Multi-Hazard Mitigation Plan Update 2019

Town of Madbury, NH

Adopted 2006
Updated October 22, 2014
Updated September 6, 2019

Submitted to the New Hampshire Homeland Security & Emergency Management

By the

Town of Madbury, NH
with Strafford Regional Planning Commission

This project was funded from the fiscal year 2017 Pre-Disaster Mitigation (PDM) Grant Program, which was awarded to the Department of Safety, Division of Homeland Security and Emergency Management (HSEM) from the Federal Emergency Management Agency (FEMA).

Acknowledgements

This plan was created through a grant from New Hampshire Homeland Security and Emergency Management (HSEM). The following organizations have contributed invaluable assistance and support for this project:

The 2006 and 2014 Madbury Multi-Hazard Mitigation Committee
New Hampshire Homeland Security Emergency Management (HSEM)
Town of Madbury

The 2019 Town of Madbury Multi-Hazard Mitigation Planning Committee

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

- Tom Perley — Fire Chief/Emergency Management Director, Town of Madbury
- Mark Avery — Planning Board Chair, Town of Madbury
- Joseph Moriarty — Road Agent, Town of Madbury
- Jim Davis — Assistant Fire Chief, Town of Madbury
- Justin Corrow — Building Inspector, Town of Madbury
- Joseph McGann — Chief of Police, Town of Madbury
- Fritz Green — Board of Selectmen, Town of Madbury
- Eric Fiegenbaum — Administrative Assistant. Town of Madbury
- Elizabeth Durfee — Contract Planner, Town of Madbury
- Kayla Henderson — State Hazard Mitigation Planner, NH HSEM

Plan Prepared and Authored By
Kyle Pimental, Principal Regional Planner
Strafford Regional Planning Commission
150 Wakefield Street, Suite 12
Rochester, NH 03867
603-994-3500
www.strafford.org

Date of Conditional Approval from HSEM: 8/9/19
Date of Adoption by Town: 8/30/19
Date of Final Approval from FEMA: 9/6/19

Cover: High Road Bridge – Mother's Day Flood 2006 – Bellamy Dam at full flow
Photo Credit: Eric Fiegenbaum, Administrative Assistant, Town of Madbury

Executive Summary

This Plan was revised and updated to meet statutory requirements and to assist the Town of Madbury in reducing and mitigating future losses from natural and man-made hazardous events. An initial edition of this Plan was developed and presented to FEMA in 2006. The plan was revised in 2014, and was updated in 2019 to reflect the most recent information obtained through the evolution of the hazard mitigation program at the State. This update was developed by Strafford Regional Planning Commission (SRPC) and participants from the Multi-Hazard Mitigation Planning Team. This team was made up by the Fire Chief/Emergency Management Director, Fire Chief/Emergency Management Director, Health Officer, Planning Board Chair, Road Agent, Building Inspector, Chief of Police, and Administrative Assistant.

The Plan references historical events, as well as identifies specific vulnerabilities that are likely to impact the Town. Overall threats include:

- ∴ 3 hazards rated as having a High overall risk in Madbury: Flooding (Riverine/Extreme Rain Event), Winter Storms, and Severe Thunderstorms
- ∴ 5 hazards rated as having a Moderate overall risk in Madbury: Extreme Temperatures, Hurricanes and Tropical Storms, Tornado/Microburst, Earthquake and Landslides, and Public Health Threats
- ∴ 5 hazards rated as having a Low overall risk in Madbury: Drought, Flooding (Dam Failure), Wildfire, Hazardous Material Threat, Coastal Flooding (Storm Surge and Sea-Level Rise)

Each hazard was provided with a description and information on the hazard's extent, past events and impacts, potential future impacts to the community, and potential loss estimates. As part of this analysis, the planning team reviewed past and existing mitigation strategies and made updates for improvement. Lastly, the planning team developed a series of new mitigation actions to be completed over the course of this plan's five-year cycle. Each mitigation action was prioritized using the STAPLEE Method and responsibilities for implementation were identified.

This plan provides an updated list of Critical Infrastructure and Key Resources (CI/KR) categorized as follows: Emergency Response Facilities (ERF), Non-Emergency Response Facilities (NERF), Critical Infrastructure (CI), Vulnerable Populations to Protect (VPP), and Water Resources (WR). All critical assets were inventoried and mapped.

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

The Town of Madbury received conditional approval on August 9, 2019. A public meeting was held, and the plan was adopted by the Board of Selectmen on August 30, 2019. The Plan received formal approval from FEMA on September 6, 2019.

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

∴ Annually to assess whether the existing and suggested mitigation strategies have been successful and remain current in light of any changes in federal state and local regulations and statutes. This review will address the Plan's effectiveness, accuracy and completeness regarding the implementation strategy. The review will address any recommended improvements to the Plan, and address any weaknesses identified that the Plan did not adequately address. This report will be filed with the Board of Selectmen.

∴ Every five years the Plan will be thoroughly reviewed, revised and updated using the same criteria outlined above. At that time, it is expected to be thoroughly reviewed and updated as necessary. The public will be allowed and encouraged to participate in that five-year revision process.

∴ After any declared emergency event, the EMD using the same criteria outlined above.

∴ If the Town adopts any major modifications to its land use planning documents, the jurisdiction will conduct a Plan review and make changes as applicable.

Looking upstream from the railroad bridge – Madbury, NH

Chapter 1: Multi-Hazard Mitigation Planning Process

Authority

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

Purpose and History

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

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

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

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

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

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

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

Jurisdiction and Scope of the Plan

This Plan addresses only one jurisdiction: the Town of Madbury, NH. The Plan addresses 13 types of natural and man-made hazards that may affect the Town:

- Flooding (Riverine/Extreme Rain Event)
- Flooding (Dam Failure)
- Hurricane & Tropical Storms
- Tornado & Downburst
- Severe Winter Storms
- Severe Thunderstorms/Microbursts
- Wildfire
- Earthquake/Landslide
- Extreme Temperatures
- Drought
- Public Health Threats
- Hazardous Material
- Coastal Flooding (*Storm Surge and Sea Level Rise*)

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

Route 155 crossing on the Bellamy – Madbury, NH

Multi-Hazard Mitigation Goals

The Town's multi-hazard goals are based on the State of New Hampshire Multi-Hazard Mitigation Plan (2018) goals and include:

- *Minimize loss and disruption of human life, property, the environment, and the economy due to natural, technological, and human-caused hazards through a coordinated and collaborative effort to implement appropriate hazard mitigation measures*
- *Enhance protection of the general population, citizens, and guests of the Town of Madbury before, during, and after a hazard event through public education about disaster preparedness and resilience, and expanded awareness of the threats and hazards which face the Town.*
- *Promote continued comprehensive hazard mitigation planning to identify, introduce, and implement cost effective hazard mitigation measures.*
- *Address the challenges posed by climate change as they pertain to increasing the risk and impacts of the hazards identified within this plan.*
- *Strengthen continuity of operations and continuity of government to ensure continuation of essential services*

Multi-Hazard Mitigation Planning Process

Overview

The Plan was developed and updated with substantial local, state, and federal coordination. The completion of this new multi-hazard plan required significant planning preparation and represents the collaborative efforts of the Town of Madbury, an ad-hoc local Multi-Hazard Mitigation Planning Committee, and SRPC. The Committee followed an established ten step multi-hazard mitigation planning process (see box, right).

The Committee met four times over a two month period to discuss the range of hazards included in this plan as well as brainstorm mitigation needs and strategies to address these hazards and their impacts on people, business, and infrastructure in the Town. All meetings were geared to accommodate brainstorming, open discussion, and an increased awareness of potential threats to the Town. This process results in significant cross talk regarding all types of natural and man-made hazards.

Ten Step Multi-Hazard Mitigation Planning Process

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

Committee Meetings

The Plan is being developed with substantial local, state and federal coordination; completion of this new multi-hazard plan required significant planning preparation. All meetings are geared to accommodate brainstorming, open discussion and an increased awareness of potential threats to the Town. Below is a brief summary of each meeting. Meeting agendas and sign-in sheets are included in the Plan's Appendix B.

Meeting 1: March 22, 2019

Members present: Jim Davis (Assistant Fire Chief), Justin Corrow (Building Inspector), Eric Fiegenbaum (Administrative Assistant), Robert Gaetjens (Health Officer), and Fritz Green (Board of Selectmen).

Strafford Regional Planning Commission (SRPC) staff provided a brief overview of the update process and the federal requirements set forth in the town's grant. This included information on the five-year plan cycle, eligibility of future funding opportunities, and the town's existing plan is currently expired as of 10/22/14. SRPC staff detailed the in-kind match documentation, committee responsibilities, and steps towards successful adoption.

First, SRPC and the committee reviewed the draft community profile chapter. Committee members provided general comments and feedback. Members agreed the Census 5-year estimates seemed to have some inaccuracies and that local housing data should be supplemented into this section. The Administrative Assistance would work with the Building Inspector to provide this information. The committee decided to include the 2018 building permit data into the development trends analysis. Lastly, the committee decided that the commercial building permit on Knox Marsh Road was built near the floodplain (across the street), but was not within the floodplain.

