Ashuelot River. Flooding on Otter Brook is largely controlled by regulated outflow from Otter Brook Dam. Flooding can occur from the runoff from the watershed below Otter Brook Dam or from backwater from the Branch River. Flooding in the Minnewawa Brook basin can occur during all seasons of the year.

Drought - Medium Risk: No estimate of cost - Keene has had limited experience with severe drought conditions. Drought will increase the risk for wildfires, especially in forested areas. Drought could affect wells and irrigation in Keene.

- The entire city could be affected by drought;
- Forested areas with high fuel content have more potential to burn; and
- Recent drought from 2015 to 2017 - some wells have gone dry. There is no documentation and no count available.

Extreme Heat - High Risk: No estimate of cost. Extreme heat events can adversely affect human health, especially children, seniors and people with respiratory illnesses. In the framework of climate change forecasting, the City of Keene has been participating in the "Climate Resilient Communities Program", which resulted in the Climate Change Adaptation Plan (2007). This Plan includes a review of the impacts of extreme heat events on public health, energy needs and agriculture. The Plan includes a summary of testimony by Dr. Cameron Wake of the University of New Hampshire which states "that if the world remains on a pathway of using fossil fuels as it does now, New Hampshire will be a very different place, with sixty summer days over 90°, and 50% less snowfall. Wake says New Hampshire weather will be like a very dry North Carolina."

- The elderly are at risk. Approximately 16 % of the city population is 65 and over;
- Power outages could occur due to excessive use of air conditioners and fans; and
- The entire city could be affected by extreme heat.

Wildfire - Medium Risk: Estimated cost - Approximately $1,000/acre
The potential for wildfire depends on terrain, the fuel load, the humidity and other characteristics of the area. Previous ice storms and high wind events have left a significant amount of woody debris in the forests that may fuel future wildfires. Fires in New Hampshire are predominantly human-caused, and roughly half of the total fire activity is in the most populous three southern counties. The proximity of many populated areas to the local and state forested lands exposes these areas and their populations to the potential impact of wildfire. There is a higher risk for urban fires in the downtown area where older homes have been converted to business offices.

- Entire city is at risk; A wildfire can strike at any time and in any place;
- There is a potential for interruption of service and damage to structures;
- There is a potential for injury or death; and
- Risk increases for wooded areas with higher elevation.

Lightning Strike - High Risk: No estimate of cost - Residents and visitors to the New Hampshire area are more vulnerable to being struck by lightning because of the activities with which they are involved, particularly on those warm summer days when lightning is most likely to occur. More likely to be affected are structures and utilities, often resulting in structure fires and power outages. High elevations and areas

around water and wetlands may be more susceptible to lighting strike incidents. Lightning could strike tall trees anywhere in Keene and could potentially start wildfires in periods of drought, or create telephone and power outages. Church steeples are also at risk.

- This could occur citywide;
- There is a potential for interruption of service, and damage to structures;
- There is a potential for injury or death.
- Areas of high fuel load are at higher risk;
- Antennas and towers are at higher risk; and
- Hikers, fishermen and boaters are at higher risk.

Tornado/Downburst/Severe Wind - High Risk: **estimated cost - $37,530,256.** Severe wind events (downburst, tornadoes or high winds associated with thunderstorms) can occur anywhere in Keene. Generally the higher elevations, such as Beech Hill, are more susceptible as well as more vulnerable due to the fact that they are home to many communication towers, including emergency response/mutual aid towers. Due to the sporadic nature of Tornados, they could occur anywhere in the City of Keene. Such events can cause small blocks of downed timber. Downbursts are sometimes mistaken for tornados and can cause very similar damage.

Tornadoes rarely occur in this part of the country; therefore, assessing damage is difficult. The estimated damages to 10% of structures with 20% damage is approximately $37,530,256. The estimated cost does not include building contents, land values or damages to utilities.

- The potential for damage to structures from severe wind, downbursts, and tornados is citywide;
- There is a potential for interruption of service and damage to utilities; and
- There is a potential for injury or death.

Hurricane/Tropical Storm - Very High Risk: estimated cost - $46,912,820. Keene's location in southwestern New Hampshire reduces the risk of extremely high winds that are associated with hurricanes. Hurricanes can, and do create flooding. The estimated wind damage of 5% of the structures with 10% damage is approximately $9,382,564. The estimated flood damage of 10% of the structures with 20% damage is approximately $37,530,256. The cost of repairing or replacing the roads, bridges, utilities and contents of structures is not included.

- The potential for damage to structures is citywide;
- There is a potential for injury or death;
- Damaged power lines could disrupt services; and
- Flooding could wash out evacuation routes.

Earthquake - Low Risk: estimated cost – $375,302,560. According to the NH State Hazard Mitigation Plan, New Hampshire is considered to lie in an area of "Moderate" seismic activity with respect to other areas of the United States and is bordered to the North and Southwest by areas of "Major" activity. There are no identified fault lines for the entire state, therefore, an earthquake could occur and/or affect any location in the City. Keene is located on a lake bed (Connecticut River valley) that has high liquefaction factor which increases the impact of an earthquake. It is assumed that all of the buildings in the City have not been designed to withstand seismic activity. More specifically, the older historic buildings that are constructed of non-reinforced masonry are especially vulnerable to any moderate sized earthquake. If a strong earthquake were to occur, there is the potential for an estimated loss of 20% of city assessed structural valuation which is approximately $375,302,560. The costs for repairing or replacing roads, bridges, power lines, or the contents of the structures area not included.

- There is the potential for damage to structures from earthquakes;

- There is a potential for injury or death.
- Damaged power lines could disrupt services; and
- The entire city is at risk.

Severe Winter Weather - High Risk: No estimate of cost. Three types of winter events are heavy snow, ice storms and extreme cold; all which cause concern for Keene. Heavy snow can collapse buildings and ice storms can disrupt power and communication services. Extreme cold affects the elderly. Keene's recent history has not recorded any loss of life due to extreme winter weather. These random events are difficult to set a cost to repair or replace any of the structures or utilities affected.

- There is the potential for damage to structures from heavy snow, and freezing pipes;
- There is a potential for injury or death;
- Power outages could occur due to heavy snow and ice on power lines; and
- The entire city is at risk.

Erosion/Landslide - Very Low Risk - No estimate of cost: There is a potential for erosion of the river banks and steep slopes by heavy rain and/or spring runoff if it is not vegetated or supported by other methods.

- There is a potential for mud and debris to enter the streams;
- There is a potential for mud and debris onto roads; and
- This can occur on steep slopes and riverbanks anywhere in the City.

Hazardous Materials Spills - High Risk - No estimate of cost: Public transportation of fuel and other hazardous materials through Keene on State highways is a concern. Any road with hills where oil, fuel, and propane trucks deliver is a concern.

- A spill could cause serious or life threatening health concerns;
- A spill could contaminate drinking water sources;
- This could occur citywide, however, the State highways are heavier truck routes and, therefore, pose a greater risk.

Dam Failure/Breach - Low Risk - No estimate of cost: The committee determined that dam failure or breach is a low risk and, therefore, they do not consider any cost estimate for potential losses.

After careful review of the historical natural disasters in and near the City of Keene, the committee determined that the risk of snow avalanches do not pose enough of a risk to the city to include in this plan.

Chapter 6
Critical Facilities

The Critical Facilities list for the City of Keene has been identified by the Keene Hazard Mitigation Committee. The list is divided into two sections: Facilities needed for Emergency Response (Category 1) and Populations and facilities to protect in the event of a disaster (Category 2). The "Critical Facilities Map" at the end of the Plan identifies the critical facilities needed for emergency response.

Critical Facility Categories:

1. Facilities needed for Emergency Response
2. Populations & Other Places to Protect

CATEGORY 1 (Facilities needed for Emergency Response)

- Fire
- Emergency Medical Services (EMS)
- Police
- Hospital
- Shelter
- Public Utilities
- Communications
- Transportation
- Emergency Operations Center (EOC)
- Public Works
- Water Supply/Treatment/Dispatch Facilities
- Sewer Treatment/Collection Facilities
- Emergency Fuel
- Evacuation Routes
- Municipal Government Center

CATEGORY 2 (Populations & Other Places to Protect)

- Schools
- Daycares
- High Concentration Populations
- Elderly Facilities
- Healthcare Facilities
- Recreation areas
- Historic Resources

Vulnerability Assessment:
All the facilities are vulnerable to all the hazards, with the exception of Flooding and Dam Failure, as they have a specific geographic area that would be affected. The 100 - year floodplain and its' impact on Keene's critical facilities is shown on the Floodplain Map at the end of this Plan.

Facility	Name/Location	Owner	Back-Up Power	Assessed Value (2010)	Comment
Category 1- Facilities Needed For Emergency Response					
City Hall	Keene City Hall, 3 Washington St.	City	Yes	3,148,500	
EOC Primary	Keene City Hall, 3 Washington St.	City	Yes	n/a	
EOC Secondary	Keene Fire Department, 31Vernon St.	City	Yes	577,100	
Police Station	Keene Police Department, 400 Marlborough St.	City	Yes	6,200,000	
Fire Station	Keene Central Fire Department, Vernon St.	City	Yes	5,250,000	
	West Keene, 110 Hastings Ave.	State	Yes	1,600,400	
EMS	Fire Department, Vernon St.	City	Yes	n/a	
	Diluzio Ambulance Service, 49 Court St.	Private	No	579,800	
Hospital	Cheshire Medical Center, 580 Court St.	Private	Yes	50,562,100	
Shelters	Keene Middle School, 167 Maple Ave.	Keene Union School District	No	17,292,600	
	First Baptist Church, 105 Maple Ave	Private	No	1,088,300	
	Keene High School, 53 Arch St.	Keene Union School District	No	28,771,400	
	Keene Recreation Center, 312 Washington St.	City	Yes	2,061,300	
	Keene State College, Spaulding Gym, 229 Main St.	KSC	Yes	unknown	
Public Works	Public Works Department, 350 Marlboro St.	City	Yes	8,593,500	
	Supply Yard, 580 Main St.	City	n/a	829,900	
Sewer Treatment	Waste Water Treatment Plant, Airport Rd., Swanzey, NH	City	Yes	27,134,000a	
Water Supply/ Treatment	Water Treatment Facility, 555 Roxbury Rd.	City	Yes	9,019,900	
	Babbidge and Woodward Dams Surface Water, Roxbury	City	n/a	3,505,000	
	4 public wells: 3 on Court St. and 1 on West St. (All w/ backup power)	City	Portable	1,783,800	
Emergency Fuel Stations	Keene Public Works Department, 350 Marlboro St. (Diesel)	City	Yes		
	City's contracts with several private gas stations - some with backup	Private/Mixed	Partial	n/a	
	State DOT, Basehill Rd, Swanzey, NH	State	Yes	unknown	

Facility	Name/Location	Owner	Back-Up Power	Assessed Value (2010)	Comment
Public Utilities	Eversource - electric	Private	n/a	47,520,500	
	Spectrum - communications	Private	n/a	1,198,800	
	Liberty Utilities - gas	Private	n/a	1,121,000	
Transportation Services	First Student Bus Transportation	Private	n/a	unknown	
	Home Health Care Services, 312 Marlborough St.	Private	n/a	Unknown	
	Thomas Transportation, Swanzey	Private	n/a	unknown	
	Vermont Transit, 67 Main St. - Greyhound bus	Private	n/a	unknown	
	Dillant-Hopkins Airport, 80 Airport Rd.	City	Yes		
Evacuation Rtes.	Routes 9, 10, 12 and 101	n/a	n/a	n/a	
Communication Infrastructure	Cheshire County Sheriff Comm. Dept. 12 Court St. (Courthouse)	County	Yes	3,632,000	
	SWNHDFMA 32 Vernon St. (Part of Central Fire Station)	Private	Yes	n/a	
	Keene Police Dispatch (Part of Police Station)	City	Yes	n/a	
	Spectrum (phone)	Private	unknown	unknown	
	Consolidated Communications (formerly Fairpoint)	Private	unknown	unknown	
	Private Wireless Carrier	Private	n/a	unknown	
	City of Keene Fiber optics (wireless network)	City	Yes	unknown	
	City Wi-Fi for PD/Fire	City	Yes	unknown	
Category 2 - Populations and Other Places to Protect					
Schools	Franklin Elementary School, 217 Washington St.	Keene Union School District	No	2,732,300	
	Fuller Elementary School, 422 Elm St.	Keene Union School District	No	33,874,600	
	Jonathan Daniels Elementary, 193 Maple Ave.	Keene Union School District	No	1,149,600	
	Symonds Elementary, 79 Park Ave.	Keene Union School District	No	2,827,600	
	Wheelock School, 24 Adams St.	Keene Union School District	No	2,556,100	
	Keene High School, 43 Arch St. (including Cheshire Career Center)	Keene Union School District	No	17,530,800	
	Keene Middle School, Maple Ave.	Keene Union School District	No	32,000,000	

Facility	Name/Location	Owner	Back-Up Power	Assessed Value (2010)	Comment
Schools (continued)	Monadnock Waldorf School (nursery & kindergarten), 424 Old Walpole Rd.	Private	Unknown	827,700	
	Monadnock Waldorf High School, 146 School St.	Private	No	435,200	
	Monadnock Waldorf School (grades 1-8), 98 South Lincoln St.	Private	Unknown	1,363,200	
	Montessori Schoolhouse of Cheshire County (preschool), 28 Hurricane Rd.	Private	Unknown		
	Keene Montessori School, 125 Railroad St. (Part of 139 Railroad St.)	Private	Unknown	unknown	
	Keene State College, 251 Main St.	State	Partial	unknown	
	Antioch NH University, 40 Avon St.	Private	No	7,926,400	
	River Valley Comm. College, 438 Washington St.	State of NH	No	1,703,700	
	MC2 Charter School, 149 Emerald St.				
	Surry Village Charter School, 217 Court St.	Private	No	471,200	
	Cedarcrest Private School, 91 Maple Ave.	Private	Unknown	3,415,200	
	St. Joseph School, 92 Wilson St. (Part of church at 161-183 Main St.)	Private	Unknown	unknown	
	Trinity Christian School, 100 Maple Ave.	Private	Unknown		
Daycare	Building Tots Child Care Center, 168 Emerald St. (Tfz Child Care & Kids Fitness)				283-0350 283-0349
	Castle Center - Adult Day Care, 312 Marlboro St.				355-8281
	Children's Learning Center, 548 Court St.	Private	Unknown	1,980,000	354-5434
	Cynthia King's FDC, 56 Woodbury St.	Private	Unknown	151,000	
	Footsteps Day Care & Learning Center, 130 Martell Ct.	Private	Unknown	214,500	357-1475
	Great Beginnings Infant & Toddler Program, 39 Old Homestead Highway				355-5269
	Head Start, 69 Island St.				352-7512
	Kathy Lehrman Family Child Care, 105 Old Walpole Rd.	Private	Unknown	158,400	
	Keene Day Care Center, 86 Wood St.	Private	Unknown	674,600	352-2129
	Keene Day Care Center, Inc., 312 Washington St. (Keene Recreation Center)	Private	Unknown	n/a	357-9829
	Keene Family YMCA, 200 Summit Rd.	Private	Unknown	~~695,900~~	352-6002
	Keene State College CDC, 229 Main St.	Private	Unknown	unknown	358-2244
	Kids R People 2, 28 Greenbrier Rd.	Private	Unknown	309,200	
	Maple Ave Nursery School, 105 Maple Ave. (Part of First Baptist Church)	Private	Unknown	unknown	357-5959
	Montessori Schoolhouse of Cheshire County, 28 Hurricane Rd.	Private	Unknown	1,243,000	352-3301
	Rise for Baby and Family, 147 Washington St.	Private	Unknown	682,400	357-1395