SRPC, and the committee, reviewed the draft asset inventory chapter. The following is a summary of comments and changes:

1. Emergency Response Facilities
    a. Maintenance Shed was updated to UNH Maintenance Shed
    b. NHDOT Shed has a portable generate and should be referenced in the backup power section
    c. Moharimet Elementary School has a new generator (2017)
    d. Route 4 weigh station in Durham was added as a third helipad location
2. Non-Emergency Response Facilities
    a. Water Pumping Station should be changed to Drinking Water Wells (move to water resources)
3. Critical Facilities
    a. Add Durham as a location for the Amtrak Downeaster
    b. Perkins Road updated to Miles Lane
    c. Identified Nute Road over Bellamy and Freshet Road over Johnson Creek as REDLIST bridges
4. Vulnerable Populations to Protect
    a. University Edge updated to 10 Lee Road, LLC
    b. Add Old Stage Campground
    c. Add Carriage Hill Assisted Living

    d. The Barn at Powder Major's Farm
5. Water Resources
    a. Remove Hicks Hill Reservoir
    b. Champernown Street updated to Champernowne
    c. Added Long Hill Circle (30K) cistern
    d. Added Hoyt Pond and Evans Road as fire ponds
    e. Added two gravity main hydrants on Pudding Hill Road and Evans Road
    f. Added one pressurized hydrant on Freshet Road

Next, the Planning Committee reviewed the Town's National Flood Insurance Program (NFIP) status and past floodplain management actions. NFIP compliance actions the town has completed included: the 2010 FEMA Community Assistance Visit; enforcement of existing floodplain regulations that exceeds NFIP minimum requirements by prohibiting new buildings in the floodplain; adoption new floodplain maps, which were delineated as part of the Coastal NH Floodplain Mapping Update; implementation of a public outreach workshop to discuss concerns and actions related to extreme precipitation and flooding, drought and water supply, and emergency preparedness; and completion of a vulnerability assessment to identify key assets and resources that may be affected from flooding by seal level rise and/or storm surge. The town has also completed a variety of infrastructure projects, including: a culvert replacement on Cherry Lane; thirteen culvert replacements and improvements on Hayes Road to prepare for the upcoming paving project; and repair of the Portsmouth drinking water line on the Hayes easement. The committee is aware that Portsmouth is currently updating the emergency action plan for the Bellamy Dam, and should get a copy when finalized.

Lastly, the committee reviewed past actions and provided feedback on what strategies have been completed over the course of the past five-year plan cycle.

The next meeting was set for April 11, 2019 at 9:00AM at the Town Hall. SRPC staff indicated that materials would be sent out prior to the meeting date to give the committee adequate time to be prepared to discuss agenda items.

Meeting 2: April 11 2019

Members present: Jim Davis (Assistant Fire Chief), Eric Fiegenbaum (Administrative Assistant), Justin Corrow (Building Inspector), Joe McGann (Police Chief), and Fritz Green (Board of Selectmen).

SRPC staff opened the meeting with reviewing old business agenda items. The first item was the meeting notes from the March 22nd meeting. There was only one revision – 10 Lee Road, LLC should be changed to Madbury Wood Apartments, and that should be referenced in the asset inventory table as well. Next, the planning committee reviewed the updated asset tables. There were no additional changes or revisions. SRPC staff briefly went over the outstanding action items and asked that responsible parties follow up over the next several weeks.

The planning committee then reviewed the handful of disaster and emergency declarations that have taken place over the course of the past five years. Two events were discussed: 1) the January 2015 storm, known as blizzard "JUNO" and 2) the March 2018 Nor'easter.

The planning committee then discussed the descriptions of each hazard. Below is a summarized list of additional data that will be included into the plan:

1) Flooding
    a. The committee agreed to remove the Gangwer Wildlife Pond dam, as this dam is no longer classified as a threat.
    b. Several potential future threats to add into the plan, including: contamination from industrial uses in areas they may be impacted from a dam failure; erosion issues in some areas along the Bellamy; and large debris (campers, propane tanks, and trees) getting into the Bellamy during flooding events that could impact the 155 bridge or the railroad line.
2) Hurricane and Tropical Storms
    a. No significant impacts
3) Tornado and Microbust
    a. In July 2017, there was a significant microburst that impacted portions of French Cross Road and Moharimet Drive. This event produced several downed trees that blocked roads, took down power lines and hit homes and cars (mostly in Dover). Debris in the roads created challenges for emergency service access and mutual aid.
    b. In 2018, there was a severe storm event that produced a partial funnel cloud in Durham; however, it was a localized event and Madbury experienced only rain and a few wind gusts.
4) Severe Winter Weather
    a. The ice storm of 1998 produced long-term power outages, flooding in basements, isolation issues and slight panic after several days, gas station without power to provide fuel, increases in emergency call volumes, and no propane deliveries for generators. The ice storm in 2008 produced similar challenges.
    b. During the January 2015 storm, which was known as blizzard "JUNO" and brought heavy snow, the town implemented emergency protective measures; snow removal assistance; and school closures.
    c. During the March 2018 nor'easter the town implemented emergency protective measures; snow removal assistance; and school closures. The night portion of Town Meeting was postponed; however, election ballots went on as scheduled.
5) Severe Thunderstorms and Lightning
    a. No significant impacts
6) Wildfire
    a. No significant impacts
    b. Cherry Lane is vulnerable to potential future fires as it is in the wildland-urban interface zone.
7) Earthquake and Landslide
    a. Several years ago, there was a minor landslide off Garrison Lane along Gerrish Brook. The residential property lost part of the lawn up to a shed. A bank stabilization project was implemented by NRCS.
8) Extreme Temperatures
    a. No significant impacts for extreme heat. Durham provides a regional cooling shelter that could be uses in extreme heat waves.

b. A larger concern is during the winter and with stretches of extreme cold. If there are power outages, additional issues (especially with first-time homebuyers) emerge including pipes freezing and basement flooding.

9) Drought
    a. During the 2016-2017 drought, there were a handful of shallow-dug wells that went dry.
    b. The town should increase education efforts on explaining to residents where their water comes from, and where to get potable water during a prolonged drought.
    c. The town hall can offer water for "every-day services" (not necessarily for drinking) during an emergency.
10) Public Health Threats
    a. The town needs to determine if the closest POD is Durham or Dover.
    b. Over the past several years, there have been four opioid overdose reversals using Narcan. In 2016, police officers will be receiving recertification in advanced AED, Narcan, and CPR training.
    c. The town should work on providing additional information on Lyme disease prevention.
    d. The water board has been conducting testing for radon. Data from that effort should be included in the plan.
    e. A public health study on arsenic and uranium in well water, conducted by the N.H. Biomonitoring Program, has been published by the state Department of Health and Human Services. Relevant information and results should be included in the plan.
    f. PFOS and PFAS are an emerging threat.
11) Hazard Materials
    a. Add Bellamy Reservoir on Route 9 and PanAm railroad as vulnerable locations for potential future spills.
12) Coastal Hazards
    a. The committee is adding coastal hazards into the plan; however, the town's vulnerability to storm surge and sea-level are low. Increases in extreme precipitation events in future will be a higher priority.

Next, the committee reviewed and ranked each of the identified hazards using the hazard vulnerability assessment tool. The results are as follows:

- 3 hazards rated as having a High overall risk in Madbury: Flooding (Riverine/Extreme Rain Event), Winter Storms, and Severe Thunderstorms
- 5 hazards rated as having a Moderate overall risk in Madbury: Extreme Temperatures, Hurricanes and Tropical Storms, Tornado/Microburst, Earthquake and Landslides, and Public Health Threats
- 5 hazards rated as having a Low overall risk in Madbury: Drought, Flooding (Dam Failure), Wildfire, Hazardous Material Threat, Coastal Flooding (Storm Surge and Sea-Level Rise)

The planning committee did not get the opportunity to review Table 21 and will be added to the April agenda.

The next meeting was set for April 11, 2019 at 9:00AM at the Town Hall. SRPC staff indicated that materials would be sent out prior to the meeting date to give the committee adequate time to be prepared to discuss agenda items.

Meeting 3: May 9, 2019

Members present: Mark Avery (Planning Board), Eric Fiegenbaum (Administrative Assistant), Fritz Green (Board of Selectmen), Liz Durfee (Contract Planner), Justin Corrow (Building Inspector), Joe McGann (Police Chief), and Jim Davis (Assistant Fire Chief).

SRPC staff opened the meeting with reviewing old business agenda items. The first item was the meeting notes from the April 11th meeting; there were no comments or revisions. Next, SRPC staff briefly went over the outstanding action items and asked that responsible parties follow up over the next several weeks. Lastly, the committee had the opportunity to review the past mitigation strategies table that was completed at the first meeting.

Next, SRPC and the committee brainstormed a series of new mitigation actions for the town to consider over the next Five-year cycle. The committee did not have an opportunity to organize or prioritize the actions into the implementation table using the STAPLEE method; however, this will be accomplished at the next meeting.

The last meeting to finalize the committee's future actions and to review maps was set for June 6, 2019 at 9AM at the Town Hall. SRPC staff indicated that materials would be sent out prior to the meeting date to give the committee adequate time to be prepared to discuss agenda items. A member of HSEM will be invited to participate in the meeting and to answer any questions.

Meeting 4: June 6, 2019

Members present: Mark Avery (Planning Board), Eric Fiegenbaum (Administrative Assistant), Fritz Green (Board of Selectmen), Justin Corrow (Building Inspector), and Kayla Henderson (Hazard Mitigation Planner, HSEM)

SRPC staff opened the meeting with reviewing old business agenda items. The first item was the meeting notes from the May 9th meeting; there were no comments or revisions. Next, SRPC staff briefly went over the outstanding action items and asked that responsible parties follow up over the next several weeks. Lastly, SRPC reviewed the existing mitigation strategies table, which was filled out at the prior meeting, and asked for any comments or corrections.

The remainder of the meeting was spent on reviewing the actions and implementation tables, as well as the critical facilities and key resources maps.

Before the meeting ended, the planning committee had the opportunity to ask questions or get clarification on any existing issues from the HSEM representative.

SRPC will finalize the plan for conditional approval and submit the plan to HSEM in the next week or two.

Public Involvement

Public involvement is an important part of the planning process. A local Multi-Hazard Mitigation Planning Committee (the Committee) was formed to guide and oversee the development of this Plan. Members of the Select Board, Conservation Commission, Planning Department; Police, Fire, and Highway Departments; and local business owners, interested organizations, and Madbury residents were invited to participate. Community officials were encouraged to contact as many people as they could to participate in the planning process. Members of the public and other stakeholders from neighboring communities were also informed of and encouraged to attend the Committee's meetings.

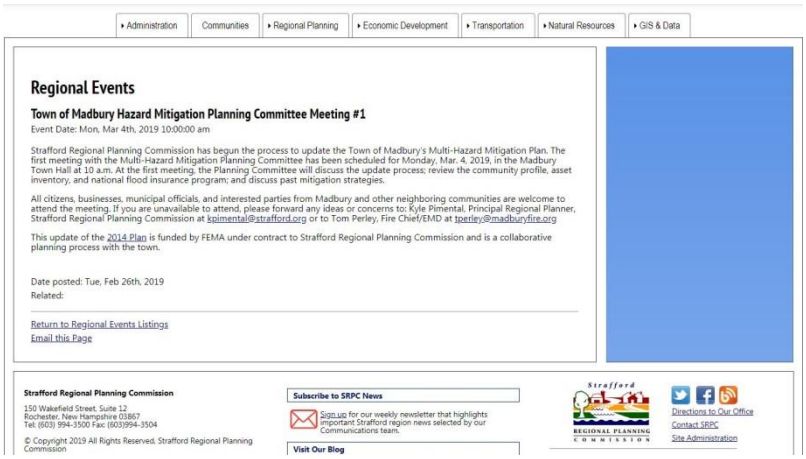
Public Notices for the Town of Madbury, NH.
13 Town Hall Rd, Madbury, NH 03823
Tel: 603 742-5131 • Fax: 603 742-2502

Public Announcement
Town of Madbury Hazard Mitigation Planning Committee
Strafford Regional Planning Commission has begun the process to update the **Town of Madbury's Multi-Hazard Mitigation Plan**. The first meeting with the Multi-Hazard Mitigation Planning Committee has been scheduled for **Monday, March 4th, 2019 in the Madbury Town Hall at 10am**. At the first meeting, the Planning Committee will discuss the update process; review the community profile, asset inventory, and national flood insurance program; and discuss past mitigation strategies.

All citizens, businesses, municipal officials, and interested parties from Madbury and other neighboring communities are welcome to attend the meeting. If you are unavailable to attend, please forward any ideas or concerns to: Kyle Pimental, Principal Regional Planner, Strafford Regional Planning Commission at kpimental@strafford.org or to Tom Perley, Fire Chief/EMD at tperley@madburyfire.org

This update of the 2014 Plan is funded by FEMA under contract to Strafford Regional Planning Commission and is a collaborative planning process with the town.

Posted 2/26/2019



To build awareness of the Plan and opportunity to be involved, an announcement about the Plan update was included on the Strafford Regional Planning Commission's website and information about the Plan was included in SRPC's news updates in order to ensure that adjacent communities were aware of Madbury's committee meetings and had the opportunity to attend. A public notice, stressing the public nature of the process, was posted on the Town's website and notices were hung at the municipal offices in advance of each meeting. The Committee met four times between March 22, 2019 and June 6, 2019. All feedback from participants of the planning committee was incorporated into the Plan. There was no participation from surrounding communities.

The public will have the opportunity for future involvement as the Plan will be periodically reviewed and the public will be invited to participate in all future reviews and updates to this plan. There will also be a public meeting before each formal review and before any change/update is sent to HSEM.

Once final approval by HSEM has been received, copies of the Plan will be distributed to the relevant Town Departments and personnel, HSEM, and FEMA and other state and local governmental entities; the Plan will then be distributed by these entities per requirements. Copies of the Plan will remain on file at the Strafford Regional Planning Commission (SRPC) in both digital and paper format.

Adoption and Integration

Once approved by the Planning Committee, the Plan will be forwarded to HSEM for Conditional Approval. Upon review and conditional approval by HSEM, the Select Board will a meeting to review the revised Plan, and will hold a public meeting to consider public comments and must promulgate a signed Resolution to Adopt the Plan.

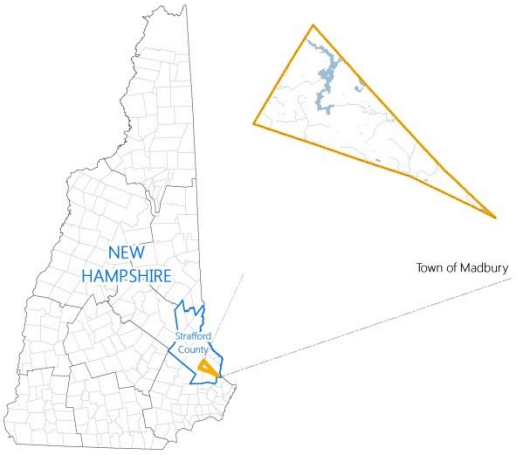
Elements of the Plan will be incorporated into other planning processes and documents, such as the Town's Master Plan, Capital Improvement Plan, and Emergency Operations Plan. The Town will refer to this Multi-Hazard Mitigation, as appropriate, in other documents.

Mother's Day Flooding – Madbury, NH

Chapter 2: Community Profile

Overview

The Town of Madbury is located in southeastern NH within Strafford County. The towns bordering Madbury are: Dover to the north, Durham and Lee to the south, Newington to the east, and Barrington to the west. With a population of 1,906 (according to the 2013-2017 American Community Survey 5-year population estimates), Madbury has experienced roughly a 20.8% increase in total population since 2000 (1,509). This population increase is significantly higher than the regional demographic trend of Strafford County, which experienced a 10.9% increase between 2000 and 2010 and represents one of the fastest growing areas in the state of New Hampshire.



Map 1: Madbury Locus Map (Source: SRPC, 2019)

The Town of Madbury covers a total area of 12.2 square miles (7,799.1 acres), with a land area of 11.6 square miles (7,400.4 acres) and a water area of 0.6 square miles (398.7 acres). Madbury's surface water flows through three watersheds: the Bellamy River Watershed in the northwestern portion of town, the Oyster River Watershed in the southeastern portion of town, and the Little Bay Watershed of the Great Bay Estuary. The Bellamy and Oyster are the primary river systems; smaller tributaries include Beard Creek, Johnson Creek, Dube Brook, and Gerrish Brook. Madbury's topography is generally flat with few areas of high relief, except for Hicks Hill; a glacial "drumlin" at 331 feet above sea level it is the highest point in town[1].

According to the town's master plan, Madbury is home to large undeveloped areas that provide valuable wildlife habitat and protect the regionally significant water resources in town. There are forest areas and a few remaining large tracts of agricultural land, including a handful of operating farms and stables, that preserve the rural character of the town. The University of New Hampshire (UNH) owned Kingman Farm is both a major component of the town's rural appearance and a significant recreational resource for the area.

The region currently enjoys relative economic prosperity and a reputation for high quality of life including educational, cultural, economic and recreational opportunities. Recent development has been mostly detached single-family residences for middle and upper middle class income households. Homebuyers appear to be attracted by the same rural character of the town that is gradually eroded by the development these buyers encourage

Commercial activity is quite limited, occurring mainly on the state roads through town. Despite the relatively high speeds used on these roads, they retain their rural appearance with minimal development in Madbury. Several homes located along these routes have witnessed the encroachment of traffic as these roadways have been widened over the years.

[1] Town of Madbury, New Hampshire Master Plan: Towards the Year 2010

As these areas become less desirable for residential use, their conversion to business or professional offices becomes more attractive.

Industrial facilities are limited. One plot near the Bellamy River, accessed from a Dover industrial park, is unused. A metal recycling business occupies an old gravel pit threatening an important aquifer. A gravel mine near Barbadoes Pond has expanded its long history of operation with the introduction of hydro-mining.

Housing

In the period between 2013 and 2017, Madbury experienced an overall decrease of 61 total housing units (roughly 9.2%). Madbury experienced the lowest number of total housing units in 2015, and the highest in 2013. According to housing tenure data for that same 5-year time period, the total renter-occupied unit counts significantly decreased by 71.1% while owner-occupied housing units stayed relatively the same. During this time period, the vacant housing units decreased slightly by 6.7% and total occupied housing units decreased of 9.3%. As of 2017, Madbury's occupied housing units are roughly 80.1% owner-occupied and 12.5% renter occupied. Vacant housing units have fluctuated slightly over the past five years; however, 2017 vacancy match those in 2013. As of 2017, the Town exhibits a 6.8% vacancy rate; this rate does not take into consideration Madbury's limited seasonal homes. The 2010 Census estimates (not shown) that 2 homes in the Town are for seasonal, recreational, or occasional use. Unfortunately, these estimates are not available for other years, but if these numbers are substituted in 2017, a slightly more accurate vacancy rate would be 6.5%.