Facility	Name/Location	Owner	Back-Up Power	Assessed Value (2010)	Comment
Daycare (continued)	Sophia's Hearth, 700 Court St.	Private	Unknown	1,047,000	357-3755
	Sue's House, 22 Eastern Ave.	Private	Unknown	211,800	355-4329
	UCC Nursery, 23 Central Square	Private	Unknown	2,841,300	352-4136
High Population Areas	Keene State College	State of NH	Yes	unknown	
	Central Business District (Main St.)	Mixed	n/a	n/a	
Assisted, Elderly, Senior Facilities	Autumn Leaf Village, 7-25 Ivy Dr.	Private	Unknown	2,428,400	
	Bentley Commons, 197 Water St.	Private		11,324,300	
	Cedarcrest, 91 Maple Ave.	Private		2,989,800	
	Central Square Terrace, 4-7 Central Square	Private	Unknown	5,724,600	
	Cleveland Building, 21 Roxbury St.	Private	Unknown	4,151,500	
	Genesis, 677 Court St.	Private		4,304,100	
	Harper Acres, 104 Castle St.	Private	Unknown	5,019,400	
	Hillside Village, 99 Wyman Rd.	Private			
	Keene Eastside Elderly Housing (Beaver Mills) 101-129 Railroad St.	Private		906,300	
	Langdon Place, 136A Arch St.	Private		6,591,000	
	Southwestern Community Services, 63 Community Way	Private		2,780,000	
	Stone Arch Senior Housing, 835 Court St.				
	The Prospect - Woodard Home, 192-202 Court St.	Private	Unknown	823,000	
	Westmill Senior Housing, 110 Railroad St.				
	Westwood Harborside, 298 Main St.	Private		2,240,400	
Healthcare Facilities	Cheshire Medical Center, 580 Court St.	Private	Yes	50,562,100	
	Cheshire Medical Center Walk-in, 149 Emerald St.	Private	Unknown		354-5484
	Convenient MD, 351 Winchester St.	Private	Unknown		605-0654
Recreation Areas	American Legion Ball Fields, 797 Court St.	Private	n/a	767,900	
	Ashuelot River Park, 273 West St.	City	n/a	381,600	
	Beech Hill Recreation Area, Chapman Rd.	City	n/a	281,000	
	Bretwood Golf Course, East Surry Rd.	Private	n/a	3,074,200	
	Mayor Patricia Russell Park (formerly Carpenter St. Field)	City	n/a	unknown	

Facility	Name/Location	Owner	Back-Up Power	Assessed Value (2010)	Comment
Recreation Areas (continue)	City Skate Park, Gilbo Ave.	City	n/a	121,800	
	City Tennis Courts, Knight St.	City	No		
	Central Business District	Mixed	n/a	n/a	
	Drummer Hill Recreation Area, Old Gilsum Rd/Drummer Hill Rd.	City	n/a	798,600	
	Goose Pond Nature Preserve, East Surry Rd.	City	n/a	647,200	
	Horatio Colony Preserve, Daniels Hill Rd.	Private	n/a	1,559,400	
	Keene Country Club Golf Course, 755 West Hill Rd.	Private	n/a	2,799,400	
	Keene Family YMCA, 200 Summit Rd.	Public	No	2,218,400	
	Keene Ice, 380 Marlboro St.	Private	No		499-8873
	Keene State College, athletic field, Main St.	KSC	Partial		
	Ladies Wildwood Park, Park Ave & Arch St.	City	n/a	386,500	.
	Otter Brook Recreation Area, Route 9	US-ACOE	n/a	894,200	367 Acres
	Owl Stadium/recreational fields, Krif Rd.	KSC	n/a	unknown	
	Recreation Center, Washington St.	City	Yes		
	Robin Hood Park, Reservoir St.	City	n/a	1,895,000	
	School Recreational Facilities	Keene Union School District	n/a		
	Shadow Lake Park, Kendall Rd.	City	n/a	1,500	
	Stearns Hill Nature Preserve, Hurricane Hill Rd.	City	n/a	n/a	
	Water St. Basketball Court, 152 Water St.	City	n/a	320,200	
	Wheelock Park, 101 Park Ave.	City	n/a	2,027,600	
Historic Buildings and Places/ Resources	Beaver Mills, 93 - 115 Railroad St.	Private	Unknown	1,831,900	
	Catherine Fiske Seminary for Young Ladies, 251 Main St.	Private	Unknown	unknown	
	Cheshire County Courthouse, 12 Court St.	Cheshire County	Unknown		.
	City Clerk's Record Center (Historical records)	City	Unknown	unknown	
	Colony's Block, 4-7 Central Square	Private	Unknown	5,724,600	
	Dinsmoor - Hale House, Main & Winchester St.	KSC	Unknown		

Facility	Name/Location	Owner	Back-Up Power	Assessed Value (2010)	Comment
Historic Buildings (continued)	Downtown Historic District	Mixed	Unknown		
	Dr. Daniel Adams House, 324 Main St.	Private	Unknown	392,700	
	Elliot Mansion, 305 Main St.	KSC	Unknown	6,741,300	
	Grace United Methodist Church, 34 Court St.	Private	Unknown	520,700	
	Historical Society, 246Main St.	Private	Unknown	1,250,000	
	Noah Cooke House, Daniels Hill Rd.	Private	Unknown	unknown	
	Sawyer Tavern, 63 Arch St.	Private	Unknown	329,000	
	Southwest Fire Mutual Aid building, 32 Vernon St.	City	Limited		
	United Church of Christ, 23 Central Sq.	Private	Unknown	2,841,300	
	Wyman Tavern Museum, 339 Main St.	Private	Unknown	368,400	

CHAPTER 7
EXISTING MITIGATION STRATEGIES & AND PROPOSED IMPROVEMENTS

This chapter examines the existing mitigation strategies being implemented throughout the city and considers areas that need improvements or where there may be gaps in coverage.

The following is a list of current policies, regulations and plans that Keene currently has in place to help reduce the loss of life and property due to hazard events.

Existing Programs

Emergency Operation Plan (2016)
Zoning Ordinance
Building Code
Fire Code
Natural Resource Protection Ordinance
Elevation Certificates
Community Rating System
National Flood Insurance Program
Floodplain Development Ordinance
Emergency Notification System
Land Development Regulations
Public Improvement Standards (infrastructure)
Bridge Maintenance Program
Storm Drain/Culvert Maintenance
Dam Emergency Action Plans
Dam Master Plan
Shoreland Protection Program
Hazardous Materials Plan/Committee
Public Education Programs
Tree Maintenance
Comprehensive Master Plan (2010)
Capital Improvement Program
Shelters with Emergency Back-up Power
Mitigation Grants
Geographic Information System (GIS)
Wetlands Protection Ordinance
Climate Change Adaptation Plan (2007)
Climate Change Action Plan (2004)
Water Emergency Plan
Water Supply Shortage Plan

EXISTING PROTECTION MATRIX

This matrix identifies and evaluates the mitigation strategies and city programs that are currently in place. It also outlines those programs and recommends improvements to ensure the highest quality emergency services possible. Effectiveness of the existing protection is rated *Poor, Average, or Good*: Poor - needs improvements; Average - meets most expectations; Excellent - meets or exceeds expectations.

Existing Program or Activity	Description/Area Covered	Department or Local Contact	Effectiveness	Improvements or Changes Needed/Comments
Emergency Operations Plan (2016)	City-wide emergency response plan that identifies the response procedures and capabilities of the City in the event of a natural or man-made disaster.	EMD	Average	Update in 3 years as recommended in the Comprehensive Master Plan. (in 2021)
Zoning Ordinance	The City has adopted a zoning ordinance and map to protect the health, safety and welfare of the residents from the effects of ill-considered and indiscriminate use of land.	Zoning Administrator	Average	Currently being updated. Expected completion in 2018. No changes needed at this time.
Building Code	The City complies with the State of New Hampshire Building Code.	Health & Code Enforcement Director	Average	Better enforcement w/staff as recommended in the Comprehensive Master Plan.
Fire Code	The City meets or exceeds the State of New Hampshire Fire Code.	Fire Chief	Excellent	Reviewed every three years. Next update is in 2020.
Natural Resources Protection Ordinance	National Flood Insurance Program (NFIP) requirements have been adopted as part of the City's Zoning Ordinance. This regulates all new and substantially improved structures located in the 100-year floodplain, as identified on the FEMA Flood Maps.	Health & Code Enforcement Director	Excellent	This is currently being updated. No changes needed at this time.
Elevation Certificates Maintained	For all development (new or substantially improved) in 100 year Floodplain. **Area:** Floodplain	Health Code Enforcement Director	Average	Continue to enforce NFIP by requiring elevation certificates.
Community Rating System	A voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk.	Health Code Enforcement Director	Excellent	Continue to participate in the Community Rating System. No changes needed at this time.
National Flood Insurance Program (NFIP)	A federally backed program that encourages communities to enact and enforce floodplain regulations. **Area:** Floodplain	Health Code Enforcement Director	Average	Continue outreach efforts to homeowners on the benefits of the program and encourage participation.

Existing Program or Activity	Description/Area Covered	Department or Local Contact	Effectiveness	Improvements or Changes Needed/Comments
Floodplain Development Ordinance	An ordinance has been adopted as part of the City zoning ordinance to control development in the 100-year floodplain. This was a requirement to become a member of the NFIP. **Area:** Floodplain	Health Code Enforcement Director	Excellent	Review and update as needed.
Emergency Notification System	Emergency apparatus with bullhorns, signs, use of local media, message boards. Recently started to use Reverse 911 and social media.	EMD	Average	Continue to work on available communication systems and evaluate options.
Land Development Regulations	Subdivision regulations provide for the orderly present and future development of the City by promoting the public health, safety, convenience and welfare of the City's residents.	Planning Dept.	Average	Regulations are currently being reviewed and updated. Completion is anticipated for 2019.
Public Improvement Standards (infrastructure)	City Code includes road design and stormwater design standards.	DPW	Average	Update is underway with anticipated completion of 2019.
Bridge Maintenance Prog.	Inspection and clean-up occur annually. The state inspects all bridges every other year. Red listed bridges are inspected annually.	DPW	Poor	13 out of 32 bridges are red listed. Replacement is needed.
Storm Drain/Culvert Maintenance	Keene Public Works and the State DOT clean one quarter of the drainage basins once a year and after major flooding events. Culverts are repaired as needed.	DPW	Average	Storm water Phase 2 needs to be evaluated.
Dam Emergency Action Plans	The dam emergency plans establish evacuation and emergency response procedures for potential dam failure.	DPW, Parks & Rec Director, EMD	Average	Continue annual exercising & updating of all plans.
Dam Master Plan	A report that evaluates and sets priorities for dam improvements.	DPW, Parks & Rec Director	Average	Update the report as needed. No changes needed at this time.
Shoreland Protection Prog.	Designates a protective buffer along shorelines in accordance to NHDES regulations.	NH DES	Average	Continue to support the Shoreland Protection Program.
Hazardous Materials Plan/Team	City of Keene HazMat Team & current HazMat Plan.	Fire Chief/Fire Department	Excellent	Continue ongoing training and updating.

Existing Program or Activity	Description/Area Covered	Department or Local Contact	Effective-ness	Improvements or Changes Needed/Comments
Public Education Programs	Multiple City departments conduct periodic public education programs pertaining to natural, human caused and public health emergencies.	Multi - agency	Average	Continue to develop and improve the public education program.
Tree Maintenance	Citywide	Public Works	Poor	Develop and implement a citywide tree maintenance program.
Comprehensive Master Plan (2010)	The Comprehensive Master Plan serves as the guiding document for future development in Keene and assists the Planning Board as it updates the Subdivision & Site Plan Regs.	Planning Dept./ Planning Board & City Council	Average	No changes needed at this time.
Capital Improvement Program	A decision making tool used to plan and schedule city improvements over a six-year period. The CIP provides a suggested timeline for budgeting and implementing needed capital improvements.	Finance department	Average	No changes needed at this time.
Shelters with Emergency Back-up Power	Keene High School and Middle School, Keene Recreation Center, First Baptist Church, and Keene State College (Spaulding Gym).	Fire Chief/EMD	Poor	Additional generators are needed.
Mitigation Grants	Federal grants to assist with funding of mitigation projects.	Multi-Agency	Average	Continue to pursue mitigation grants.
GIS	Keene Planning department provides mapping capabilities for natural and human caused mitigation planning.	Planning Director	Average	Obtain additional data layers.
Climate Change Adaptation Plan	2007 Plan assessed the vulnerability to climate impacts and identifies actions to enhance resiliency.	Planning Dept.	Average	Implement as recommended in the Comprehensive Master Plan.
Climate Change Action Plan	Identifies actions to reduce greenhouse gas emissions.	Planning Dept.	Excellent	Implement as recommended in the Comprehensive Master Plan.
Water Emergency Plan	Outlines response procedures for water emergencies.	DPW	Average	Recently updated. Update again in 5 years.
Water Supply Shortage Plan	An ordinance that outlines methods of water supply rationing.	DPW	Unknown	No changes needed at this time.
Wetlands Protection	Surface Water Protection Overlay District.	Code Officer/ Planning Dept.	Average	Adopted in 2013. Review and update periodically. No changes needed.

STATUS OF PREVIOUS PRIORITY MITIGATION ACTIONS

The following table provides a status update for the Priority Mitigation Actions identified in the previous Hazard Mitigation Plan. Previously identified mitigation actions are noted as *completed*, *deleted*, *deferred* or *completed & ongoing* to the updated Plan's new mitigation strategies list.

Mitigation Action (strategy)	Status	Comments
Zoning Ordinance needs to be revised with current national and state standards as recommended in the Comprehensive Master Plan.	Completed	Actively in process and nearly completed. This will be completed in 2018.
Improve enforcement of building and fire codes.	Completed and ongoing.*	This is ongoing. Continue as a new mitigation action as two separate actions (building, and fire).
Review and update road and utility design standards.	Completed and ongoing.*	The road and utility designs are updated as needed. Continue as new action.
Continue to review, update and obtain additional GIS data layers, specifically digital orthophoto, to be used for natural and human-caused hazard mitigation planning.	Completed and ongoing.*	This was completed in 2015. Reviews and updates are ongoing and should continue as a new action.
Implement projects as identified in the Keene Comprehensive Master Plan.	Completed and ongoing.*	Some work has been done, but more is required. Continue as a new mitigation action.
Develop a Continuity of Operations Plan (COOP) for the City.	Deferred*	Continue as a new mitigation action.
Tanglewood Estates: Develop a program to assess flood risks and potential secondary hazards for the approximate 80 mobile homes in the 100-year floodplain. Fund a mobile home owner mitigation program to ensure mobile homes and fuel tanks are securely anchored in place.	Deferred*	Some work has been done, but more is required. Continue as a new mitigation action.
Develop strategies to acquire the necessary rights from the following properties for the purpose of protecting and preserving floodplain storage: - Realities Inc. parcel - Behind Hannaford - Parcel along Ashuelot - South of Tanglewood - Beaver Brook North of 101 - Pearl Street Parcel - Silent Way/Lower Main Street Parcel - Wyman Road parcel - Lower Production Avenue	Deferred*	This is a difficult strategy to complete, but is important to keep in the plan as a new strategy.
Collect additional data and monitoring equipment at Three Mile Reservoir, Babbidge, Woodard and Robin Hood Dams.	Completed and ongoing.*	Some data has been collected. Continue as a new mitigation strategy.
Evaluate and floodproof, if necessary, Court Street Lift Station, Bradco Lift Station and Well numbers one and four.	Deferred*	Partial and ongoing. Continue as a new mitigation strategy.
Evaluate the location/style of disinfection equipment at the waste water treatment plant.	Completed	This was completed in 2016.