Table 1: Housing Data 2013 - 2017

	2013	2014	2015	2016	2017	% Change 2013-2017
Total Housing Units	727	707	652	678	666	-9.2%
Occupied Housing Units	679	655	626	635	621	-9.3%
Owner Occupied Housing Units	537	517	510	525	538	0.2%
Renter Occupied Housing Units	142	138	116	110	83	-71.1%
Vacant Housing Units	48	52	26	43	45	-6.7%

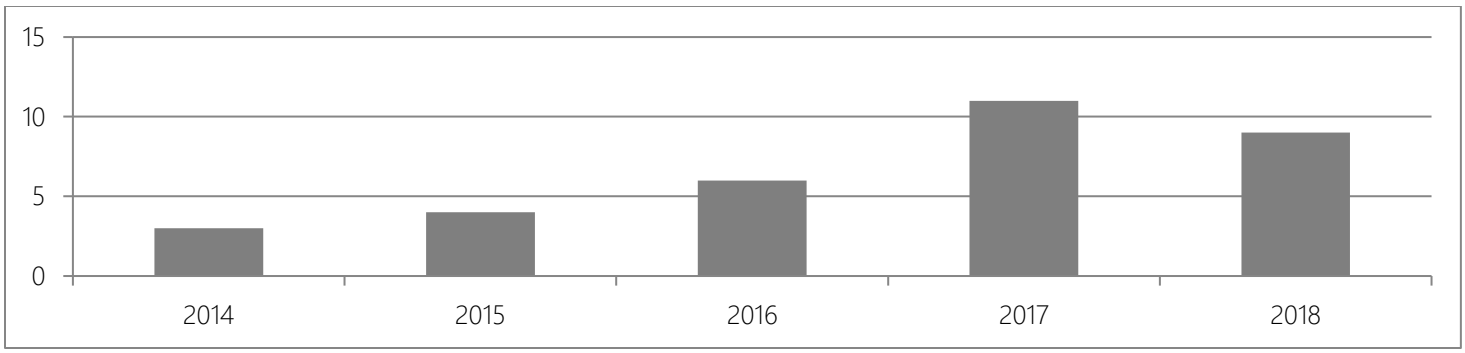
Source: U.S. Census Bureau, American Community Survey 5-Year Estimates

More localized total housing data from the town may shows slight discrepancies for years 2013-2017. It is also important to note that the census data has a margin of error associated with it that indicates there may not be as significant losses over the last five years.

Building Permit Data

According to the data that was received from the Town, a total of 27 new building permits have been issued from 2014 through 2018. Madbury experienced an average of roughly 5.5 new structures (mostly single-unit residential, with one commercial building, and one multi-family structure) between 2014 and 2018. Figure 1 (below) shows that Madbury has experienced some growth since 2014; the largest number of permits was received in 2018 (9 permits). This data represents the best available information at the time of the preparation of the Plan; however, it should be noted that the issuance of a building permit does not always directly correlate with new development.

Figure 1: New Building Permits 2014 - 2018



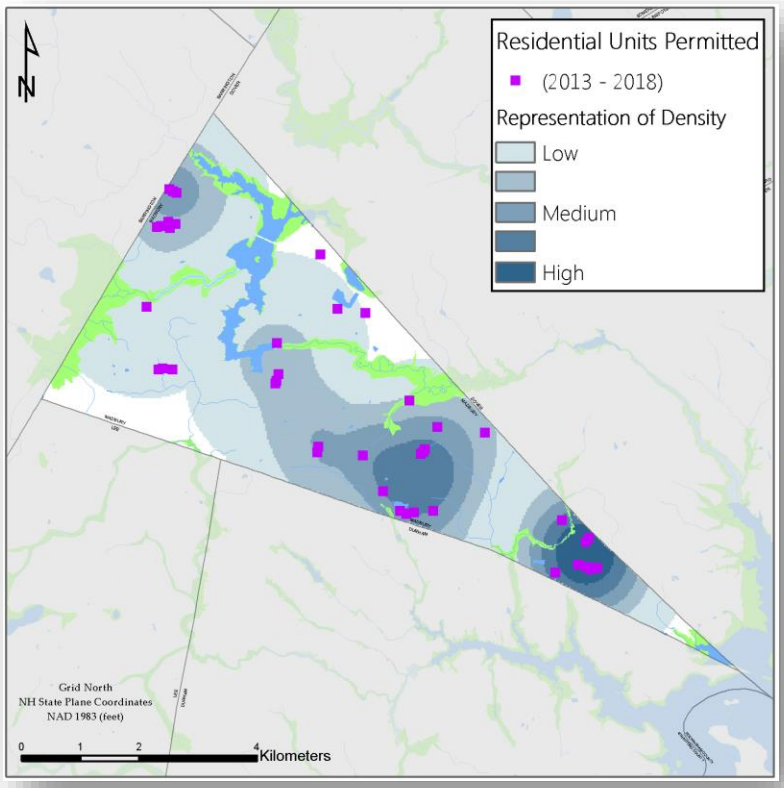
Source: Madbury's Building Inspector

Development Trends

A GIS density analysis was completed using building permit data collected from 2013 – 2018 in order to identify and map clusters of development.

The results indicate that Madbury has experienced very little growth. The predominant development type over the last several years has been residential and has been clustered into: Long Hill Circle and Hayes Road. Other development has been largely scattered throughout the Town along existing roadways.

As mentioned above, the issuance of a building permit does not always directly correlate with new development and these maps should be used for general planning purposes only.



Map 2: Development Density Map (Source: SRPC/Madbury, 2019)

By looking at these past development trends the Town recognizes that it will continue to grow slowly in the coming years. The planning board will continue to monitor land use regulations, as needed, for all subdivision and site plan proposals in order to reduce or eliminate flood damage.

Development within the FEMA Floodplain

According to a simple GIS analysis, of all the building permits issued over the course of the last five years (2013 – 2017), there were zero homes identified to be within the FEMA floodplain; however, there was one commercial property that was near the floodplain. The result of that analysis is shown on Map 3. It is important to note building permit data does not always correlate directly with new construction; permits may refer to renovations or additions to existing structures.

Over the last five years, there was only one commercial building permit issued near the FEMA floodplain. It is unclear as to the exact location of that structure; however, the committee was confident that it was not vulnerable to flooding. The location of that building permit is identified in more detail in Table 2 below and can be viewed on Map 3.

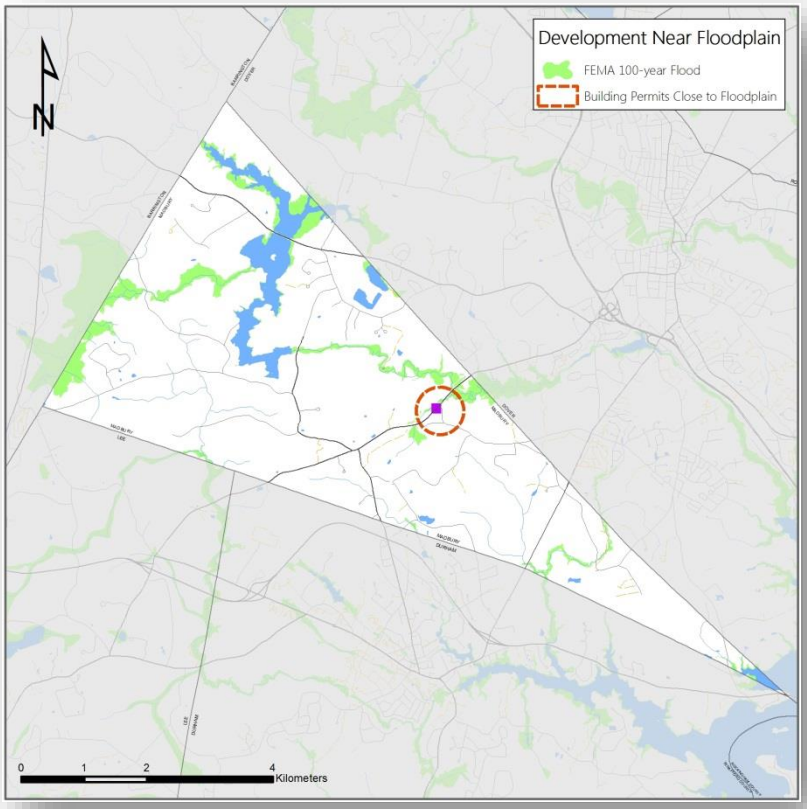
Table 2: Building Permits Near Floodplain

Location	Year	Type
306 Knox Marsh Road	2015	COM

[Source: Town of Madbury, 2019]

As shown on Map 3, over the course of the last five years, Madbury has successfully steered almost all new developments away from existing and potential flooding dangers; therefore, the community's vulnerability has been reduced. However, as more extreme precipitation events are projected to occur throughout the region, Madbury will need to continue to proactively plan for future flooding scenarios in town.

Madbury's current regulations are some of the most stringent in the region, and prohibit new habitat buildings or other structures within the floodplain except by Special Exception.

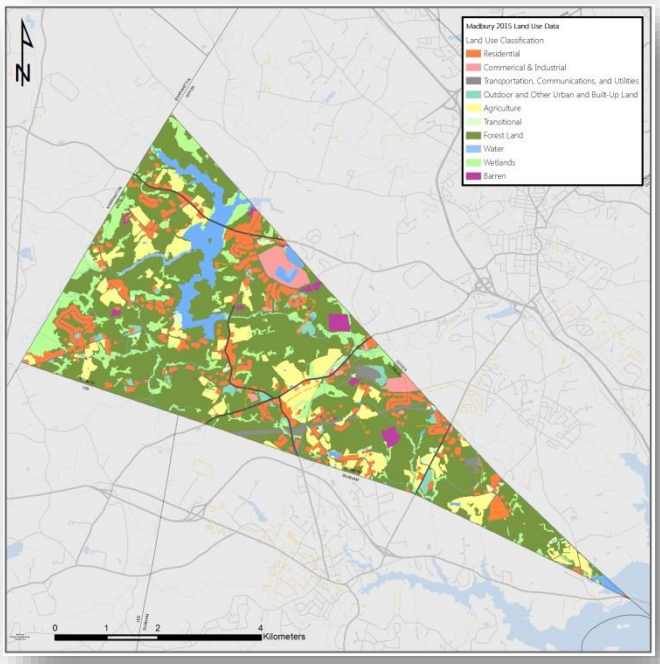


Map 3: Building Permits Near the FEMA Floodplain (Source: SRPC/OSI, 2018)

Looking ahead, the Town will use this plan as a guide to determine where past hazards have been documented and try to steer potential development away from these hazard areas.