Mitigation Action (strategy)	Status	Comments
Conduct public outreach on inundation pathway for High Hazard Dams and develop emergency evacuation strategies for properties within the pathway.	Completed and ongoing.*	Some efforts have been made, but additional outreach is needed. Continue as a new mitigation strategy.
Develop and sustain a community outreach program to discuss mitigation and emergency preparedness with schools, businesses, hospitals, and colleges.	Completed and ongoing.*	Completed in 2017 and ongoing. Need to increase outreach. Continue as a new mitigation strategy.
Implement recommendations and projects identified in the Beaver Brook *Escherichia coli* Impairment Investigation and Remediation, and Habitat Restoration Project.	Deferred*	Continue as a new mitigation strategy.
Continue Incident Command System (ICS) training for all staff.	Completed and ongoing.*	Completed and ongoing. Continue as a new mitigation strategy.
Conduct tabletops, drills and exercises for all hazards.	Completed and ongoing.*	Partially complete and ongoing. Continue as a new mitigation strategy.
Review and implement emergency notification systems (i.e. reverse notification, social media and City website.).	Deferred*	Partially complete and ongoing. Need to increase outreach. Continue as a new mitigation strategy.
Update communications and data equipment to ensure inter-operability for all City personnel.	Completed and ongoing.*	Completed and ongoing. Continue as a new mitigation strategy.
Beaver Brook Bridge Modifications: In 1994, the Soil Conservation Service suggested that removal of flow constrictions caused by bridges could significantly reduce flooding, without causing additional problems downstream. Initial grant funds would be used for an engineering study to validate the impacts of this approach. Subsequent grants would be applied for to fund bridge modification.	Deferred*	Some work has been done to remove debris. Continue as new mitigation action.*
Woodland Cemetery: Significant amounts of fill and biotic debris have been stored in this area, decreasing potential flood water storage. Excavate previously filled sites and restore wetlands.	Completed	This was completed in 2017.
Three Mile Reservoir: Existing impoundment at Three Mile Swamp is rated to mitigate against 10 to 25 year storm event. Assess feasibility to enlarge storage capacity to reduce flood potential in Beaver Brook Watershed.	Deferred	Partially complete and continue as new mitigation action.*
Road and Bridge Repair: Eleven out of thirty-two bridges are red listed and need to be replaced. Repair or replace culverts & bridges associated with road flooding as identified by City DPW.	Deferred	Partially complete and continue as new mitigation action.*
Obtain a mobile command center for use during multi-agency response.	Deleted	Action not needed. Current practices are working.
Obtain alternative energy back-up systems for critical facilities and infrastructure.	Completed and ongoing.*	Some generators have been installed, but more are needed. Continue as a new mitigation action.

**These actions will be continued into the new Action Plan (Chapter 9).*

Chapter 8
Existing and Potential Mitigation Strategies
Identifying Gaps in Coverage

In addition to the programs and activities that Keene is currently undertaking to protect its residents and property from natural and manmade disasters, a number of additional strategies were identified by the Local Hazard Mitigation Committee for consideration. The process of compiling a comprehensive list of all mitigation strategies currently in place throughout the city helped the committee to identify gaps in the existing coverage and improvements which could be made to the strategies. Existing and potential strategies were identified for each general hazard type using the following categories: Prevention (programs and policies), Property Protection, Emergency Services, and Public Information. Each strategy was discussed to determine realistic strategies to be included in the STAPLEE chart.

Potential Strategies Matrix

Hazard Type	Prevention	Property Protection	Emergency Services	Public Information
Flooding	Floodplain Development Ordinance	Upsize culverts/bridges included in the CIP.	Continue to participate in NFIP trainings/workshops offered by the State and/or FEMA (or in other training) that addresses flood hazard planning and management.	Continue to provide information to the public about NFIP and other flood management strategies.
	Storm drain/culvert maintenance.	Develop a citywide emergency warning system.		Continue utilizing the Community Rating System.
		Elevation certificates.		
Drought	Implementation of the Climate Change Adaptation Plan.	Water Emergency Plan	Develop an immediate response water distribution plan.	Provide information to residents on water conservation/drought resistant landscaping and/or rain gardens.
	Implementation of the Climate Change Action Plan.	Water Supply Shortage & Use Restrictions Plan.		
Extreme Heat	Implementation of the Climate Change Adaptation Plan.	Public education about benefits of landscaping and site selection when building a home.	Provide a cooling center.	Public education about benefits of landscaping and site selection when building a home.
	Implementation of the Climate Change Action Plan.			
Wild Fires	Work with planning standards on new construction & site work.	Public education programs.	Continue training for firefighters and equipment updates.	Continue fire prevention training at public schools.
			Identify rural water supply opportunities.	
Lightning	Follow building codes and best management practices.	Install grounding equipment on public & historic buildings.	Maintain shelters with emergency back-up power.	Provide outreach material on safety during lightning and storm events. Include a link of FEMA's website on the city website.

Hazard Type	Prevention	Property Protection	Emergency Services	Public Information
Tornados/ Severe Wind/ Downbursts	Coordinate with utility companies to trim tree branches near power lines to reduce outages due to tree branches.	Trim tree branches near critical facilities, city structures, and roadways.	Maintain shelters with emergency back-up power. Continue to provide training for emergency responders.	Provide the public with information on the hazards associated with severe weather and ways to mitigate the impact.
Hurricanes/Tropical Storms	Coordinate with Eversource to trim tree branches near power lines.	Consider requirement for new construction to withstand severe wind speeds.	Maintain shelters with emergency back-up power. Continue to provide training for emergency responders.	Continue to provide information to the public about NFIP.
Severe Winter Weather	Coordinate to utilize the Emergency Snow & Ice Response Plan.	Coordinate with utility companies to trim tree branches near power lines to reduce outages due to tree branches. Trim tree branches near critical facilities, city structures, and roadways.	Review current and future needs for emergency backup power. Maintain shelters with emergency back-up power. Include warming centers in the Emergency Operations Plan.	Disseminate information to residents about the proper use of heating sources and installation of generators.
Earthquakes	Building Codes.	Retrofit public buildings with earthquake standards.	Maintain shelters with emergency back-up power.	Provide information to the public about reducing damage due to earthquakes.
Landslide/Erosion	Steep Slopes Ordinance and Road Design Standards.	Inspect road embankments for signs of erosion and undermining of roadway. Stabilize steep slopes with plantings, retaining walls, and rip rap.	Implementation of search and rescues, and evacuation plans when needed.	Provide information to the public on stormwater management methods including how to stabilize steep slopes.
Hazardous Materials	Spill Prevention Control and Counter Measures Plans.	Update Hazardous Materials Handling and Management Plans.	Maintain and updated Hazardous Materials Plan.	Disseminate outreach material on proper disposal of hazardous household materials and medicines.
Dams	Inspect dams, bridges and culverts prior to heavy rain events.	Maintain Dam Emergency Action Plans. Update to current regulations.	Provide information to the public on emergency evacuation routes and shelters with emergency backup power.	Provide information to the public on emergency evacuation routes.

Prioritizing Proposed Mitigation Actions

Each proposed mitigation strategy identified in the previous section was ranked in order to determine a prioritized list of strategies to implement. The method of ranking used for this Hazard Mitigation Plan was the STAPLEE method.

STAPLEE is an acronym for a general set of criteria common to public administration officials and planners. It stands for the Social, Technical, Administrative, Political, Legal, Economic and Environmental criteria for making planning decisions. Questions to ask about suggested actions include:

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

The Keene Hazard Mitigation Committee assigned a score (Good=3, Average=2, Poor=1) to each strategy for its effectiveness related to the critical evaluation factors listed above. The values were totaled and the mitigation priorities were listed according to the scores.

STAPLEE Chart: Prioritization of Mitigation Actions

Proposed Mitigation Strategy	Is it **Socially** acceptable?	Is it **Technically** feasible & potentially successful?	Is it **Administratively** workable?	Is it **Politically** acceptable?	Is there **Legal** authority to implement?	Is it **Economically** beneficial?	Is it **Environmentally** beneficial?	**Total Score**
Develop and conduct public outreach on the inundation pathway for High Hazard Dams and develop emergency evacuation strategies for properties within the pathway.	3	3	3	3	3	3	3	21
Increase participation to develop and sustain a community outreach program to discuss mitigation and emergency preparedness with schools, businesses, the hospital, and colleges.	3	3	3	3	3	3	3	21
Road and Bridge Repair: 13 out of 22 bridges are red listed and need to be replaced. Repair or replace culverts & bridges associated with road flooding as identified by City PWD.	3	3	3	3	3	3	3	21
Continue outreach efforts to homeowners on the benefits of NFIP and encourage participation in the program.	3	3	3	3	3	3	3	21
Continue to enforce NFIP by requiring elevation certificates.	3	3	3	3	3	3	3	21
Tanglewood Estates: Develop a program to assess flood risks and potential secondary hazards for the approximate 80 mobile homes in the 100-year floodplain. Seek ways to fund a mobile home owner mitigation program to ensure mobile homes and fuel tanks are securely anchored in place.	3	3	3	3	3	3	3	21
Develop strategies to acquire the necessary rights from the following properties for the purpose of protecting and preserving floodplain storage: - Realities Inc. parcel - behind Hannaford - Parcel along Ashuelot - south of Tanglewood - Beaver Brook north of NH 101 - Pearl Street parcel - Silent Way/Lower Main Street parcel - Wyman Road parcel - Lower Production Avenue	3	3	3	3	3	3	3	21
Collect additional data and install monitoring equipment at Three Mile Reservoir, Babbidge, Woodard and Robin Hood Dams.	3	3	3	3	3	3	3	21
Evaluate and floodproof, if necessary, Court Street Lift Station, Bradco Lift Station and Well numbers one and four.	3	3	3	3	3	3	3	21

Proposed Mitigation Strategy	Is it **Socially** acceptable?	Is it **Technically** feasible & potentially successful?	Is it **Administratively** workable?	Is it **Politically** acceptable?	Is there **Legal** authority to implement?	Is it **Economically** beneficial?	Is it **Environmentally** beneficial?	**Total Score**
Implement recommendations and projects identified in the Beaver Brook *Escherichia coli* Impairment Investigation and Remediation, and Habitat Restoration Project.	3	3	3	3	3	3	3	21
Continue to review, update and obtain additional GIS data layers, specifically digital orthophoto, to be used for natural and human-caused hazard mitigation planning.	3	3	3	3	3	3	3	21
Implement projects as identified in the Keene Comprehensive Master Plan.	3	3	3	3	3	3	3	21
Develop a Continuity of Operations Plan (COOP) for the City.	3	3	3	3	3	3	3	21
Continue Incident Command System (ICS) training for all staff.	3	3	3	3	3	3	3	21
Conduct tabletops, drills and exercises for all hazards.	3	3	3	3	3	3	3	21
Review and implement emergency notification systems (i.e. reverse notification, social media and City website).	3	3	3	3	3	3	3	21
Update communications and data equipment to ensure inter-operability for all City personnel.	3	3	3	3	3	3	3	21
Modification of Beaver Brook Bridges: In 1994, the Soil Conservation Service suggested that removal of flow constrictions caused by bridges could significantly reduce flooding, without causing additional problems downstream. Initial grant funds would be used for an engineering study to validate the impacts of this approach. Subsequent grants would be applied for to fund bridge modification.	3	3	3	3	3	3	3	21
Three Mile Reservoir: Existing impoundment at Three Mile Swamp is rated to mitigate against 10 to 25 year storm event. Assess feasibility to enlarge storage capacity to reduce flood potential in the Beaver Brook watershed.	3	3	3	3	3	3	3	21
Obtain alternative energy back-up systems for critical facilities and infrastructure.	3	3	3	3	3	3	3	21
Evaluate the Storm Water Phase 2.	3	3	3	3	3	3	3	21
Continue ongoing update of the Hazardous Materials Plan and training of the team.	3	3	3	3	3	3	3	21
Update the Emergency Operations Plan in 2021.	3	3	3	3	3	3	3	21

Proposed Mitigation Strategy	Is it **Socially** acceptable?	Is it **Technically** feasible & potentially successful?	Is it **Administratively** workable?	Is it **Politically** acceptable?	Is there **Legal** authority to implement?	Is it **Economically** beneficial?	Is it **Environmentally** beneficial?	**Total Score**
Continue annual exercising & updating of all Dam Action Plans.	3	3	3	3	3	3	3	21
Review the Climate Change Adaptation Plan and Action Plan, and implement strategies.	3	3	3	3	3	3	3	21
Review and update the floodplain development ordinance as needed.	3	3	3	3	3	3	3	21
Continue enforcement of building codes.	2	3	3	3	3	3	3	20
Continue enforcement of fire codes.	2	3	3	3	3	3	3	20
Review and update the Keene Fire Code in 2020.	2	3	3	2	3	3	3	19
Review and update road and utility design standards.	3	3	3	3	3	2	1	18
Develop and implement a citywide tree maintenance program.	2	3	3	1	3	2	3	17

Chapter 9
Prioritized Implementation Schedule and Action Plan

The following questions were asked 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?

As additional information becomes available regarding project leadership, timeline, funding sources, and/or cost estimates, the plan will be reviewed and amended accordingly.

The Committee created a prioritized schedule for implementation of the plan. The following terms are used to provide a general timeframe to complete the actions: Short term: 1 - 2 years; Mid-term:3 - 4 years; Long term: 4- 5 years. Some actions do not have a completion date and are considered to be ongoing actions that will continue through the duration of the plan.

IMPLEMENTATION STRATEGY FOR PRIORITY MITIGATION ACTIONS

Mitigation Action	Who (Leadership)	When (Deadline)	How (Funding Source and Estimated Cost)
Develop and conduct public outreach on inundation pathway for High Hazard Dams and develop emergency evacuation strategies for properties within the pathway.	Emergency Management Director, Public Works Director, and Parks Director	Mid-term	Grants/City Budget $50,000
Increase participation to develop and sustain a community outreach program to discuss mitigation and emergency preparedness with schools, businesses, hospitals, and colleges.	Emergency Management Director	Mid-term	Grants/City Budget $100,000
Road and Bridge Repair: 13 out of 22 bridges are red listed and need to be replaced. Repair or replace culverts & bridges associated with road flooding as identified by City PWD.	Public Works Director	Long term	Grants/City Budget $5,000,000
Continue outreach efforts to homeowners on the benefits of NFIP and encourage participation in the program.	Code Enforcement	Long term	Grants/City Budget $50,000
Continue to enforce NFIP by requiring elevation certificates.	Code Enforcement	Long term	Grants/City Budget $50,000

Mitigation Action	Who (Leadership)	When (Deadline)	How (Funding Source and Estimated Cost)
Tanglewood Estates: Develop a program to assess flood risks and potential secondary hazards for the approximate 80 mobile homes in the 100-year floodplain. Seek ways to fund a mobile home owner mitigation program to ensure mobile homes and fuel tanks are securely anchored in place.	Planning Director	Long term	Grants/City Budget $100,000-$200,000
Develop strategies to acquire the necessary rights from the following properties for the purpose of protecting and preserving floodplain storage: - Realities Inc. parcel - behind Hannaford - Parcel along Ashuelot - south of Tanglewood - Beaver Brook north of NH 101 - Pearl Street parcel - Silent Way/Lower Main Street parcel - Wyman Road parcel - Lower Production Avenue	Planning Director and Public Works Director	Long term	Grants/City Budget $1,000,000-$2,000,000
Collect additional data and install monitoring equipment at Three Mile Reservoir, Babbidge, Woodard and Robin Hood Dams.	Public Works Director	Mid-term	Grants/City Budget $250,000
Evaluate and floodproof, if necessary, Court Street Lift Station, Bradco Lift Station and Well numbers one and four.	Public Works Director	Mid-term	Grants/City Budget $100,000-$250,000
Implement recommendations and projects identified in the Beaver Brook *Escherichia coli* Impairment Investigation and Remediation, and Habitat Restoration Project.	Planning Director and Public Works Director	Long term	Grants/City Budget $1,000,000 or greater
Continue to review, update and obtain additional GIS data layers, specifically digital orthophoto, to be used for natural and human-caused hazard mitigation planning.	Planning Director	Mid-term	Grants/City Budget $250,000
Implement projects as identified in the Keene Comprehensive Master Plan.	Department Heads	Mid-term	Grants/City Budget $5,000,000
Develop a Continuity of Operations Plan (COOP) for the City.	Emergency Management Director	Mid-term	Grants/City Budget $20,000
Continue Incident Command System (ICS) training for all staff.	Emergency Management Director	Long term	Grants/City Budget $5,000-10,000

Mitigation Action	Who (Leadership)	When (Deadline)	How (Funding Source and Estimated Cost)
Conduct tabletops, drills and exercises for all hazards.	Emergency Management Director	Long term	Grants/City Budget $50,000-75,000
Review and implement emergency notification systems (i.e. reverse notification, social media and City website.)	Emergency Management Director	Mid-term	City Budget $5,000-10,000
Update communications and data equipment to ensure inter-operability for all City personnel.	Emergency Management Director	Long term	Grants/City Budget $50,000-100,000
Modification of Beaver Brook Bridges: In 1994, the Soil Conservation Service suggested that removal of flow constrictions caused by bridges could significantly reduce flooding, without causing additional problems downstream. Initial grant funds would be used for an engineering study to validate the impacts of this approach. Subsequent grants would be sought to fund bridge modification.	Public Works Director	Long term	Grants/City Budget $5,000,000
Three Mile Reservoir: Existing impoundment at Three Mile Swamp is rated to mitigate against 10 to 25 year storm event. Assess feasibility to enlarge storage capacity to reduce flood potential in Beaver Brook Watershed.	Public Works Director	Long term	Grants/City Budget $5,000,000
Obtain alternative energy back-up systems for critical facilities and infrastructure.	Public Works Director, Emergency Management Director, Facilities Director	Mid-term	Grants/City Budget $1,000,000
Evaluate the Storm Water Phase 2.	Public Works Director	Long term	Grants/City Budget $1,000,000
Continue ongoing updates of the Hazardous Materials Plan and training of the team.	Fire Chief	Short term	Grants/City Budget $60,000 annually
Update the Emergency Operations Plan in 2021.	Emergency Management Director	Mid-term	Grants/City Budget $10,000
Continue annual exercising & updating of all Dam Action Plans.	Emergency Management Director, Parks Director	Mid-term	City Budget $2,000-5,000
Review the Climate Change Adaptation Plan and Action Plan, and implement strategies.	All Department Heads	Long term	Grants/City Budget $10,000-100,000
Review and update the floodplain development ordinance as needed.	Planning Director	Long term	City Budget $5,000-10,000
Continue enforcement of building codes.	Code Enforcement	Mid-term	City Budget $250,000

Mitigation Action	Who (Leadership)	When (Deadline)	How (Funding Source and Estimated Cost)
Continue enforcement of fire codes.	Fire Chief	Mid-term	City Budget $250,000
Review and update the Keene Fire Code in 2020.	Fire Chief	Mid-term	City Budget $2,000-5,000
Review and update road and utility design standards.	Public Works Director	Mid-term	City Budget $2,000-5,000
Develop and implement a citywide tree maintenance program.	Public Works Director	Long term	Grants/City Budget $100,000

CHAPTER 10

ADOPTION, IMPLEMENTATION, MONITORING, AND UPDATE

ADOPTION

The Keene City Council adopted the Keene Hazard Mitigation Plan Update 2018 on August 2, 2018. A copy of the resolution can be found at the end of this chapter. Adopted policy addresses the actions for implementation set forth in the prioritized implementation schedule (action plan) in the previous chapter and in the "Monitoring & Updates" subsection contained in this chapter. All other sections of this Plan are supporting documentation for information purposes only and are not included as the statement of policy.

A copy of the public hearing notice for the City Council meeting at which the plan was adopted is included in **Appendix E.** The meeting was a public meeting to provide an opportunity for input from interested parties. The plan was available to the public via a hard copy at the City Hall prior to the meeting.

MONITORING & UPDATES

Recognizing that many mitigation projects are ongoing, and that while in the implementation stage, the city may suffer budget cuts, experience staff turnover, or projects may fail altogether, a good plan needs to provide for periodic monitoring and evaluation of its successes and failures and allow for updates of the plan where necessary.

In order to track progress and update the mitigation strategies identified in the Action Plan (Chapter 9), it is recommended that the City revisit the Keene Hazard Mitigation Plan annually, or after a hazard event. The Emergency Management Director is responsible for initiating this review and needs to consult with members of the Keene Hazard Mitigation Committee, in order to track progress and update the Prioritized Project List. Changes should be made to the plan to accommodate for projects that have failed or are not considered feasible after a review for their consistency with the timeframe, the city's priorities, and funding resources. Priorities that did not make the implementation list, but identified as potential mitigation strategies, should be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. In keeping with the process of adopting the Keene Hazard Mitigation Plan Update 2018, a public hearing to receive public comment on plan maintenance and updating should be held during the annual review period and the final product adopted by the City Council appropriately.

The City of Keene, NH Hazard Mitigation Plan must be reviewed, revised as appropriate, and resubmitted to NH HSEM for approval every **five years** in order to maintain eligibility for all Hazard Mitigation Assistance (HMA) funding. Approval of this plan was granted by NH HSEM on August 14, 2018. This update was prepared with assistance from Planners at Southwest Region Planning Commission trained in Hazard Mitigation Planning. Data and maps used to prepare this plan are available at their office and should be used in preparing future updates.

IMPLEMENTATION OF THE PLAN THROUGH EXISTING PROGRAMS

In addition to work by the Hazard Mitigation Committee and city departments, several other mechanisms exist which will ensure that the Keene Hazard Mitigation Plan Update 2018 receives the attention it requires for satisfactory use.

Capital Improvements Plan

Many of the projects found within the Action Plan of this update are incorporated into the Capital Improvements Plan. It is there that the funding of the projects will be reviewed and determined to be included in future budget considerations by the City.

Comprehensive Master Plan

Implementation of the Comprehensive Master Plan was updated in 2010. It is an intention of this plan that the Planning Board considers incorporation into its Comprehensive Master Plan. The Local Hazard Mitigation Committee will oversee the process to begin working with the Planning Board.

Zoning Ordinance and Regulations

Some of the implementation strategies proposed involve revisions to the Subdivision Regulations and/or the Site Plan Review Regulations as well as the Zoning Ordinance. The Local Hazard Mitigation Committee will oversee the process to begin working with the Planning Board to develop appropriate language for the recommended modifications.

Continued Public Involvement

On behalf of the Hazard Mitigation Committee, the Emergency Management Director (EMD), under direction of the City Council, will be responsible for ensuring that city departments and the public have adequate opportunity to participate in the planning process. Administrative staff may be utilized to assist with the public involvement process. For the yearly update process, potential techniques for public involvement include:

- Provide personal invitations to Budget Committee members;
- Provide personal invitations to city department heads;
- Post notices of meetings at the City Hall, and the City website; and
- Public notices in the local newspapers.

A number of Implementation Action items which will be undertaken relate to public education and involvement. Additionally, the public will be invited to participate in the yearly process of updating the Keene Hazard Mitigation Plan. These outreach activities will be undertaken during the Plan's annual review and during any Hazard Mitigation Committee meetings the Emergency Management Director or City Council calls to order.

CERTIFICATE OF ADOPTION

KEENE, NEW HAMPSHIRE

CITY COUNCIL

A RESOLUTION ADOPTING THE

KEENE HAZARD MITIGATION PLAN UPDATE 2018

WHEREAS, the City of Keene has developed and received conditional approval from NH Homeland Security & Emergency Management (HSEM) for its Hazard Mitigation Plan Update 2018 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held between November 2017 and March 2018 regarding the development and review of the Keene Hazard Mitigation Plan Update 2018; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the City of Keene; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the City of Keene, with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the City of Keene eligible for funding to alleviate the impacts of future hazards; now therefore the Keene City Council adopted the Keene Hazard Mitigation Plan Update 2018 on August 2, 2018:

1. The Plan is hereby adopted as an official plan of the City of Keene;
2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.

Approved and signed, this 13th day of Aug, **2018**

Elizabeth A. Dragon

Elizabeth A. Dragon, City Manager

APPENDICES

Appendix A: Hazard Descriptions

The following list describes hazards that have occurred or have the potential to occur in the City of Keene. The descriptions provided are those used in the State of NH Hazard Mitigation Plan (2013).

Flooding

Floods are defined as a temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and/or inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination. Floods can also disrupt travel routes on roads and bridges. Inland floods are most likely to occur in the spring due to the increase in rainfall and melting of snow; however, floods can occur at any time of the year. A sudden thaw in the winter or a major downpour in the summer can cause flooding because there is suddenly a lot of water in one place with nowhere to go.

100-year Floodplain Events

• Floodplains are usually located in lowlands near rivers, and flood on a regular basis. The term 100 - year flood does not mean that a flood will occur once every 100 years. Rather, it is a statement of probability that scientists and engineers use to describe how one flood compares to others that are likely to occur. It is more accurate to use the phrase "1% annual chance of flood." What this means is that there is a 1% chance of a flood of that size happening in a year.

Rapid Snow Pack Melt

• Warm temperatures and heavy rains cause rapid snowmelt. Quickly melting snow coupled with moderate to heavy rains are prime conditions for flooding.

River Ice Jams

• Rising waters in early spring breaks ice into chunks, which float downstream and often pile up, causing flooding. Small rivers and streams pose special flooding risks because they are easily blocked by jams. Ice collecting in river bends and against structures presents significant flooding threats to bridges, roads, and the surrounding lands.

Severe Storms

• Flooding associated with severe storms can inflict heavy damage to property. Heavy rains during severe storms are a common cause of inland flooding.

Beaver Dams and Lodging

• Flooding associated with beaver dams and lodging can cause road flooding or flooding damage to property.

Drought

A drought is defined as a long period of abnormally low precipitation, especially one that adversely affects growing or living conditions. Droughts are rare in New Hampshire. They generally are not as damaging and disruptive as floods and are more difficult to define. The effect of droughts is indicated through measurements of soil moisture, groundwater levels, and stream-flow. However, not all of these indicators will be minimal during a drought. For example, frequent minor rainstorms can replenish the soil moisture without raising ground-water levels or increasing stream-flow. Low stream-flow correlates with low ground-water levels because ground-water discharge to streams and rivers maintains stream flow during extended dry periods. Low stream-flow and low ground-water levels commonly cause diminished water supply.

Extreme Heat

Extreme heat is characterized by abnormally high temperatures and/or longer than average time periods of high temperatures. These event conditions may impact the health of both humans and livestock.

Wildfire

Wildfire is defined as an uncontrolled and rapidly spreading fire. A forest fire is an uncontrolled fire in a woody area. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassy areas.

Earthquake

New England is considered a moderate risk earthquake zone. An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric, water and phone lines, and often cause landslides, flash floods, fires, and avalanches. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined by the use of scales such as the Richter scale and Mercalli scale.

Tornado, Downburst, Severe Wind

Tornado: A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. They 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. Damage paths can be in excess of one mile wide and 50 miles long. Violent winds and debris slamming into buildings cause the most structural damage.

The Enhanced Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes. 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.

Severe Wind: Significantly high winds occur especially during tornadoes, hurricanes, winter storms and thunderstorms. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during severe wind occurrences.

Downburst: 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.

Hurricane/Tropical Storm

A hurricane is a tropical cyclone in which winds reach speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center. The eye of the storm is usually 20 - 30 miles wide and may extend over 400 miles. High winds and flooding are primary causes of hurricane-inflicted loss of life and property damage. A tropical storm is a downgraded form of a hurricane with slower wind speeds.

Lightning

Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through the air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Fires are a likely result of lightning strikes, and lightning strikes can cause death, injury, and property damage.

Severe Winter Weather

Ice and snow events typically occur during the winter months and can cause loss of life, property damage and tree damage.

Heavy Snow Storms

• A winter storm can range from moderate snow to blizzard conditions. Blizzard conditions are defined as a storm which contains large amounts of snow OR blowing snow, with winds in excess of 35 mph and visibilities of less than 1/4 mile for an extended period of time (at least 3 hours). A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period.

Ice Storms

• An ice storm involves rain, which freezes on impact. Ice coating at least one-fourth inch of thickness is heavy enough to damage trees, overhead wires and similar objects. Ice storms often produce widespread power outages.

Nor'easter

• A Nor'easter is a large weather system traveling from South to North passing along or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas from a Northeasterly direction. The sustained winds may meet or exceed hurricane force, with larger bursts, and may exceed hurricane events by many hours (or days) in terms of duration.

Erosion

Erosion is the process in which soil is carried from one area to another, usually along slopes, by rain, river flow, stormwater runoff, or other means. Without stabilization, erosion can cause severe damage to roads, reduce water quality, and reduce property area at the top of embankments.

Landslide

A landslide is the downward or outward movement of slope forming materials reacting under the force of gravity including: mudflows, mudslides, debris flow, rockslides, debris avalanches, debris slides and earth flows.

Man-Made Hazards

Hazardous Materials

• Hazardous materials spills or releases can cause damage of loss to life and property. Short or long-term evacuation of local residents and businesses may be required, depending on the nature and extent of the incident.

Dam Breach and Failure

• Dam failure results in rapid loss of water that is normally held by the dam. These kinds of floods are extremely dangerous and pose a significant threat to both life and property.

Appendix B: Risk Assessment

The following terms are used to analyze the hazards considered. *Very Low*, *Low*, *Medium*, *High*, or *Very High* are synonymous with 1, 2, 3, 4 and 5, respectively.

VULNERABILITY - An adjective description (Very Low, Low, Medium, High, and Very High) of the potential impact a hazard could have on the town relating to human, business and property impacts. It is the ratio of population, property, commerce, infrastructure and services at risk relative to the entire town. Vulnerability is an estimate generally based on a hazard's characteristics, information obtained by the various town departments.

VERY LOW (1): Little or no 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 proportions.

LOW (2): 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.

MEDIUM (3): (1) The total population, property, commerce, infrastructure and services of the town are exposed to the effects of a hazard of moderate influence; or (2) the total population, property, commerce, infrastructure and services of the town are exposed to the effects of a hazard, but not all to the same degree; or (3) 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 proportions.

HIGH (4): The total population, property, commerce, infrastructure and services of the town are exposed to some effects of a hazard of potentially moderate to great magnitude. In a worst case scenario there could be a disaster of major proportions.

VERY HIGH (5): The total population, property, commerce, infrastructure and services of the town are 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.

PROBABILITY OF OCCURRENCE - An adjective description (Very Low, Low, Medium, High, and Very High) of the probability of a hazard impacting the town within the next 25 years. Probability is based on a limited objective appraisal of a hazard's frequency using information provided by relevant sources, observations and trends.

VERY LOW (1): There is very little likelihood that a hazardous event will occur within the next 25 years (1 event in 25 years), however, the potential still exists.

LOW (2): There is little likelihood that a hazardous event will occur within the next 25 years (1 event in 25 years).

MEDIUM (3): There is moderate likelihood that a hazardous event will occur within the next 25 years (1 - 2 events each 5 - 10 years).

HIGH (4): There is good likelihood that a hazardous event will occur within the next 25 years (1 - 2 events within 5 years).

VERY HIGH (5): It is highly likely that a hazardous event will occur within the next 25 years (1 - 2 events each year).

SEVERITY - Calculated by taking the average of the vulnerability for human, business and property impacts of each hazard type.

RISK LEVEL - An adjective description (Very Low, Low, Medium, High, or Very High) of the overall threat posed by a hazard over the next 25 years. It is calculated by multiplying the probability of occurrence and vulnerability. The result is then compared to a scale from 1 - 25 to determine the level of risk for each hazard.

VERY LOW (1 - 5): There is very little potential for a disaster during the next 25 years. The threat is so minor that it warrants no special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the town's emergency management training and exercise program except as generally dealt with during hazard awareness training.