Land Use Changes

It is much easier to identify and analyze regional land use trends, compared to strictly looking at land use conversion changes at the local level; however, this data remains an important component of long-term planning efforts. As previously mentioned, Madbury has experienced small population increases over the course of the last decade. This has resulted in an increase in the amount of land converted to residential use over the span of the last fifteen years. See Table 3 for a more detailed analysis of land use changes of time.



Map 4: 2015 Land Use Data (Source, GRANIT, 2019)

According to the 2015 regional land use layer, roughly 17.8% (1,385.7 acres) of Madbury's total acreage is currently classified as developed, with residential (11.3%) as the predominate land use type. Development is scattered throughout the Town along existing transportation corridors, including Hayes Road and Madbury Road as well as Routes 9, 155, and 108. Madbury did not experience any substantial increase in residential land use conversion in the last five years (>1%). Nor did the Town see any major changes in commercial and industrial uses, agriculture, or wetlands. The Town experienced roughly a 1.2% loss of forest land due to land conversion.

Over the past several years, Madbury has been working on completing an update to their Master Plan, which was last adopted by the Planning Board in 2003. The town should ensure that the revised plan provides direction to establish and update the town regulations and ordinances that meet the desired vision of Madbury's future.

Table 3: Land Use Data 2010 - 2015

Land Use Classification	Acres (2010)	% of total acreage	Acres (2015)	% of total acreage	5-year (+/-) % change
Residential	840.2	10.8%	881.5	11.3%	0.5%
Commercial & Industrial	180.6	2.3%	160.3	2.1%	-0.2%
Agriculture	887.40	11.4%	879.1	11.3%	-0.1%
Forest Land	4,262.30	54.7%	4,175.1	53.5%	-1.2%
Wetlands	843.70	10.8%	821.0	10.5%	-0.3%
TOTAL	**7,799.10**	**89.9%**	**7,799.10**	**88.7%**	N/A

This analysis does not include: transportation, communications, and utilities; outdoor recreation; maintained open space; vacant land; brush or transitional land; open water; and disturbed lands, which together make up the remaining 11-12%.

Chapter 3: Asset Inventory

Critical Facilities and Key Resources

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

FEMA describes the term 'critical facilities' as all manmade structures or other improvements that, because of their function, size, service area, or uniqueness, have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if they are destroyed, damaged, or if their functionality is impaired.[2] These facilities include all public and private facilities that a community considers essential for the delivery of vital services for the protection of the community, such as emergency operations centers, shelters, or utilities. [3]

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

-FEMA Critical Facility Design Considerations

Tables include a list of CF/KR, including the type of facility and building, and the address of the CF/KR, if available. Appendix D contains a correlating map set. Facilities in bold are located in other communities and are not mapped.

Table 4: Emergency Response Facilities (ERF)

ERF's are primary facilities and resources that may be needed during an emergency response

Facility	Type	Address
Town Hall (Municipal Office)	Administrative Office & Communication	13 Town Hall Road
Fire & Rescue Station	Emergency Operations Center	334 Knox Marsh Road
Police Station	Emergency Operations Center	334 Knox Marsh Road
*UNH Maintenance Shed	Emergency Fuel	Route 155A (*Durham*)
**NHDOT Shed	Emergency Fuel	Route 9 at Weeks Crossing (*Dover*)
NHDOT Shed	Emergency Fuel	Old Hedding Road (*Epping*)
Oyster River High School	Primary Regional Shelter	55 Coe Drive (*Durham*)
Moharimet Elementary School	Backup Shelter	11 Lee Road
Helipad Location(s)	Emergency Medical Evacuation	33 Mill Hill Road Tibbett's Field Route 4 Weigh Station ((*Durham*)

* There is not a generator at this station; ** Generator is only in use during the daytime

Table 5: Non-Emergency Response Facilities (NERF)

NERF's are facilities considered essential, that although critical, not necessary for the immediate emergency response effort.

Facility	Type	Address
Water Treatment Plant	Water Plant	60 Freshet Road
Pump House for Bellamy Reservoir	Pump House	Mill Hill Road
Pudding Hill Transfer Station	Transfer Station	Pudding Hill Road
Mast Road Sand and Gravel	Potential Resource	Mast Road
Dow Properties Sand and Gravel	Potential Resource	Pudding Hill Road

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

Madbury Sand and Gravel (PIKE)	Potential Resource	174 Littleworth Road

Table 6: Critical Infrastructure (CI)

CI are important structures that may be vulnerable during a hazardous event		
Facility	**Type**	**Address**
Amtrak Downeaster	Transportation	Transportation Center (*Dover/Durham*)
Cell Tower	Communication Function	Jenkins Road Beech Hill Road
Distribution Substation	Power Substation	Miles Lane
Transmission Lines	Power Utility	Route 125 to Route 108 (East/West)
Bellamy Reservoir Dam	High Hazard	Bellamy River
A High Hazard dam 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.		
Madbury #056/072	Transportation (Town Owned)	Nute Road over Bellamy River
Madbury #071/100	Transportation (State)	NH9 over Mallego Brook
Madbury #088/084	Transportation (State)	Mill Hill Road over Bellamy River
Madbury #115/085	Transportation (State)	NH155 over PAR
Madbury #120/096	Transportation (State)	NH155 over Bellamy River
Madbury #160/086	Transportation (Town Owned)	Freshet Road over Johnson Creek
Bridges have been identified by the NHDOT Bridge Design Bureau; Dams have been identified by the NHDES, Water Division		

Note: According to NHDOT, there are two REDLIST bridges in the City of Dover, and one in Rollinsford along the municipal boundary

Table 7: Vulnerable Populations to Protect (VPP)

Vulnerable populations can be defined broadly to include those who are not able to access and use the standard resources offered in disaster preparedness and planning, response, and recovery		
Facility	**Type**	**Address**
Moharimet Elementary School	School	11 Lee Road
Little Tree Education	School (Children)	314 Durham Road
Growing Places/Our Time	After School Program	11 Lee Road
Manufactured Home Park	Manufactured Housing Park	Bunker Lane/Jenkins Road
Madbury Woods Apartments	Student Housing	10 Lee Road
Old Stage Campground	Campground	46 Old Stage Road
Carriage Hill Assisted Living	Assisted Living	306 Knox Marsh Road
Barn at Powder Major's Farm	Large Gatherings	6 Cherry Lane

Table 8: Water Resources

Sources of water that may be of potential use during emergencies.

Facility	Type	Address
Dry Hydrants	Auxiliary Fire Aid	Moharimet Drive Perkins Road Raynes Farm Road
Gravity Main Hydrants	Auxiliary Fire Aid	Kelley Road Evans Road
Pressured Hydrant	Auxiliary Fire Aid	Freshet Road Mast Road
Cisterns	Auxiliary Fire Aid	Moharimet Elementary School (30K) Long Hill Circle (30K) Hoyt Pond Road (15K) Champernowne (15K)
Drinking Water Wells	Wells	Freshet Road (Portsmouth) Pudding Hill Road (Dover – not online) Barbadoes Pond (Dover)

Chapter 4: Vulnerable Structures and Potential Loss

Critical Facilities/Key Resources and Other Assets

It is important to identify critical facilities and other structures that are most likely to be damaged by hazards. A GIS-based analysis was completed to determine, spatially, which critical facilities and key resources (CF/KR) within the Town intersected with the FEMA floodplain, and identified past and potential flooding areas from previous updates. Table 9 lists the 11 CF/KRs located within those areas with a potential loss value estimate of $3,499,290 at 100%.

Table 9: Vulnerable Critical Facilities/Key Resources

CF/KR and Other Assets	Hazard	100% of Structure Value
Non-Emergency Response Facilities		
Madbury Sand and Gravel (PIKE)	Past Flooding	$1,304590 (land and building)
Critical Infrastructure		
Dams		
Bellamy Reservoir Dam	FEMA Floodplain & Dam Breach	The Dam Bureau at NHDES has investigated assessing values for state-owned dams with marginal success. They considered bond ratings, market value, and construction costs. They also developed a formula that calculated the cubic feet of water impounded as a monetary value. Because dams serve different purposes (recreational, hydropower), assessed values are hard to estimate and cannot be determined.
Bridges		
Nute Road over Bellamy River	Past Flooding	$180,000 (15 x 12 x $1,000)
NH9 over Mallego Brook	Past Flooding	$648,000 (54 x 12 x $1,000)
Mill Hill Road over Bellamy River	Dam Breach	$144,000 (12 x 12 x $1,000)
NH155 over Bellamy River	FEMA Floodplain & Past Flooding	$960,000 (80 x 12 x $1,000)
Freshet Road over Johnson Creek	Past Flooding	$168,000 (14 x 12 x $1,000)
Vulnerable Populations to Protect		
Old Stage Campground	Past Flooding	$94,700 (land only)
Water Resources		
Gravity Main Hydrant (Evans Road)	Past Flooding	N/A
Dry Hydrant (Moharimet Drive)	Past Flooding	N/A
Pressure Hydrant (Freshet Road)	Past Flooding	N/A
	Total	**$3,499,290**

Note: The approximate assessed value for the bridges was calculated by multiplying $1,000.00 per square foot of bridge. This estimate was provided by the Bridge Design Bureau at NHDOT and includes all cost (engineering, consulting and in-house design, construction, etc.) to build a new bridge.

The GIS analysis completed by Strafford Regional Planning Commission showed that there were no emergency response facilities that fell within the FEMA floodplain or any past identified flooding areas. The only non-emergency response facility was Madbury Sand and Gravel, which was identified as a location that has experienced areas of flooding. This piece of property is large, and the past flooding could have been centralized in only certain areas. There is no data stating that the building or the remainder of the site would be impacted. The data did reflect significant impacts to the town's transportation infrastructure, specifically bridges – both town and state owned. It should be noted that due to limitations with the mapping data, it was impossible to determine what the extent of the damage would be at each location; however, it is safe to say that these areas are likely vulnerable to flooding under a variety of scenarios.