LOW (6 - 10): There is little potential for a disaster during the next 25 years. The threat is such as to warrant no special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the town's emergency management training and exercise program except as generally dealt with during hazard awareness training.

MEDIUM (11 - 15): There is moderate potential for a disaster of less than major proportions during the next 25 years. The threat is great enough to warrant modest effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be included in the town's emergency management training and exercise program.

HIGH (16 - 20): (1) There is moderate to strong potential for a disaster of major proportions during the next 25 years; or (2) history suggests the occurrence of multiple disasters of moderate proportions during the next 25 years. The threat is significant enough to warrant major program effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be a major focus of the town's emergency management training and exercise program.

VERY HIGH (21 - 25): (1) There is strong potential for a disaster of major proportions during the next 25 years; or (2) history suggests the occurrence of multiple disasters of moderate to severe proportions during the next 25 years. The threat is significant enough to warrant serious program effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be a priority focus of the town's emergency management training and exercise program.

Appendix C: Resources

Resources Used in the Preparation of this Plan

NH HSEM's *State of New Hampshire Natural Hazards Mitigation Plan* (2013)
FEMA's Understanding Your Risks: Identifying Hazards and Estimating Losses
FEMA's *Local Multi-Hazard Mitigation Planning Guidance*
Keene Hazard Mitigation Plan, 2013
Keene Comprehensive Master Plan, 2010

New Hampshire Homeland Security and Emergency Management (HSEM) 271-2231
Field Representative Hillsborough County 271-2231
Field Representative Cheshire County 271-2231
Federal Emergency Management Agency (FEMA) 877-336-2734
NH Regional Planning Commissions:
Central NH Regional Planning Commission 226-6020
Lakes Region Planning Commission 279-8171
Nashua Regional Planning Commission 424-2240
North Country Council 444-6303
Rockingham Planning Commission 778-0885
Southern New Hampshire Planning Commission 669-4664
Southwest Region Planning Commission 357-0557
Strafford Regional Planning Commission 994-3500
Upper Valley Lake Sunapee Regional Planning Commission 448-1680
NH Executive Department:
Governor's Office of Energy and Community Services 271-2611
NH Department of Cultural Resources: 271-2540
Division of Historical Resources 271-3483
NH Department of Environmental Services: 271-3503
Air Resources 271-1370
Air Toxins Control Program.....271-0901
Asbestos Program.....271-1373
Childhood Lead Poisoning Prevention Program.....271-5733
Environmental Health Tracking Program.....271-4072
Environmental Toxicology Program 271-3994
Health Risk Assessment Program.....271-6909
Indoor Air Quality Program.....271-3911
Occupational Health and Safety Program.....271-2024
Radon Program.....271-4764
Geology Unit 271-3503
Pollution Preventive Program.....271-6460
Waste Management 271-2900
Water Supply and Pollution Control 271-3414
Rivers Management and Protection Program 271-8801
NH Office of Strategic Initiatives (OSI) 271-2155
Jennifer Gilbert, State Coordinator, Floodplain Management.....271-1762
NH Municipal Association 224-7447
NH Fish and Game Department 271-3421
Region 1, Lancaster.....788-3164
Region 2, New Hampton.....744-5470
Region 3, Durham 868-1095
Region 4, Keene 352-9669
NH Department of Business and Economic Affairs:
Economic Development 271-2591
Travel and Tourism 271-2665

NH Department of Natural and Cultural Resources:
Division of Forests and Lands 271-2214
Division of Parks and Recreation 271-3556
NH Department of Transportation 271-3734
Northeast States Emergency Consortium, Inc. (NESEC) .....(781) 224-9876
US Department of Commerce: .....(202) 482-2000
NOAA: National Weather Service; Gray, ME .....(207) 688-3216
US Department of the Interior: 202-208-3100
US Fish and Wildlife Service 225-1411
US Geological Survey 225-4681
US Army Corps of Engineers .....(978) 318-8087
US Department of Agriculture:
Natural Resource Conservation Service 868-7581
Cheshire County, Walpole 756-2988
Sullivan County, Newport 863-4297
Hillsborough County, Milford ..... 673-2409 Ext. #4

Mitigation Funding Resources

404 Hazard Mitigation Grant Program (HMGP).....NH Homeland Security and Emergency Management
406 Public Assistance and Hazard Mitigation.....NH Homeland Security and Emergency Management
Community Development Block Grant (CDBG) .....NH HSEM, NH OSI, also refer to RPC
Dam Safety Program .....NH Department of Environmental Services
Emergency Generators Program by NESEC‡ .....NH Homeland Security and Emergency Management
Emergency Watershed Protection (EWP) Program.....USDA, Natural Resources Conservation Service
Flood Mitigation Assistance Program (FMAP) .....NH HSEM, NH OSI
Flood Plain Management Services (FPMS) .....US Army Corps of Engineers
Mitigation Assistance Planning (MAP) .....NH Homeland Security and Emergency Management
Mutual Aid for Public Works.....NH Municipal Association
National Flood Insurance Program (NFIP) † .....NH OSI, NH HSEM
Power of Prevention Grant by NESEC‡ .....NH Homeland Security and Emergency Management
Project Impact .....NH Homeland Security and Emergency Management
Roadway Repair & Maintenance Program(s).....NH Department of Transportation
Section 14 Emergency Stream Bank Erosion & Shoreline Protection .....US Army Corps of Engineers
Section 103 Beach Erosion .....US Army Corps of Engineers
Section 205 Flood Damage Reduction.....US Army Corps of Engineers
Section 208 Snagging and Clearing .....US Army Corps of Engineers
Shoreline Protection Program .....NH Department of Environmental Services
Various Forest and Lands Program(s)..... NH Department of Natural and Cultural Resources
Wetlands Programs .....NH Department of Environmental Services

‡NESEC - Northeast States Emergency Consortium, Inc. is a 501(c)(3), not-for-profit natural disaster, multi-hazard mitigation and emergency management organization located in Wakefield, Massachusetts. Please, contact NH HSEM for more information or visit the Consortium's website at http://www.nesec.org/index.cfm.

† Note regarding **National Flood Insurance Program** (NFIP) and **Community Rating System** (CRS):
The National Flood Insurance Program has developed suggested floodplain management activities for those communities who wish to more thoroughly manage or reduce the impact of flooding in their jurisdiction. Through use of a rating system (CRS rating), a community's floodplain management efforts can be evaluated for effectiveness. The rating, which indicates an above average floodplain management effort, is then factored into the premium cost for flood insurance policies sold in the community. The higher the rating achieved in that community, the greater the reduction in flood insurance premium costs for local property owners. The NH Office of Strategic Initiatives can provide additional information regarding participation in the NFIP-CRS Program.

FEMA REGION I MITIGATION PLANNING WEBLIOGRAPHY

Hazard Mitigation is sustained action taken to reduce or eliminate risk to people and their property from natural hazards over the longest possible term.

REGULATORY INFORMATION

Final Rule

44 CFR 201.6

http://www.fema.gov/pdf/help/fr02-4321.pdf

Disaster Mitigation Act of 2000 (DMA 2K)

http://www.fema.gov/library/viewRecord.do?id=1935

DISASTERS AND NATURAL HAZARDS INFORMATION

FEMA-How to deal with specific hazards

http://www.ready.gov/natural-disasters

Natural Hazards Center at the University of Colorado

http://www.colorado.edu/hazards

National Oceanic and Atmospheric Administration (NOAA): Information on various projects and research on climate and weather.

http://www.websites.noaa.gov

National Climatic Data Center active archive of weather data.

http://lwf.ncdc.noaa.gov/oa/ncdc.html

Northeast Snowfall Impact Scale

http://www.erh.noaa.gov/rnk/Newsletter/Fall%202007/NESIS.htm

Weekend Snowstorm Strikes The Northeast Corridor Classified As A Category 3"Major"Storm

http://www.publicaffairs.noaa.gov/releases2006/feb06/noaa06-023.html

FLOOD RELATED HAZARDS

FEMA Coastal Flood Hazard Analysis & Mapping

http://www.fema.gov/national-flood-insurance-program-0/fema-coastal-flood-hazard-analyses-and-mapping-1

Floodsmart

http://www.floodsmart.gov/floodsmart/

National Flood Insurance Program (NFIP)

http://www.fema.gov/nfip

Digital quality Level 3 Flood Maps

http://msc.fema.gov/MSC/statemap.htm

Flood Map Modernization

http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/map-modernization

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Reducing Damage from Localized Flooding: A Guide for Communities, 2005 FEMA 511

http://www.fema.gov/library/viewRecord.do?id=1448

FIRE RELATED HAZARDS

Firewise

http://www.firewise.org

NOAA Fire Event Satellite Photos

http://www.osei.noaa.gov/Events/Fires

U.S. Forest Service, USDA

http://www.fs.fed.us/land/wfas/welcome.htm

Wildfire Hazards - A National Threat

http://pubs.usgs.gov/fs/2006/3015/2006-3015.pdf

GEOLOGIC RELATED HAZARDS

USGS Topographic Maps

http://topomaps.usgs.gov/

Building Seismic Safety Council

http://www.nibs.org/?page=bssc

Earthquake hazard history by state

http://earthquake.usgs.gov/earthquakes/states/

USGS data on earthquakes

http://earthquake.usgs.gov/monitoring/deformation/data/download/

USGS Earthquake homepage

http://quake.wr.usgs.gov

National Cooperative Geologic Mapping Program (NCGMP)

http://ncgmp.usgs.gov/

Landslide Overview Map of the Conterminous United States

http://landslides.usgs.gov/learning/nationalmap/

Kafka, Alan L. 2008. Why Does the Earth Quake in New England? Boston College, Weston

Observatory, Department of Geology and Geophysics

http://www2.bc.edu/~kafka/Why_Quakes/why_quakes.html

Map and Geographic Information Center, 2010, "Connecticut GIS Data", University of Connecticut

http://magic.lib.uconn.edu/connecticut_data.html

2012 Maine earthquake

http://www.huffingtonpost.com/2012/10/17/maine-earthquake-2012-new-england_n_1972555.html

WIND-RELATED HAZARDS

ATC Wind Speed Web Site

http://www.atcouncil.org/windspeed/index.php

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U.S. Wind Zone Maps

http://www.fema.gov/safe-rooms/wind-zones-united-states

Tornado Project Online

http://www.tornadoproject.com/

National Hurricane Center

http://www.nhc.noaa.gov

Community Hurricane Preparedness Tutorial

http://meted.ucar.edu/hurrican/chp/hp.htm

National Severe Storms Laboratory, 2009, "Tornado Basics",

http://www.nssl.noaa.gov/primer/tornado/tor_basics.html

DETERMINING RISK AND VULNERABILITY

HAZUS

http://www.hazus.org

FEMA Hazus Average Annualized Loss Viewer

http://fema.maps.arcgis.com/home/webmap/viewer.html?webmap=cb8228309e9d405ca6b4db6027df36d9&extent=-139.0898,7.6266,-48.2109,62.6754

Vulnerability Assessment Tutorial: On-line tutorial for local risk and vulnerability assessment

http://www.csc.noaa.gov/products/nchaz/htm/mitigate.htm

Case Study: an example of a completed risk and vulnerability assessment

http://www.csc.noaa.gov/products/nchaz/htm/case.htm

GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND MAPPING

The National Spatial Data Infrastructure & Clearinghouse (NSDI) and Federal Geographic Data Committee (FGDC) Source for information on producing and sharing geographic data

http://www.fgdc.gov

The OpenGIS Consortium Industry source for developing standards and specifications for GIS data

http://www.opengis.org

Northeast States Emergency Consortium (NESEC): Provides information on various hazards, funding resources, and other information

http://www.nesec.org

US Dept of the Interior Geospatial Emergency Management System (IGEMS) provides the public with both an overview and more specific information on current natural hazard events. It is supported by the Department of the Interior Office of Emergency Management.

http://igems.doi.gov/

FEMA GeoPlatform: Geospatial data and analytics in support of emergency management

http://fema.maps.arcgis.com/home/index.html

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DATA GATHERING

National Information Sharing Consortium (NISC): brings together data owners, custodians, and users in the fields of homeland security, public safety, and emergency management and response. Members leverage efforts related to the governance, development, and sharing of situational awareness and incident management resources, tools, and best practices

http://nisconsortium.org/

The Hydrologic Engineering Center (HEC), an organization within the Institute for Water Resources, is the designated Center of Expertise for the US Army Corps of Engineers

http://www.hec.usace.army.mil/

National Water & Climate Center

http://www.wcc.nrcs.usda.gov/

WinTR-55 Watershed Hydrology

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1042901

USACE Hydrologic Engineering Center (HEC)

http://www.hec.usace.army.mil/software/

Stormwater Manager's Resource Center SMRC

http://www.stormwatercenter.net

USGS Current Water Data for the Nation

http://waterdata.usgs.gov/nwis/rt

USGS Water Data for the Nation

http://waterdata.usgs.gov/nwis /

Topography Maps and Aerial photos

http://www.terraserver.com/view.asp?tid=142

National Register of Historic Places

http://www.nps.gov/nr/about.htm

National Wetlands Inventory

http://www.fws.gov/wetlands/ ICLUS Data for Northeast Region

http://www.epa.gov/ncea/global/iclus/inclus_nca_northeast.htm

PLANNING

American Planning Association

http://www.planning.org

PlannersWeb - Provides city and regional planning resources

http://www.plannersweb.com

FEMA RESOURCES

Federal Emergency Management Agency (FEMA)

www.fema.gov

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National Mitigation Framework

http://www.fema.gov/national-mitigation-framework

Federal Insurance and Mitigation Administration (FIMA)

http://www.fema.gov/fima

Community Rating System (CRS)

http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-rating-system

FEMA Building Science

http://www.fema.gov/building-science

National Flood Insurance Program (NFIP)

http://www.fema.gov/national-flood-insurance-program

Floodplain Management & Community Assistance Program

http://www.fema.gov/floodplain-management

Increased Cost of Compliance (ICC): ICC coverage allows homeowners whose structures have been repeatedly or substantially damaged to cover the cost of elevation and design requirements for rebuilding with their flood insurance claim up to a maximum of $30,000.

http://www.fema.gov/national-flood-insurance-program-2/increased-cost-compliance-coverage

National Disaster Recovery Framework

http://www.fema.gov/national-disaster-recovery-framework

Computer Sciences Corporation: contracted by FIMA as the NFIP Statistical Agent, CSC provides information and assistance on flood insurance to lenders, insurance agents and communities

www.csc.com

Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan: A Guidebook for Local Governments

https://www.fema.gov/ar/media-library/assets/documents/89725

Mitigation Best Practices Portfolio

http://www.fema.gov/mitigation-best-practices-portfolio

FEMA Multi-Hazard Mitigation Planning Website

http://www.fema.gov/multi-hazard-mitigation-planning

FEMA Resources Page

http://www.fema.gov/plan/mitplanning/resources.shtm

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Local Mitigation Plan Review Guide

http://www.fema.gov/library/viewRecord.do?id=4859

Local Mitigation Planning Handbook complements and liberally references the Local Mitigation Plan Review Guide above

http://www.fema.gov/library/viewRecord.do?id=7209

HAZUS

http://www.fema.gov/protecting-our-communities/hazus

Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards

http://www.fema.gov/library/viewRecord.do?id=6938

Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials

http://www.fema.gov/library/viewRecord.do?id=7130

IS-318

Mitigation Planning for Local and Tribal Communities

Independent Study Course

http://training.fema.gov/EMIWeb/IS/is318.asp

REGION I MITIGATION PLANNING CONTACTS

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FEMA Region I – Mitigation Division

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Email: josiah.neiderbach@fema.dhs.gov

OTHER FEDERAL RESOURCES

U.S. Army Corps of Engineers: Provides funding for floodplain management planning and technical assistance and other water resources issues.