The only vulnerable population is located at the Old Stage Campground, which has experienced past flooding over the years. Other infrastructure includes one gravity main hydrant, dry hydrant, and pressurized hydrant that serve as fire aids. Fire aids are intentionally located near waterbodies to allow fire trucks to draft water during an emergency; therefore, they will inherently be vulnerable to flooding issues and do not raise big concerns for the town.

Buildings and Utilities

It is difficult to ascertain the amount of damage that could be caused by a natural or man-made hazard because the damage will depend on the hazard's extent and severity, making each hazard event somewhat unique. The assumption used here when calculating the damage to property is equal to: 0-1%, 1-5%, or 5-10% of Madbury's structures, depending on the nature of the hazard, whether or not the hazard is localized, and its economic impact.

The total local assessed value included in this analysis is **$151,927,716** including **$136,408,316** for buildings and **$15,519,400** for utilities. Based on this assumption, the potential loss from any of the identified hazards under a low, medium, and high damage scenario of buildings and utilities would range from **$0 to $1,519,277 (low)** or **$1,519,277 to $7,596,386 (medium)** or **$7,596,386 to $15,192,772 (high)** based on the 2017 Madbury Town valuation. Table 10 provides more detail on these estimated economic losses.

Table 10: Economic Loss Data

Local Assessed Valuation				
	Total Assessed Value (2017)	Economic Loss		
		Low 1% Damage	Medium 5% Damage	High 10% Damage
Buildings				
Residential	$127,648,216	$1,276,482	$6,382,411	$12,764,822
Manufactured Housing	$2,996,400	$29,964	$149,820	$299,640
Commercial Industrial	$5,763,700	$57,637	$288,185	$576,370
Total Buildings	**$136,408,316**	**$1,364,083**	**$6,820,416**	**$13,640,832**
Utilities				
Public Water	-	-	-	-
Gas	$263,800	$2,638	$13,190	$26,380
Electric	$15,255,600	$152,556	$762,780	$1,525,560
Total Utilities	**$15,519,400**	$155,194	$775,970	$1,551,940
Net Valuation Building and Utilities	**$151,927,716**	**$1,519,277**	**$7,596,386**	**$15,192,772**

Source: NH Department of Revenue Administration. 2017 Annual Report. Assessed value does not include value of land or local exemptions. (https://www.revenue.nh.gov/mun-prop/property/equalization-2017/documents/tbc-alpha.pdf)

Human loss of life was not included in the potential loss estimates, but could be expected to occur, depending on the severity and type of the hazard.

Chapter 5: National Flood Insurance Program (NFIP)

The Office of Strategic Initiatives, (OSI) administers the National Flood Insurance Program (NFIP) in New Hampshire. The NFIP is a partnership between a community and the federal government. Communities participate by agreeing to adopt and enforce a floodplain management ordinance designed to reduce future flood risks and in return all residents in those participating communities (whether in floodplain or not) can purchase flood insurance. Currently 217 communities (92 percent) that participate in the NFIP have adopted at least the minimum standards of the NFIP.

Through FEMA's Community Assistance Program, OSI provides technical assistance to communities and the public on floodplain management and helps to promote sound land use planning techniques that will reduce flood losses. OSI conducts Community Assistance Visits to ensure that communities participating in the NFIP are meeting program goals.

Madbury's National Flood Insurance Program Status

According to FEMA's Community Status Book Report, Madbury has been a member of the National Flood Insurance Program (NFIP) since March 4, 2010. The Town does have portions of land in the 100-year floodplain along the Bellamy River; the northern part of the Bellamy Reservoir (there is a large inundation hazard area south of the dam on the reservoir); a small section along the Oyster River; and along Johnson Creek.

Article XXI of the Town's Land Use Regulations (as revised March 2017) outlines the Town's floodplain development performance standards and ensures that all development within the floodplain conform to the Town's floodplain development ordinance. Madbury recognizes the need to minimize the potential loss of life and property during periods of flooding and prohibits new habitable buildings or other structures in the special flood hazard identified by FEMA. The Town's floodplain development ordinance shall apply to all lands designated as areas of special flood hazard by FEMA in its "Flood Insurance Study for the County of Strafford, N.H." dated September 30, 2015.

According to information from the FEMA Community Overview (as of 10/4/2018), provided by NH OSI Principal Planner Samara Ebinger, Madbury has zero total policies in the floodplain hazard area. There has been zero paid loss with zero repetitive loss[4] claims.

Table 11: Madbury's Insurance Zone Policies

Zone	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Loses	Amount of closed Paid Loses
AE Zones	0	$0	$0	0	$0
A Zones	0	$0	$0	0	$0
TOTAL	**0**	**$0**	**$0**	**0**	**$0**

In order to remain NFIP compliant, Madbury has implemented a number of actions, including:

[4] Repetitive losses are defined as residential property that is covered under an NFIP flood insurance policy and that has had at least four NFIP claim payments over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; as well as at least two separate claims payments that have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building. At least two of the claims must have occurred within any ten-year period, and must be greater than 10 days apart.

∴ In 2010, a FEMA Community Assistance Visit (CAV) was completed. The results did not find any major problems with the existing floodplain management regulations or any other problems in the community's floodplain management program. It should be noted that this CAV was completed nearly nine years ago, and the town should work with FEMA to schedule another visit in the near future.

∴ The Town's Flood Hazard Area Overlay District enforces regulations that exceed the NFIP minimum requirements by prohibiting new habitable buildings or other structures in special flood hazard areas.

∴ In 2015, the town adopted new floodplain maps delineated as part of the Coastal NH Floodplain Mapping Update to include all lands designated as special flood hazard areas by the Federal Emergency Management Agency (FEMA) in its "Flood Insurance Study for the County of Strafford, NH" dated September 30, 2015, are declared to be part of the Madbury Zoning Ordinance and are hereby incorporated by reference.

∴ In 2017, the town partnered with the SRPC to plan, design, publicize, and implement a public outreach workshop to discuss concerns and actions related to extreme precipitation and flooding, drought and water supply, and emergency preparedness. A follow-up meeting to the fall workshop focused on discussing concerns and actions that the town could take to help reduce its vulnerabilities. Topics discussed at the follow-up meeting included which actions should be included in the town's annual report and how the water board could incentivize water quality testing. The planning team also discussed drafting an emergency preparedness/contact list that could be distributed on a refrigerator magnet or other type of giveaway for town residents. The results of the meeting were forwarded to the town's new contract planner in order to take advantage of potential opportunities to integrate the concerns, needs, and action ideas raised by the workshop participants into the town's master plan.

∴ In 2017, Madbury was one of ten communities to complete a vulnerability assessment report as part of the Climate Risk in the Seacoast (C-RiSe) project. Using the latest sea-level rise projections, this report identified key assets and resources that may be affected from flooding by one or more of the sea-level rise and/or coastal storm surge scenarios. Assets included, but are not limited to: state and municipal infrastructure, municipal facilities, transportation routes and roadways, and natural resources. As part of this vulnerability assessment, UNH researchers conducted a detailed analysis of culvert flow capacity, function, and fish passage based on current and projected increases in precipitation.

∴ The town has completed various infrastructure improvements. The following is a summarize list of other improvement projects the town has completed over the past plan cycle:

- A culvert replacement on Cherry Lane
- Thirteen culvert replacements on Hayes Road prior to upcoming paving in 2020-2022
- Repair of the Portsmouth drinking water line on the Hayes easement

Chapter 6: Hazards & Mitigation Strategies

Overview

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

Rating Probability, Severity, and Overall Risk of Future Disasters

The nature of each hazard type and the quality and availability of corresponding data made the evaluation of hazard potential difficult. The Multi-Hazard Planning Committee considered what data was at hand and used its collective experience to formulate statements of impact or potential. Each hazard type was rated using a hazard vulnerability assessment tool (refer to Table 12).

This tool estimates the probability of occurrence, severity, and overall risk of an event using a projected number system answering questions, which answer High (3), Moderate (2), and Low (1). A zero (0) score meant that there is no likelihood the hazard would impact the Town in the next 25 years. The ranges established for the average to determine severity were:

- ∴ High = >3
- ∴ Moderate = 2
- ∴ Low = 1 or below

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

Probability of Occurrence

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

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

Severity

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

- ∴ High: The total population, property, commerce, infrastructure and services of the Town are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst case scenario there could be a disaster of major to catastrophic proportions. Score = 3
- ∴ Moderate: The total population, property, commerce, infrastructure and services of the Town are exposed to the effects of a hazard of moderate influence; or the total population, property, commerce, infrastructure and services of the community is exposed to the effects of a hazard, but not all to the same degree; or an important segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of moderate to major, though not catastrophic, proportions. Score = 2
- ∴ Low: A limited area or segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of minor to moderate proportions. Score = 1

Overall Risk

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

- ∴ High: There is a great risk of this hazard in Madbury. Score = 5 or greater
- ∴ Moderate: There is moderate risk of this hazard in Madbury. Score = 3-4
- ∴ Low: There is little risk of this hazard in Madbury. Score = 0-3

Hazards Ratings in Madbury, NH

The Committee determined that the hazards are distributed as follows:

- ∴ 3 hazards rated as having a High overall risk in Madbury: Flooding (Riverine/Extreme Rain Event), Winter Storms, and Severe Thunderstorms
- ∴ 5 hazards rated as having a Moderate overall risk in Madbury: Extreme Temperatures, Hurricanes and Tropical Storms, Tornado/Microburst, Earthquake and Landslides, and Public Health Threats
- ∴ 5 hazards rated as having a Low overall risk in Madbury: Drought, Flooding (Dam Failure), Wildfire, Hazardous Material Threat, Coastal Flooding (Storm Surge and Sea-Level Rise)

Table 12 is the Town's vulnerability assessment tool, which provides more information on the multi-hazard threat analysis that was completed during a brainstorming session with the Planning Committee.