www.nae.usace.army.mil

Natural Resources Conservation Service: Technical assistance to individual land owners, groups of landowners, communities, and soil and water conservation districts.

www.nrcs.usda.gov

NOAA Coastal Services Center

http://www.coast.noaa.gov

Rural Economic and Community Development: Technical assistance to rural areas and smaller communities in rural areas on financing public works projects.

www.rurdev.usda.gov

Farm Service Agency: Manages the Wetlands Reserve Program (useful in open space or acquisition projects by purchasing easements on wetlands properties) and farmland set aside programs

www.fsa.usda.gov

National Weather Service: Prepares and issues flood, severe weather and coastal storm warnings. Staff hydrologists can work with communities on flood warning issues; can give technical assistance in preparing flood-warning plans.

www.weather.gov/gyx

Economic Development Administration (EDA): Assists communities with technical assistance for economic development planning

www.osec.doc.gov/eda/default.htm

National Park Service: Technical assistance with open space preservation planning; can help facilitate meetings and identify non-structural options for floodplain redevelopment.

www.nps.gov

Fish and Wildlife Services: Can provide technical and financial assistance to restore wetlands and riparian habitats.

www.fws.gov

Department of Housing & Urban Development

www.hud.gov

Small Business Administration: SBA can provide additional low-interest funds (up to 20% above what an eligible applicant would qualify for) to install mitigation measures. They can also loan the cost of bringing a damaged property up to state or local code requirements.

www.sba.gov/disaster

Environmental Protection Agency

www.epa.gov

SUSTAINABILTY/ADAPTATION/CLIMATE CHANGE

Why the Emergency Management Community Should be Concerned about Climate Change: A discussion of the impact of climate change on selected natural hazards

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http://www.cna.org/sites/default/files/research/WEB%2007%2029%2010.1%20Climate%20Change%20and%20the%20Emergency%20Management%20Community.pdf

Resilient Sustainable Communities: Integrating Hazard Mitigation& Sustainability into Land Use

http://www.earth.columbia.edu/sitefiles/file/education/documents/2013/Resilient-Sustainable-Communities-Report.pdf

U.S. EPA

http://www.epa.gov/climatechange/

NOAA National Ocean Service (NOS)

http://oceanservice.noaa.gov/

The Northeast Climate Research Center (NRCC) folks were heavily involved in climate data in the NCA, below. They have a wealth of historic climate data and weather information, trends, etc. http://www.nrcc.cornell.edu/

NOAA RISA for the Northeast (Regional Integrated Sciences and Assessments)

http://ccrun.org/home

Community and Regional Resilience: Perspectives from hazards, disasters, and emergency

management

http://www.resilientus.org/library/FINAL_CUTTER_9-25-08_1223482309.pdf

National Fish, Wildlife and Plants Climate Adaptation Strategy

www.wildlifeadaptationstrategy.gov

ICLEI Local Governments for Sustainability

http://www.icleiusa.org/

Kresge Foundation Survey

http://www.kresge.org/news/survey-finds-communities-northeast-are-trying-plan-for-changes-climate-need-help-0

New England's Sustainable Knowledge Corridor

http://www.sustainableknowledgecorridor.org/site/

The Strategic Foresight Initiative (SFI)

http://www.fema.gov/pdf/about/programs/oppa/findings_051111.pdf

Northeast Climate Choices

http://www.climatechoices.org/ne/resources_ne/nereport.html

Northeast Climate Impacts Assessment

http://www.northeastclimateimpacts.org/

Draft National Climate Assessment Northeast Chapter released early 2013

http://ncadac.globalchange.gov/

Northeast Chapter of the National Climate Assessment of 2009:

http://www.globalchange.gov/images/cir/pdf/northeast.pdf

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NEclimateUS.org

ClimateNE

www.climatenortheast.com

Scenarios for Climate Assessment and Adaptation

http://scenarios.globalchange.gov/

Northeast Climate Science Center

http://necsc.umass.edu/

FEMA Climate Change Adaptation and Emergency Management

https://www.llis.dhs.gov/content/climate-change-adaptation-and-emergency-management-0

Climate Central

http://www.climatecentral.org

OTHER RESOURCES

New England States Emergency Consortium (NESEC): NESEC conducts public awareness and education programs on natural disaster and emergency management activities throughout New England. Resources are available on earthquake preparedness, mitigation, and hurricane safety.

www.nesec.org

Association of State Floodplain Managers (ASFPM): ASFPM has developed a series of technical and topical research papers, and a series of Proceedings from their annual conferences.

www.floods.org

National Voluntary Organizations Active in Disaster (VOAD) is a non-profit, nonpartisan membership organization that serves as the forum where organizations share knowledge and resources throughout the disaster cycle—preparation, response, recovery and mitigation.

http://www.nvoad.org/

Appendix D: Hazard Mitigation Resource Profiles

The following are fact sheets about the various hazard mitigation grant program.

U.S. Army Corps of Engineers

Contacts:

John Kennelly, Chief, Special Studies Section (for Flood Plain Management Services activities), Phone: (978) 318-8505, Fax: (978) 318-8080, E-mail: John.R.Kennelly@usace.army.mil

Mike Keegan, Chief, Project Planning Section (for Section 14, 103, and 205 authorities), Phone: (978) 318-8087, Fax: (978)318-8080, E-mail: Michael.F.Keegan@usace.army.mil

Address: US Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742-2751

Description and Mission:

The Corps of Engineers is a multi-disciplinary engineering and environmental organization that has been identifying and meeting the water resources needs of the nation. These needs have been in the areas of flood damage reduction, flood plain information and management, navigation, shore protection, environmental restoration, water supply, streambank protection, recreation, and fish and wildlife resources conservation, as well as technical assistance in other water resources areas.

The New England District (NAE) of the Corps of Engineers is responsible for managing the Corps' civil responsibilities in a 66,000 square-mile region encompassing the six New England states east of the Lake Champlain drainage basin. The District and its leadership are headquartered in Concord, Massachusetts. The missions of the New England District are many and varied. They include:

- flood damage reduction
- navigation improvements and maintenance
- natural resource management
- streambank and shoreline protection
- disaster assistance
- environmental remediation and engineering
- engineering and construction management support to other agencies

Flood Mitigation Involvement:

As a result of the catastrophic floods in 1936, 1938 and 1955, the Corps was called upon to undertake a comprehensive flood damage reduction program. Since then the Corps has built many flood control structures throughout New England. These include 35 dams and reservoirs, five hurricane protection barriers (two are operated by the Corps) and approximately 60 local flood protection projects. The New England District has also completed two nonstructural projects involving the relocation of flood prone property and the acquisition of natural flood storage areas. The Corps also provides technical assistance to

states and municipalities in locally constructed flood damage mitigation projects and to promote wise and informed use of floodplain and natural retention areas in order to minimize potential future flood damages.

Mitigation Goals and Objectives:
The New England District has two primary mitigation objectives with respect to flood damage reduction. The first objective is the operation and maintenance of the 35 flood control reservoirs and two hurricane barriers that provide protection to the Connecticut, Merrimack, Thames, Naugatuck, and Blackstone River Basins. The second objective is to continue to work with the states and communities in New England to address flooding problems affecting the region.

Projects Desired: The Corps of Engineers has several programs available under its Civil Works authorities to address flooding problems. These programs provide assistance either through the construction of structural and nonstructural projects to mitigate the flooding problem or by providing technical information to assist mitigation performed at the state or local level. Flood damage reduction projects constructed by the Corps of Engineers must demonstrate, based on current Federal guidelines, that the flood damages prevented by the project's construction exceed its total cost. The Corps must also demonstrate that the 10-year frequency flood discharge at the point of concern is equal to or greater than 800 cubic-feet per second (cfs). Technical assistance provided by the Corps does not need to meet the above criteria.

COE Resources with Respect to Hazard Mitigation:

The New England Division assists in meeting national, regional and local needs through a variety of means. Congressionally authorized water resources investigations have resulted in the planning, design and implementation of many flood control and flood damage reduction projects. Work conducted under a Congressional authorization can be extensive and there is currently no monetary limit of funding. Typically there is a 1 - 2 year minimum delay in the identification of a proposed investigation and the funding of that work. The first phase of study, the Reconnaissance investigation, is 100 percent Federally funded and must be completed within twelve months. The second phase, the Feasibility investigations, must be cost-shared with a local sponsor where the sponsor provides 50 percent of the cost of the feasibility study. Congress in a Water Resources Development Act must specifically authorize construction of any project resulting from a General Investigation study. The cost of implementation for flood damage reduction projects is generally 65 percent Federal and 35 percent non-Federal.

Through the Continuing Authorities Programs of the Corps many structural and non-structural local protection project reducing or eliminating damages from flooding have been constructed. Investigations initiated under the Corps Continuing Authorities do not require specific congressional authorization are initiated simply with a request from the State or community to the New England District. The following is a list of Continuing Authorities applicable to flood mitigation:

Section 14 - Emergency Stream Bank & Shoreline Protection: This work consists of evaluating alternatives to provide emergency protection to public facilities, such as highways and bridges that are threatened due to erosion. The current Federal limit on Section 14 projects is $500,000. The local sponsor is required to provide 25 percent of the cost of developing plans and specifications and of construction.

Section 103 - Beach Erosion: Investigations conducted under this authority are to determine methods of protecting public facilities that have been threatened by beach erosion. Currently there is a Federal limit of $2,000,000 and the local sponsor is required to contribute 35 percent of plans, specifications and construction. The local sponsor is also required to cost-share equally the cost of the feasibility investigation that exceeds $100,000. The first $100,000 is at full Federal expense.

Section 205 - Flood Damage Reduction: Investigations are conducted under this program to assist local communities to identify flooding problems and to formulate and construct alternatives for flood damage reduction. The local sponsor is required to cost-share equally in the cost of the feasibility investigation that exceeds $100,000 and the Federal limit is $5,000,000. The local sponsor is required to contribute 25 percent of the cost of plans, specifications and construction.

Section 208 - Snagging and Clearing: This emergency program is designed to reduce flood damage potential by identifying and removing obstructions that contribute to flooding by causing higher flood stages in the floodways. The Federal limit under this program is $500,000 and the local sponsor is required to contribute 25 percent of the cost of plans, specifications and construction.

The New England Division also has two Planning Assistance Programs, which provide opportunities for the States to obtain assistance in addressing water resource issues. These programs are the Section 22, Planning Assistance to the States (PAS) program and the Section 206, Flood Plain Management Services (FPMS) program.

Planning Assistance to States Program (PAS): The Planning Assistance to States Program is designed to assist the States in developing comprehensive plans to meet State planning goals. The program is extremely flexible in the type and the methodology of investigations. Studies conducted under the PAS program require a 50/50 cost share with a local sponsor. The existing funding limits are $300,000 per state and a national budget not to exceed $5,000,000.

Flood Plain Management Services (FPMS): The FPMS Program is designed for the Corps to assist States and local communities improve management of flood plains by performing technical assistance and conducting special investigations. Cost recovery has been implemented in this program effective in FY 1991. Under cost recovery, assistance provided to Federal agencies and private interests must be fully reimbursed by those customers. States and local communities are still provided technical assistance at 100 percent Federal cost. One of the major efforts being conducted under the FPMS program at this time is the preparation of Hurricane Evacuation Studies. These studies are jointly funded with the Federal Emergency Management Agency.

Ice Engineering Research Division
U.S. Army Cold Regions Research and Engineering Laboratory

Contact:

Dr. J-C Tatinclaux, Chief, Ice Engineering Research Division
Phone: (603) 646-4187 Fax: (603) 646-4477
E-mail: Jean-Claude.Tatinclaux@crl02.usace.army.mil
Website: http://www.crrel.usace.army.mil/ierd/

Address: US Army Cold Regions Research and Engineering Laboratory
Ice Engineering Research Division
72 Lyme Road
Hanover, NH 03755-1290

Description and Mission:

The US Army Cold Regions Research and Engineering Laboratory (CRREL) is a Corps of Engineers' research laboratory that is dedicated to multi-disciplinary engineering and research that addresses the problems and opportunities unique to the world's cold regions. CRREL exists largely to solve the technical

problems that develop in cold regions, especially those related to construction, transport, and military operations. Most of these problems are caused by falling and blowing snow, snow on the ground, ice in the air and in the ground, river ice, ice on seas and lakes, and ice effects on manmade materials. CRREL serves the Corps of Engineers and its clients in three main areas:

- Traditional military engineering, which deals with problems that arise during conflict;
- Military construction and operations technology, i.e., the building and maintenance of military bases, airfields, roads, ports, and other facilities; and
- Civil works, which involves the Corps in such things as flood protection, navigation on inland waterways and coastal engineering.

CRREL also deals with cold regions problems for the other defense services, for civilian agencies of the federal government, and to some extent for state agencies, municipalities, and private industry.

CRREL's Ice Engineering Research Division (IERD) was created to research, analyze and solve ice problems in and around water bodies, including ice jam flooding and ice accumulation in lock chambers, to ice buildup at water intakes and the destructive forces that moving ice exerts on riverine or coastal structures. In cooperation with the New England District (NAE) of the Corps of Engineers (located in Concord, MA), IERD personnel provide technical assistance before, during, and after ice jam flood emergencies. IERD research has resulted in the design and construction of a number of low-cost ice control structures as well as nonstructural mitigation measures. IERD also provides instruction on dealing with river ice problems to local emergency management agencies.

Flood Mitigation Involvement:

IERD is frequently called upon by the various Corps Districts to provide technical assistance to states and municipalities in the form of emergency mitigation. IERD is also involved with Corps and local agencies in developing locally constructed flood damage mitigation projects and promoting wise and informed use of floodplain areas in order to minimize potential future flood damages.

Mitigation Goals and Objectives:

The IERD has two primary mitigation objectives with respect to flood damage reduction. The first objective is to work with the Corps and other federal, state, and local agencies to design and implement ice control methods to reduce ice-related flood potential. The second is to work with the states and communities in nationwide as well as in New England to address ice-related emergency flooding problems affecting the region.

Projects Desired: CRREL and IERD are a national resource ready to apply our unique facilities and capabilities to solve problems and conduct innovative, state-of-the-art research and technical support. There are a number of mechanisms that enable IERD and the rest of CRREL to partner with various Federal, non-DoD and private sector entities. The Federal Technology Transfer Act of 1986 (15 USC 3710a) allows CRREL to collaborate with any non-Federal partner on research and technical support consistent with the mission of the laboratory. The Intergovernmental Cooperation Act (31 USC 6505) lets CRREL work with state and local governments on a broad range of reimbursable projects. Under the "Authority to Sell" (10 USC 2539b), CRREL can provide test and evaluation services to the states and the private sector. This includes the testing and evaluation of materials, equipment, models, computer software, and other items. The laboratory can also provide support to other Federal agencies via the Economy in Government Act (31 USC 1535) through MOUs/MOAs that establish a framework for the partnership and provide a concise description of the planned work. CRREL's 35 active Cooperative Research and Development Agreements

(CRADAs) with industry and academia and 17 Intergovernmental Cooperation Agreements with states and local governments in 1998 demonstrate a robust program in this area and the relevance of CRREL's research to many segments of American society beyond DoD.

The Corps of Engineers has several programs available under its Civil Works authorities to address flooding problems. These programs provide assistance either through the construction of structural and nonstructural projects to mitigate the flooding problem or by providing technical information to assist mitigation performed at the state or local level. Flood damage reduction projects constructed by the Corps of Engineers must demonstrate, based on current Federal guidelines, that the flood damages prevented by the project's construction exceed its total cost. The Corps must also demonstrate that the 10-year frequency flood discharge at the point of concern is equal to or greater than 800 cubic-feet per second (cfs). Technical assistance provided by the Corps does not need to meet the above criteria. Through the Corps, IERD has been involved in Section 205 Flood Damage Reduction program, Section 22 Planning Assistance to States Program (PAS)) projects, the Section 206 Flood Plain Management Services (FPMS) program funded jointly with FEMA, and numerous instances of technical assistance.