Hazard Vulnerability Table

Table 12: Hazard Vulnerability Assessment Tool – Town of Madbury

Impact Rankings 0 – N/a 1-Low 2-Moderate 3-High	Human Impact *Probability of death or injury*	Property Impact *Physical losses and damages*	Business Impact *Interruption of service*	Severity *Average of human, property, and business impacts*	Probability *Likelihood this will occur within 25 years*	Overall Threat *Low = 0-2* *Moderate = 3-4* *High = 5 or greater* *(Severity x probability)*
Hazard Event						
Flooding (Riverine/Extreme Rain Event)	2	2	2	2.0	3	6.0
Winter Storms	2	2	2	2.0	3	6.0
Severe Thunderstorms	2	2	2	2.0	3	6.0
Extreme Temperatures	1	2	2	1.7	2	3.3
Hurricanes and Tropical Storms	3	3	3	3.0	1	3.0
Tornado/Microbursts	3	3	3	3.0	1	3.0
Earthquake & Landslides	3	3	3	3.0	1	3.0
Public Health Threats	2	1	1	1.3	2	2.7
Drought	1	1	1	1.0	2	2.0
Flooding (Dam Failure)	1	2	3	2.0	1	2.0
Wildfire	1	3	1	1.7	1	1.7
Hazardous Material Threat	2	1	1	1.3	1	1.3
Coastal Flooding (Storm surge and sea-level rise)	1	1	1	1.0	1	1.0

Declared Disasters and Emergency Declarations

Table 13: Presidentially Declared Disasters (DR) 1990-April 2019 impacting the Town Madbury

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
September 9, 1991	Hurricane Bob	August 18-20, 1991	FEMA 917-DR	PA	$2,293,449	Severe storm and wind; no power, trees knocked down.
October 29, 1996	Severe Storms & Flooding	Oct 20-23, 1996	FEMA 1144-DR	PA	$2,341,273	Heavy rains. Severe storm, flooding.
January 15, 1998	Ice Storm	January 7-35, 1998	FEMA 1199-DR	PA/IA	$12,446,202	Major tree damage, electric power interrupted for a number of days. Schools were closed.
May 25, 2006	Severe Storm & Flooding	May 12-23, 2006	FEMA 1643-DR	PA/IA	$17,691,586	Severe storm causing massive flooding, road closures, dams breaching and evacuations
April 27, 2007	Severe Storm & Flooding	April 15-23, 2007	FEMA 1695-DR	PA/IA	$26,826,780	Severe storm causing flooding along Dube Brook and Beards Brook. Culvert and road washouts.
August 11, 2008	Severe Storms, Tornado, & Flooding	July 24, 2008	FEMA 1782-DR	PA	$3,673,097	No significant damage or major impacts.
January 2, 2009	Severe Winter Storm	December 11-23, 2008	FEMA 1812-DR	DFA/PA	$14,898,663	Winter Storm, snow removal. Some people without power for a week.
March 29, 2010	Severe Winter Storm	February 23-March 3, 2010	FEMA 1892-DR	PA	$6,841,093	Loss of power. No major damage. Trees down. School vacation, so no closures.
September 3, 2011	Tropical Storm Irene	August 26 – Sept 6, 2011	FEMA 4026-DR	PA	$17,684,244	Rain, heavy at times. No major damage. No flooding. Few small trees down.

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
March 19, 2013	Severe Snow and Blizzard	February 9-11, 2013	FEMA 4105-DR	PA	$6,153,471	Known as blizzard "NEMO:" brought heavy snow. No major damage. Loss of power in some locations in Town.
August 2, 2013	Severe Storms, Flooding, and Landslides	June 26 – July 3, 2013	FEMA 4139-DR	ND	N/A	Strafford County was not included in the designated counties.
March 25, 2015	Severe Snow & Snowstorm	January 26-29, 2015	FEMA 4209-DR	PA	$4,939,214	Known as blizzard "JUNO" brought heavy snow. Emergency protective measures; snow removal assistance; and school closures.
June 1, 2017	Severe Winter Storm	March 14-15, 2017	FEMA 4316-DR	ND	N/A	Strafford County was not included in the designated counties.
August 9, 2017	Severe Storms and Flooding	July 1-2, 2017	FEMA 4329-DR	ND	$1,852,059.28	Strafford County was not included in the designated counties.
January 2, 2018	Severe Storms and Flooding	October 29 - Nov 1, 2017	FEMA 4355-DR	ND	$1,987,507.41	Strafford County was not included in the designated counties.
June 7, 2018	Severe Storms and Flooding	March 2-8, 2018	FEMA 4370-DR	ND	N/A	Strafford County was not included in the designated counties.
June 7, 2018	Severe Snow & Snowstorm	March 13-14, 2018	FEMA 4371-DR	PA	$820,824.38	Emergency protective measures; snow removal assistance; and school closures. Night portion of Town Meeting was postponed; however, election ballots went on as scheduled.
15 declarations totaling approximately $120,449,463						
Program Key: PA: Public Assistance, IA: Individual Assistance, DFA: Direct Federal Assistance, ND: No Designation						

Table 14: Emergency Declaration (EM) 1990-April 2019 impacting the Town of Madbury

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
March 16, 1993	Heavy Snow	March 13-17, 1993	FEMA 3101-EM	PA	$832,396	Snow removal; high winds.
March 28, 2001	Snow Emergency	March 5-7, 2001	FEMA 3166-EM	PA	$3,433,252	Snow removal
March 11, 2003	Snow Emergency	February 17-18, 2003	FEMA 3177-EM	PA	$2,288,671	Snow removal
March 30, 2005	Snow Emergency	January 22-23, 2005	FEMA 3207-EM	PA	$3,611,491	Winter storm, snow removal
December 13, 2008	Severe Winter Storm	December 11-23, 2008	FEMA 3297-EM	DFA/PA	$900,000	Winter storm, snow removal
November 1, 2011	Severe Winter Storm	October 29-30, 2011	FEMA 3344-EM	PA	Data not available	Known as the "Halloween Snowstorm." Significant amount of large oak trees came down due to the leaves still on the trees; power outages ranging from 4 to 5 days
October 30, 2012	Hurricane Sandy	October 26-31, 2012	FEMA 3360-EM	PA	$643,660	Minor impacts, including periods of heavy rain and short-term power outages.
7 emergency declarations totaling approximately $11,709,470						
Program Key: PA: Public Assistance, DFA: Direct Federal Assistance						

Flooding

Overview			
Hazard Type	Flooding		
Location/Extent	Bellamy River/Reservoir, Oyster River and Johnson Creek, and the wetlands adjacent to Dube Hill		
Vulnerability	Riverine/Extreme Rain Event	Dam Failure	
Severity	2.0	2.0	
Probability	3	1	
Overall Threat	6.0 (High)	2.0 (Low)	

Description of the Hazard

FEMA defines a flood as a general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties (at least 1 of which is the policyholder's property) from overflow of inland or tidal waters; or unusual and rapid accumulation or runoff of surface waters from any source; or mudflow; or collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood. A 100-year flood event is a flood that has a 1% chance of being equaled or exceeded in any given year.

Riverine flooding is the most common natural disaster to impact New Hampshire. Riverine flooding occurs when surface water runoff introduced into streams and rivers exceeds the capacity of the natural or constructed channels to accommodate the flow. As a result, water overflows the river banks and spills out into adjacent low lying areas.[5] Floods are most likely to occur in the spring due to the increase in rainfall and the melting of snow; however, floods can occur at any time of the year because of heavy rains, hurricane, or a Nor'easter.

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

Special Flood Hazard Areas are areas with a one percent annual chance flood hazard in a community. The one percent annual chance flood is also referred to as the base flood or 100-year flood.

[Source: Office of Strategic Initiatives (OSI)]

- ∴ 1% annual chance rainstorm event
- ∴ Severe tropical storm (hurricane or tropical storm) that can bring torrential rainfall in excess of that from a 500-year storm.

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

∴ Rapid snow pack melt in spring can be a significant potential flooding source, given the northern, relatively cold location and climate of Madbury

∴ River ice jams, could occur, although the Army Corps of Engineers Ice Jam Database contains no record of ice jams and the Committee did not encounter any record or reference to ice jamming in the town.

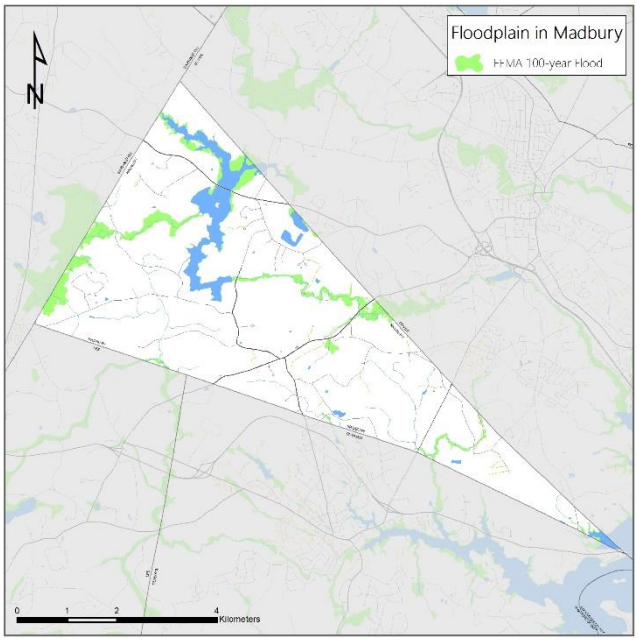
∴ Dam breach or failure.