CRREL IERD Resources with Respect to Hazard Mitigation:

Corps: CRREL works jointly with the Corps' New England Division to address regional and local ice-related hazard mitigation needs through a variety of means. Congressionally authorized water resources investigations have resulted in the planning, design and implementation of many flood control and flood damage reduction projects. Work conducted under a Congressional authorization can be extensive and there is currently no monetary limit of funding. Typically there is a 1 - 2 year minimum delay in the identification of a proposed investigation and the funding of that work. The first phase of study, the Reconnaissance Investigation, is 100 percent federally funded and must be completed within twelve months. The second phase, the Feasibility Investigations, must be cost-shared with a local sponsor where the sponsor provides 50 percent of the cost of the feasibility study. Congress in a Water Resources Development Act must specifically authorize construction of any project resulting from a General Investigation study. The cost of implementation for flood damage reduction projects is generally 65 percent Federal and 35 percent non-Federal.

Through the Continuing Authorities Programs of the Corps many structural and non-structural local protection project reducing or eliminating damages from flooding have been constructed. Investigations initiated under the Corps Continuing Authorities do not require specific congressional authorization are initiated simply with a request from the State or community to the New England District. The following is a list of Continuing Authorities applicable to flood mitigation:

Section 205 - Flood Damage Reduction: Investigations are conducted under this program to assist local communities to identify flooding problems and to formulate and construct alternatives for flood damage reduction. The local sponsor is required to cost-share equally in the cost of the feasibility investigation that exceeds $100,000 and the Federal limit is $5,000,000. The local sponsor is required to contribute 25 percent of the cost of plans, specifications and construction.

Section 22 - Planning Assistance to States Program (PAS): The Planning Assistance to States Program is designed to assist the States in developing comprehensive plans to meet State planning goals. The program is extremely flexible in the type and the methodology of investigations. Studies conducted under the PAS program require a 50/50 cost share with a local sponsor. The existing funding limits are $300,000 per state and a national budget not to exceed $5,000,000.

Section 206 - Flood Plain Management Services (FPMS): The FPMS Program is designed for the Corps to assist States and local communities improve management of flood plains by performing technical

assistance and conducting special investigations. Cost recovery has been implemented in this program effective in FY 1991. Under cost recovery, assistance provided to Federal agencies and private interests must be fully reimbursed by those customers. States and local communities are still provided technical assistance at 100 percent Federal cost. One of the major efforts being conducted under the FPMS program at this time is the preparation of Hurricane Evacuation Studies. These studies are jointly funded with the Federal Emergency Management Agency.

Personnel:
IERD was created to research, analyze and solve ice problems in and around water bodies. The technical experience of the staff and their in-depth research and field capabilities combine with CRREL's unique Ice Engineering Facility to form one of the premier ice engineering organizations in the world. IERD has a staff of 15 engineers and technicians experienced in technical analyses, methods, and engineering solutions to ice problems -- that is, any situation where the effects of ice cause flooding, increase operational and maintenance requirements of water control projects, impede navigation, or adversely impact the environment in cold regions.

Equipment and Facilities:
The Ice Engineering Facility was built to increase the research capabilities of the U.S. Army Cold Regions Research and Engineering Laboratory. It is a two-story building approximately 160 by 210 feet containing three primary cold spaces: the test Basin, Flume, and Research Area. We have recently designed and built a new Wind Tunnel Facility. In addition there is a machine room in the basement, an instrumentation corridor separating the flume and test basin spaces, a shop/storage area, and one sample-storage cold room.

The Test Basin was designed primarily for large-scale work on ice forces on structures, such as drill platforms and bridge piers, and for tests using model icebreakers. The Basin is 30 feet wide, 8 feet deep and 120 feet long. The room is designed to operate at any temperatures between +65° and -10°F with very even temperature distribution, which results in uniform ice thickness. Other studies conducted in the Test Basin concern the formation of ice pressure ridges, ice problems in and around navigation locks, and vertical uplift forces.

The Flume is situated in a room where the temperature can be regulated between +65° and -20° F. The Flume is 2 by 4 feet in cross section and 120 feet long. It can tilt from +2° to -1° slope, have a flow capacity of nearly 14 cubic feet per second and have a refrigerated bottom. Some other studies conducted in the Flume are the formation of ice covers and frazil ice, the hydraulics of ice-covered rivers, the formation of ice jams, and the effect of ice covers on sediment transport and scour.

Possibly the most versatile portion of the Ice Engineering Facility is the Research Area. This room is 80 by 160 feet clear span and has a temperature range of +65° to -10°F. Piping capable of providing a flow of 1, 2, 4 or 8 cubic feet per second is located on one side of the room, and a large drain trough is on the other. The floor is designed for loads up to 400 pounds per square foot. Models of reaches can be constructed in this area to test ways to alleviate ice jams through channel modification. Tests of the bearing capacity of large ice sheets and cold-testing of vehicles and structures are a few of the other potential uses of this space. Tests conducted in this room will help to alleviate much of the flooding caused by ice jams.

USDA, Natural Resources Conservation Service

Contacts:

Gerald J. Lang, Technology Leader; Phone: (603) 868-7581, Fax: (603) 868-5301
E-mail: gerald.lang@nh.usda.gov

Edward Hansalik, Civil Engineer; Phone: (603) 868-7581, Fax: (603) 868-5301
E-mail: ehansalik@nh.usda.gov

Address: Federal Building
2 Madbury Road
Durham, NH 03824

Description and Mission:
The Natural Resources Conservation Service (NRCS) is a Federal agency within the US Department of Agriculture. The mission of the NRCS is to help people conserve, improve and sustain our natural resources and environment. NRCS, formerly the Soil Conservation Service, is the lead federal agency for conservation on private land. NRCS provides conservation technical assistance through local conservation districts and Resource Conservation and Development (RC&D) Councils to individuals, communities, watershed groups, tribal governments, federal, state, and local agencies, and others. NRCS has an interdisciplinary staff of professional engineers, planners, biologists, foresters, agronomists, and soil scientists working together to provide the necessary technical assistance to solve resource or environmental problems. NRCS products typically include conservation plans, study reports, engineering designs, and resource maps.

Authorities and Funding:
NRCS state and field offices derive funding from two possible sources, direct Federal appropriations and reimbursable agreements with agencies and units of government. NRCS manages several programs; Environmental Quality Incentive Program (EQIP), Wildlife Habitat Incentives Program (WHIP), Wetland Reserve Program (WRP), Forestry Incentives Program (FIP), and Farmland Protection Program (FPP) which provide cost-share assistance to landowners and users (primarily agricultural or forestry land) to install conservation practices to restore and protect natural resources. NRCS can also provide technical assistance ranging from preliminary reviews to complete detail designs to landowners/users solving resource problems even if financial assistance is not being provided for the installation of conservation practices. This assistance is dependent on staff availability and priorities.

NRCS also manages the Emergency Watershed Protection (EWP) program, which can provide financial and technical assistance to units of government and groups to repair damages sustained from a natural disaster (flood, fire, hurricane, tornado) creating an imminent hazard to life and property. The restoration efforts must be environmentally and economically cost effective and typically includes clearing debris from clogged stream channels, stabilizing eroded stream banks and restoring vegetation for stabilization purposes. NRCS can also provide technical assistance to watershed associations or groups to develop comprehensive plans for improving or protecting the watershed environment (water quality, flood reduction, wildlife habitat).

Mitigation Involvement:
The NRCS can provide technical assistance to conduct inventories, to complete watershed or site-specific plans, or to develop detail engineering and construction designs for conservation applications that will help reduce future damages from natural disasters. Some examples of past mitigation efforts include: floodplain management studies for towns, site assessments of stream flow impairments, stabilization designs to protect structures which could sustain severe damages from another storm event, and small watershed plans

addressing flooding problems. Some of these products can be provided through other conservation assistance efforts. However, the major jobs would require a reimbursable agreement with the state or towns to complete the work.

Mitigation Goals and Objectives:
With respect to hazard mitigation, the goal of the NRCS in New Hampshire is to meet the needs of the State and local governments by providing timely technical assistance to support recovery and restoration efforts. NRCS can contribute this technical assistance by interacting directly with NHHSEM at the state level and having our field staff working directly with Town Emergency Management officials at the local level. Short-term goals are to establish contacts with local officials and the conservation districts at the field office level to facilitate quicker response times. Intermediate and long-term objectives are to improve the cooperative efforts of working with NHHSEM and establish additional contacts for providing timely technical assistance at the local level.

Projects/Planning Desired:
NRCS would like to work with local watershed associations to develop comprehensive plans addressing resource and environmental needs and opportunities in the priority watersheds as identified in the Unified Watershed Assessment. These plans can provide the basis for targeting and requesting special funding to meet the needs of the local watershed association. Technical assistance for planning and designing along with public information dissemination are the typical activities our agency can provide in this effort.

NRCS Resources with respect to Hazard Mitigation

Personnel:
NRCS in New Hampshire has a workforce of 45 staff members along with 5 multi-state staff members. Approximately 22 staff members consisting of engineers, biologists, foresters, conservation planners, and technicians are available to provide some assistance in mitigation efforts. Support staff of a GIS specialist, computer specialist, and public information specialist could assist in providing information for public outreach. This staff is available to provide limited assistance under our present program funding authorities. However, larger projects would require reimbursement for planning and design assistance.

Equipment, Physical Facilities and Other Capabilities:
All of our field offices and State office have computers and access to the internet. All of the field offices have survey equipment and all engineers have the use of CADD software. All field offices have access to small meeting rooms and access to the Federal Telecommunications System. Government vehicles are located at all field offices for use by government employees and could be made available in emergencies.

Northeast States Emergency Consortium (NESEC)

Contacts:

Edward S. Fratto, Executive Director: Phone: (781) 224-9876, Fax: (781) 224-4350
E-Mail: www.nesec.org

Address: Northeast States Emergency Consortium
1 West Water Street, Suite 205
Wakefield, MA 01880

Organization Description:

The Northeast States Emergency Consortium, Inc. (NESEC) is a 501(c)(3) not-for-profit natural disaster mitigation and emergency management organization, located in Wakefield, Massachusetts. NESEC is the only multi-hazard consortium of its kind in the country and is supported and funded by the Federal Emergency Management Agency (FEMA). The eight Northeast States of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont form the consortium. NESEC has a full-time Executive Director, and Assistant. It is governed by a Board of Directors. The Board is comprised of the Directors of the State Emergency Management Agencies from each of the six New England States and the States of New York and New Jersey.

Organization Mission:
NESEC works in partnership with government and private organizations to reduce losses of life and property from natural disasters in the Northeast United States. The Northeast States are vulnerable to most of the natural hazards, including hurricanes, earthquakes, coastal and inland flooding, tornadoes and micro-bursts, forest fires, drought, lightning, blizzards and other forms of severe weather. Our developed urban areas and the desire to build and live on waterfront property have increased our degree of risk from natural hazards.

Mitigation Programs:

HAZUS: NESEC assists FEMA PROJECT IMPACT Communities in the use of HAZUS as a planning platform for incorporating multi-hazard disaster prevention initiatives. NESEC can produce a HAZUS report using default data for each of the initial PROJECT IMPACT Communities. Priority is given to PROJECT IMPACT communities, however assistance may be provided to other communities as resources allow. This report provides an excellent starting point for communities wishing to utilize HAZUS to identify potential hazards. The NESEC HAZUS Report is multi-hazard and usually contains information on earthquakes, tornadoes, flood and wind.

There is no fee or charge for producing the default HAZUS Report and meeting with the community to discuss the results. All HAZUS support is arranged in cooperation with the New Hampshire Homeland Security and Emergency Management (NHHSEM). Communities interested in participating should contact NHHSEM.

Emergency Generators: NESEC assists communities to establish a partnership with their electric utilities and service companies. The partnership would conduct an energy efficiency audit of the community, recommend cost saving measures, and implement a cost saving plan. Monthly savings could be used to fund emergency generator(s) for local critical facilities. The utility or energy service company could then lease, install, and maintain generator(s) in a community.

The community would pay a monthly charge for the lease agreement. This charge would not exceed the savings derived through energy efficiency measures, so there would be no capital outlay or additional cost to the community. In fact, some communities may be able to reduce their monthly electric bills in an amount that exceeds the cost of the generator(s) lease agreement.

Monthly savings and utility participation will vary from state to state and community-to-community depending on present electric power usage and efficiency measures and deregulation. There is no fee or charge for assisting communities in establishing partnerships with electric utilities. NESEC assistance will be provided as resources allow. All emergency generator support is arranged in cooperation with the New Hampshire Homeland Security and Emergency Management (NHHSEM). Communities interested in participating should contact NHHSEM.

Federal Mitigation Grant Programs

I. Pre-Disaster Mitigation Grant Program

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. http://www.fema.gov/government/grant/pdm/index.shtm

II. 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. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
http://www.fema.gov/government/grant/hmgp/index.shtm

III. Flood Mitigation Assistance (FMA) Program

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. http://www.fema.gov/government/grant/fma/index.shtm

APPENDIX E
DOCUMENTATION OF THE PLANNING PROCESS

City of Keene

Hazard Mitigation Committee

Agenda- Meeting 1

Public Works Department

350 Marlborough Street

November 28, 2017 at 1:30 p.m.

I. Introductions and Overview of the Hazard Mitigation Plan Update

II. Review of Previous Mitigation Actions
   a. Review the list of actions listed in the current Hazard Mitigation Plan and determine if they need to continue into the update.

III. Identification of Hazards
   a. Determine the natural hazards that pose a threat to the city
   b. Identify the past occurrences for each hazard

IV. Risk Assessment
   a. Rate each hazard to determine the risk/vulnerability

V. Next Meeting- Potential Date: December 19th at 1:30

City of Keene

Hazard Mitigation Committee

Agenda- Meeting 2

Public Works Department

350 Marlborough Street

December 19, 2017 at 9:00 a.m.

I. Identification of Hazards
   a. Determine the natural hazards that pose a threat to the city
   b. Identify the past occurrences for each hazard

II. Risk Assessment
   a. Rate each hazard to determine the risk/vulnerability

III. Existing Mitigation Strategies and Proposed Improvements
   a. Review the list of existing strategies and programs. Determine any needed improvements.

IV. Next Meeting: January 9th at 1:00 p.m.

City of Keene

Hazard Mitigation Committee

Agenda- Meeting 3

Public Works Department

350 Marlborough Street

January 9, 2018 at 1:00 p.m.

I. Existing Mitigation Strategies and Proposed Improvements
   a. Review the list of existing strategies and programs. Determine any needed improvements.

II. Risk Assessment of Human-caused Hazards
   a. Determine the severity and probability of the human-caused hazards in the chart.

III. Critical Facilities
   a. Review the listed critical facilities from the existing mitigation plan and provide updated information.

IV. Next Meeting: January 22 at 1:00 p.m.

City of Keene

Hazard Mitigation Committee

Agenda- Meeting 4

Public Works Department

350 Marlborough Street

January 23, 2018 at 9:30 a.m.

I. Critical Facilities
   a. Review the listed critical facilities from the existing mitigation plan and provide updated information.

II. Determine gaps in coverage
   a. Review current mitigation strategies, programs, and practices to determine if all hazards are covered and where additional actions are needed.

III. Risk Assessment of Human-caused Hazards
   a. Determine the severity and probability of the human-caused hazards in the chart.

IV. Next Meeting: February 6th at 1:30 p.m.

City of Keene

Hazard Mitigation Committee

Agenda- Meeting 5

Public Works Department

350 Marlborough Street

February 6, 2018 at 1:30 p.m.

I. Critical Facilities
   a. Continue the review of the listed critical facilities from the existing mitigation plan and provide updated information. (begin at recreation areas)

II. Determine gaps in coverage
   a. Review current mitigation strategies, programs, and practices to determine if all hazards are covered and where additional actions are needed.

III. Map update for past and potential hazards

IV. Next Meeting: February 20th at 1:30 p.m.

City of Keene

Hazard Mitigation Committee

Agenda- Meeting 6

Public Works Department

350 Marlborough Street

March 13, 2018 at 9:30 a.m.

1. Identify and Prioritize Mitigation Actions for Each Hazard

   a. Identify specific locations that should be added to the Action Plan.
   b. Use the STAPLEE Chart to identify and rank actions for each hazard.

2. Prepare an Action Plan

   a. Determine the Who, When, and Funding Source for each action identified in the STAPLEE Chart.

3. Missing Pieces

   Provide information on previous sections that were incomplete.

4. Next Meeting: TBD

KEENE HAZARD MITIGATION
MEETING # 1
November 28, 2017

SIGN – IN SHEET

NAME	AFFILIATION or DEPARTMENT	CONTACT INFORMATION
Kurt Blomquist	Keene EMD, Keene Public Works Director	kblomquist@ci.keene.nh.us
Don Lussier	Keene City Engineer	dlussier@ci.keene.nh.us
Mark Howard	Keene Fire Chief, Assistant EMD	mhoward@ci.keene.nh.us
John Rogers	Keene Acting Health Director	jrodgers@ci.keene.nh.us
Rhett Lamb	Keene Planning Director, Asst. City Manager	rlamb@ci.keene.nh.us
Duncan Watson	Keene Assistant Public Works Director	dwatson@ci.keene.nh.us
Corinne Marcou	Keene Administrative Assistant	cmarcou@ci.keene.nh.us
Andy Bohannon	Keene Parks, Recreation, and Facilities Dir.	abohannon@ci.keene.nh.us

KEENE HAZARD MITIGATION
MEETING # 2
December 19, 2017

SIGN – IN SHEET

NAME	AFFILIATION or DEPARTMENT	CONTACT INFORMATION
Kurt Blomquist	Keene EMD, Keene Public Works Director	kblomquist@ci.keene.nh.us
Don Lussier	Keene City Engineer	dlussier@ci.keene.nh.us
Mark Howard	Keene Fire Chief, Assistant EMD	mhoward@ci.keene.nh.us
John Rogers	Keene Acting Health Director	jrodgers@ci.keene.nh.us
Rhett Lamb	Keene Planning Director, Asst. City Manager	rlamb@ci.keene.nh.us
Duncan Watson	Keene Assistant Public Works Director	dwatson@ci.keene.nh.us
Corinne Marcou	Keene Administrative Assistant	cmarcou@ci.keene.nh.us
Andy Bohannon	Keene Parks, Recreation, and Facilities Dir.	abohannon@ci.keene.nh.us

KEENE HAZARD MITIGATION
MEETING # 3
January 9, 2018

SIGN – IN SHEET

NAME	AFFILIATION or DEPARTMENT	CONTACT INFORMATION
Kurt Blomquist	Keene EMD, Keene Public Works Director	kblomquist@ci.keene.nh.us
Don Lussier	Keene City Engineer	dlussier@ci.keene.nh.us
Duncan Watson	Keene Assistant Public Works Director	dwatson@ci.keene.nh.us
Corinne Marcou	Keene Administrative Assistant	cmarcou@ci.keene.nh.us
Jeffery Chickering	Deputy Fire Chief	jchickering@ci.keene.nh.us

KEENE HAZARD MITIGATION
MEETING # 4
January 23, 2018
SIGN – IN SHEET

NAME	AFFILIATION or DEPARTMENT	CONTACT INFORMATION
Kurt Blomquist	Keene EMD, Keene Public Works Director	kblomquist@ci.keene.nh.us
Don Lussier	Keene City Engineer	dlussier@ci.keene.nh.us
Corinne Marcou	Keene Administrative Assistant	cmarcou@ci.keene.nh.us
John Rogers	Keene Health Director	jrogers@ci.keene.nh.us

KEENE HAZARD MITIGATION
MEETING # 5
February 6, 2018
SIGN – IN SHEET

NAME	AFFILIATION or DEPARTMENT	CONTACT INFORMATION
Kurt Blomquist	Keene EMD, Keene Public Works Director	kblomquist@ci.keene.nh.us
Don Lussier	Keene City Engineer	dlussier@ci.keene.nh.us
Duncan Watson	Keene Assistant Public Works Director	dwatson@ci.keene.nh.us
Corinne Marcou	Keene Administrative Assistant	cmarcou@ci.keene.nh.us
Jeffery Chickering	Deputy Fire Chief	jchickering@ci.keene.nh.us

KEENE HAZARD MITIGATION
MEETING # 6
March 13, 2018
SIGN – IN SHEET

NAME	AFFILIATION or DEPARTMENT	CONTACT INFORMATION
Kurt Blomquist	Keene EMD, Keene Public Works Director	kblomquist@ci.keene.nh.us
Don Lussier	Keene City Engineer	dlussier@ci.keene.nh.us
Duncan Watson	Keene Assistant Public Works Director	dwatson@ci.keene.nh.us
Corinne Marcou	Keene Administrative Assistant	cmarcou@ci.keene.nh.us
John Rogers	Keene Health Director	jrogers@ci.keene.nh.us
Mark Howard	Keene Fire Chief	mhoward@ci.keene.nh.us

Below is one page of the SWRPC Newsletter that is sent to 34 towns in the southwest region of New Hampshire, County Offices, businesses and stakeholders**.**

SWRPC

Commission Highlights

January 2018

Vol. 24 - No. 1

Hazard Mitigation Plan Updates

SWRPC has begun working with the City of Keene to update their hazard mitigation plan and will soon begin working with the Towns of Nelson, New Ipswich, Stoddard, and Walpole. Plans update are required every five years to remain eligible for assistance and hazard mitigation funding. Updates include SWRPC staff conducting a series of meetings with local officials. Meetings are posted on SWRPC's website www.swrpc.org under *Other Meetings* and are open to the public. SWRPC recently completed updates for the towns of Alstead, Fitzwilliam, Gilsum, Hancock, Harrisville, Langdon, Roxbury, and Winchester. For additional information, please contact Lisa Murphy of Commission staff.

2017 Field Work Season Completed

SWRPC was especially busy with seasonal data collection efforts related to transportation planning in 2017. These included studies through the traffic research program at 141 locations for the NH Department of Transportation as well as 28 additional counts via local requests and other program support. Other studies included 3 intersection turning movement counts, 4 rideshare studies, 12 bicycle or pedestrian counts, and 7 freight studies. During the season, SWRPC continued its efforts to map and assess culverts and streams in Greenville, New Ipswich, Roxbury, and Stoddard and is in the process of creating reports and other deliverables tied to these efforts. In addition, following a successful pilot project in the Town of Dublin, SWRPC is continuing its support of a statewide data collection effort aimed at understanding pavement condition and improvement planning. For more information, please contact Henry Underwood of Commission staff.

Hinsdale-Brattleboro Bridge Updates

The Hinsdale-Brattleboro Bridge Project Advisory Committee (PAC) met on December 18th to receive a number of updates from the NH Department of Transportation (NHDOT) on the status of Project #12210C, and to discuss various bridge design and planning matters. During the meeting, the PAC provided information regarding the design of ice protection features for the bridge piers and formed a subcommittee to study and provide feedback on the design modifications and use of the existing Connecticut River bridges. NHDOT and the Vermont Agency of Transportation (VTrans) have announced a public hearing on Thursday, January 18, 2018 at 7:00 p.m. at the Hinsdale Town Hall. The hearing will provide the public another opportunity to learn about the project and will assist both states in determining a finding as to whether to move forward with the anticipated right of way purchases for the project. For more information, please contact J. B. Mack of Commission staff.

Email Newsletter

This is a sample of the email blast that is sent to over 340 emails in the region with a listing on events that are available for the public to participate in. Each of the Keene Hazard Mitigation meetings was included in these emails to reach a broader audience.

January 9

The **Keene Hazard Mitigation Committee** will meet at 1:00 p.m. at the Keene Public Works Department at 350 Marlboro Street in Keene, NH to update the hazard mitigation plan. The public is encouraged to attend and participate. For more information, contact Lisa Murphy of SWRPC staff.

January 9

The **SWRPC Board of Directors** will meet at 3:00 p.m. at 37 Ashuelot Street in Keene, NH. For more information, contact Becky Baldwin of SWRPC Staff.

January 10

The **New Ipswich Hazard Mitigation Committee** will meet at 10:00 a.m. at the New Ipswich Town Office at 661 Turnpike Road, New Ipswich, NH to update the hazard mitigation plan. The public is encouraged to attend and participate. For more information, contact Lisa Murphy of SWRPC staff.

Right-click here to download

Phil Goff is a Senior Planning Associate with Alta Planning + Design. He brings 18 years of urban design and pedestrian and bicycle facility planning experience to his work. Since 2009, he has managed Alta's Cambridge office and has overseen planning and design projects throughout the Northeast. These projects include managing pedestrian and bicycle master planning projects in communities large and small, greenway corridor studies, complete streets plans, streetscape design projects, and bike share system master plans. His sincere passion for making cities and towns more lively, walkable, bike-friendly, and sustainable places represents a common theme in his work.

Right-click here to download

Tiffany Mannion is the Bicycle Mayor of Keene, New Hampshire and the first Bicycle Mayor in the United States. She is a LAB Certified Cycling Instructor and a passionate two-wheeled commuter and explorer. In the world of cycling and social media, she is perhaps better known as bellecycle. She has ridden over 5600 miles since 2016 in eight different countries. Her two-year term as Bicycle Mayor will focus on three community-wide goals established with the support of MAST: Education, Connection, and Creation. She has been featured in Rails to Trails Magazine and was an Ibex Advocate in the spring of 2017. Follow Tiffany online at bicyclemayorofkeene.com.

The event is free to attend, however, registration is required. To learn more or to register, please click here or contact Henry Underwood of SWRPC staff.

Locally-Based Crowdfunding Platform Expands and Seeks Proposals

March 5

The **Monadnock Alliance for Sustainable Transportation (MAST) Bicycle Friendly Community Subcommittee** will meet at 5:30 p.m. at 3 Washington Street (2nd Floor Conference Room) in Keene, NH. For more information, contact Henry Underwood of SWRPC staff.

March 13

The **Keene Hazard Mitigation Committee** will meet at 9:30 a.m. at the Public Works Department at 350 Marlborough Street in Keene, NH. For more information, contact Lisa Murphy of SWRPC staff.

March 15

The **Monadnock Alliance for Sustainable Transportation (MAST) Complete Streets Subcommittee** 37 Ashuelot Street in Keene, NH. For more information, contact Henry Underwood of SWRPC staff.

March 20

The **Monadnock Region Coordinating Council for Community Transportation**

Savings Bank – Community Room, at 145 Broad Street in Claremont, NH. This will be a unique opportunity to hear updates directly from the Federal Highway Administration and the Port of Portsmouth, and learn about the latest developments in autonomous trucks and connected trucking. Local officials are encouraged to attend. Please register at nhfreight.eventbrite.com by Friday, March 16th.

NH Preservation Alliance's Old House & Barn Expo

Have fun and learn from experts at the Preservation Alliance's Old House & Barn Expo on **March 24-25, 2018** at the Radisson Hotel in Manchester. Meet with vendors of period-appropriate materials and furnishings, watch craftspeople in action, and learn about researching your historic house. With hourly lectures and over 60 exhibitors and traditional arts demonstrators, the Expo is a rewarding experience for experienced homeowners and novices alike. For additional information, go to: https://nhpreservation.org/old-house-barn-expo or contact at Jennifer Goodman, 603-224-2281.

Annual Spring Planning and Zoning Conference

The NH Office of Strategic Initiatives (formerly NH Office of Energy and Planning) has announced the opening of registration for its 24th Annual Spring Planning and Zoning Conference, scheduled for **April 28, 2018** at the Grappone Conference Center in Concord. Seating capacity is limited, so it is recommended that attendees register early in order to ensure their preferred choice of sessions. The agenda, registration form, and directions can be accessed at the OSI website. For questions, please contact Danielle Craver at (603) 271-2155, or danielle.craver@osi.nh.gov.

Plan NH's Municipal Technical Assistant Grant

New Hampshire's population is changing rapidly, and housing inventory in most communities cannot meet future or even current demand. In an effort to address the changes, Plan NH's Municipal

RECEIVED AUG 1 3 2018

CITY OF KEENE
NEW HAMPSHIRE

DATE: August 6, 2018

TO: Elizabeth A. Dragon, City Manager

FROM: Kürt D. Blomquist, PE, Public works Director/Emergency Management Director

SUBJECT: Hazard Mitigation Plan Certificate of Adoption

Recommendation:

City Manager sign and date the Hazard Mitigation Plan Certificate of Adoption.

Background:

The City maintains a Hazard Mitigation Plan that addresses the various natural and man-made hazards that may affect the community. The plan outlines strategies to address the potential impacts of these hazards. An adopted Hazard Mitigation Plan is a requirement for the City to receive Hazard Mitigation Grants from the Federal Emergency Management Agency (FEMA).

The City Council reviewed and adopted the City's Hazard Mitigation Plan – 2018 Updated on August 2, 2018 and authorized the City Manager to do all things necessary to implement the plan. The final step in the submission of the Hazard Mitigation Plan to FEMA is the signing of the Certificate of Adoption.

It is recommended that the City Manager sign and date the Certificate of Adoption.

Attachment

1. Hazard Mitigation Plan Certificate of Adoption
2. City Council August 2,, 2019 Report of Action

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CERTIFICATE OF ADOPTION

KEENE, NEW HAMPSHIRE

CITY COUNCIL

A RESOLUTION ADOPTING THE

KEENE HAZARD MITIGATION PLAN UPDATE 2018

WHEREAS, the City of Keene has developed and received conditional approval from NH Homeland Security & Emergency Management (HSEM) for its Hazard Mitigation Plan Update 2018 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held between November 2017 and March 2018 regarding the development and review of the Keene Hazard Mitigation Plan Update 2018; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the City of Keene; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the City of Keene, with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the City of Keene eligible for funding to alleviate the impacts of future hazards; now therefore the Keene City Council adopted the Keene Hazard Mitigation Plan Update 2018 on August 2, 2018:

1. The Plan is hereby adopted as an official plan of the City of Keene;
2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.

Approved and signed, this 13th day of Aug, **2018**

Elizabeth A. Dragon

Elizabeth A. Dragon, City Manager

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

FEMA

AUG 15 2018

Whitney Welch
State Hazard Mitigation Officer
NH Department of Safety
Homeland Security and Emergency Management
33 Hazen Drive
Concord, NH 03303

Dear Ms. Welch:

We would like to acknowledge the City of Keene and the State of New Hampshire for their dedication and commitment to mitigation planning.

As outlined in the FEMA-State Agreement for FEMA-DR-4316 your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. On **August 14, 2018** our Agency was notified that your office completed its review of the Keene Hazard Mitigation Plan Update 2018 and determined it meets the requirements of 44 C.F.R. Pt. 201.

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

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

The Keene Hazard Mitigation Plan Update 2018 must be reviewed, revised as appropriate, and resubmitted to New Hampshire Homeland Security and Emergency Management for approval within **five years of the plan approval date of August 14, 2018** in order to maintain eligibility for mitigation grant funding. We encourage the City to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

AUG 15 2018

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,

Douglas F. Wolcott Jr.
Acting Deputy Regional Administrator

PFF: ms

cc: Fallon Reed, Chief of Planning, New Hampshire
Kayla Henderson, Hazard Mitigation Planner, New Hampshire
Jennifer Gilbert, New Hampshire State NFIP Coordinator

Appendix F: Project Status Sheet

The following form can be used to keep track of projects identified in the hazard mitigation plan that are in progress or that have been completed.

MITIGATION ACTION	STATUS	EXPLANATION OF STATUS