Extent of the Hazard

Flooding can occur in any area of the Town but is more likely to occur within the 1% annual chance floodplain, downstream of dams, along river and stream banks, near wetlands and road crossings, and other low-lying areas. Madbury has approximately 10.2% (797.4 acres) of its area in the 1% annual chance floodplain (see Map 5). It should be noted that this estimation is likely overstated due to the fact that the FEMA floodplain contains open water. If the portions along the Bellamy Reservoir were removed the approximate acreage may be more accurately depicted as 5.7% (444.9 acres). Based on extent of the floodplain, the Town does have significant portions of land in the 1% annual chance floodplain along the Bellamy River/Reservoir, Oyster River and Johnson Creek, and the wetlands adjacent to Dube Hill.

Although flooding of the full extent of this floodplain by definition would require a 1% annual chance storm, smaller storms with a higher annual probability of occurrence could still flood significant portions of that floodplain. Structures that could be impacted by a 1% annual chance storm could also be affected by smaller, more frequent flooding. It is likely that the 1% annual chance floodplain will change in area when flood maps are continually updated to reflect changes in development patterns and better mapping technology and current precipitation data.

Map 5: Floodplain Areas in Madbury



Past Events and Impacts

Two consequential flooding events took place in 2006 and 2007, both of which were considered 1% annual chance events. During those events, there were several areas that experienced severe impacts, including: significant flooding along both Dube and Beards Brook. Residents living on Cherry Lane, Hayes Road, and Sarah Paul Hill were all impacted. Post storm there were several culverts and river crossings that needed repair and replacement. The Town also deals with a perpetual struggle with beavers, who manage to flood portions of the community every year. Within the last five years, there have been problems on Moharimet Drive, Madbury Road, Sarah Paul Hill, and Cherry Lane.

Dam Failure

According to the International Commission on Large Dam, dam failure can be defined as a collapse or movement of part of a dam or its foundation, so that the dam cannot retain water.

There are four dam classifications, which are differentiated by the degree of potential damages that a failure of the dam is expected to cause. The classifications are designated as non-menace, low hazard, significant hazard and high hazard. A detailed breakdown of the classifications is as follows:

Non-Menace Structure

A non-menace structure is 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

A low hazard structure is 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 interrupts public safety services.
- The release of liquid industrial, agricultural, or commercial wastes, septage, or contaminated sediment if the storage capacity is less than two-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

A significant hazard structure is 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 Structure

A high hazard structure is 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 cause 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.

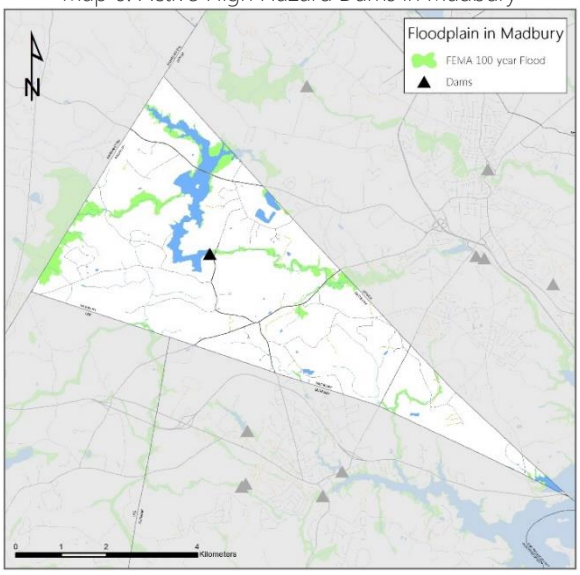
- Water levels rising above the first floor elevation of a habitable residential structure or a commercial or industrial structure, which is occupied under normal conditions when the rise due to dam failure is greater than one foot.
- Structural damage to an interstate highway, which could render the 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.

Dam failure could potentially result in flooding in Madbury. According to the NHDES 2015 database, there are a total of 10 active dams (there are an additional 13 dams that are classified as ruins, removed, breached, or exempt); however, a major of those dams are non-menacing structures. Madbury has one high hazard dam, and one low hazard dam (see Table 15).

The Bellamy Reservoir Dam is classified as a High Hazard Dam, which 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. Madbury is concerned about the Bellamy Reservoir dam and the impact on Dover, which is located downstream. The dam, however, has never breached, has been continually inspected, and is in excellent condition. At the time of this plan, the emergency action plan for the dam was being prepared by the City of Portsmouth. It is expected that Portsmouth will be reaching out to Dover and Madbury emergency response coordinators to ensure the "draft" plan is distributed appropriately. During this process, Portsmouth will be discussing spill response. The City does not have a specific spill response plan, but they do have a water system emergency response plan that is in the process of being updated. To the best of the Committee's knowledge, no other dams in town have failed over the last five years.

There is only one delineated dam inundation zone in the town is located east of the Bellamy Reservoir dam and follows the Bellamy River. If the dam were to fail, there would be limited impacts as much of the land downstream remains undeveloped; however, there is potential for several homes to be impacted on Fitch Road and Fancy Hill. It is likely the entire Old Stage Campground would need to be evacuated. Moving east towards Dover, flooding would cross the rail line and impact large stretches of Route 155. In Dover there would likely be significant impacts to areas along Crosby Road, stretches of Route 155, and portions of Bellamy Road.

Map 6: Active High Hazard Dams in Madbury



Map 7: Dam Inundation Areas in Madbury

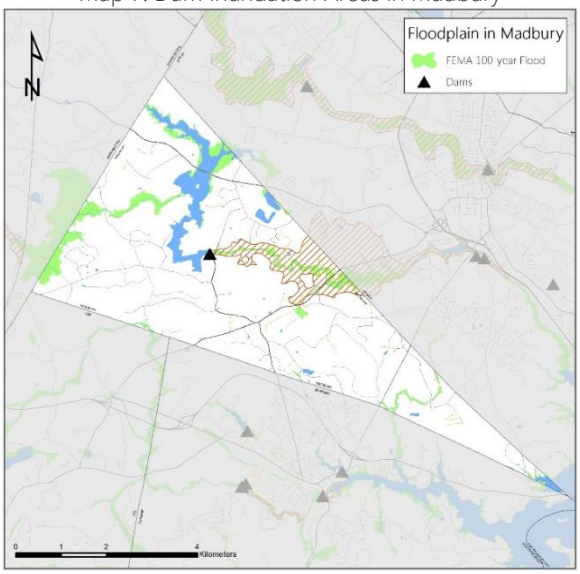


Table 15: Active Dams in Madbury

Dam Classification	Classification Definition	Number of Active Dams in Madbury	Inspection Interval (Years)
High Hazard	Dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life.	1	2
Low Hazard	Dam that has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life and low economic loss to structures/property	1	6
Non-Menace	Dam that is not a menace because it is in a location and of a size that failure of misoperation of the dam would not result in probable loss of life or loss to property.	8	6

Potential Future Impacts on the Community

According to FEMA flood maps, areas along the Bellamy River/Reservoir, Oyster River and Johnson Creek, and the wetlands adjacent to Dube Hill are all susceptible to future flooding. Several potential future threats include contamination from industrial uses in areas they may be impacted from a dam failure; erosion issues in some areas along the Bellamy; and large debris (campers, propane tanks, and trees) getting into the Bellamy during flooding events that could impact the 155 bridge or the railroad line. Overall, flooding potential in Madbury is high, and it is likely that flood conditions will continue to affect the town. Both seasonal flooding and flooding due to extreme weather events have the potential to occur during all seasons.

Estimated Potential Losses

Based on the High hazard ranking for riverine/extreme rain event and assessed value of residential, commercial, and utilities structures, there is approximately **$15,192,772** in estimated potential losses from flooding. It is important to note that this estimate is most likely overstated as there are limited structures within or within close proximity to the floodplain in Madbury. Based on the Low hazard ranking for dam failure and assessed value of residential, commercial, and utilities structures, there is approximately **$1,519,277** in estimated potential losses from flooding.

Hurricane and Tropical Storms

Overview	
Hazard Type	Hurricane and Tropical Storms
Location/Extent	Town-wide
Severity	3.0
Probability	1
Overall Threat	3.0 (Moderate)

Description of the Hazard

A hurricane is the term used for tropical cyclones that occur in the Northern Hemisphere east of the International Dateline to the Greenwich Meridian. Tropical cyclones originate over tropical or subtropical waters and are

characterized by organized deep convection and a closed surface wind circulation about a well-defined center. These events are called typhoons if they occur west of the International Dateline. Hurricane season in the Atlantic runs from June 1 to November 30.

According to the State Hazard Mitigation Plan (2018) tropical cyclones with maximum sustained winds of less than 39 mph are called tropical disturbances. Once the tropical cyclone reaches winds of at least 39 mph, they are typically called a tropical storm and assigned a formal name. If the winds reach 74 mph or greater, they are upgraded and called a hurricane. A major hurricane is considered a tropical cyclone with maximum sustained winds of >111 mph.

Extent of the Hazard

Hurricanes may impact all areas of the Town. 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.

Table 16: Saffir-Simpson Hurricane Wind Scale

Category	Sustained Winds	Types of Damage due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	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.
2	96-110 mph 83-95 kt 154-177 km/h	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.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	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.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	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.
5 (major)	157 mph or higher 137 kt or higher 252 km/h 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.

Past Impacts and Events

These severe tropical storms may occur anytime from early spring to late fall, and in general are less common than other storms, e.g. nor'easters. As wind events, historically hurricanes have caused damage in Madbury, most notably in 1938 and 1954 (Hurricane Carol).

The NOAA National Climatic Data Center's Storm Events database (NCDC 2018) does not list any Hurricanes as directly affecting Strafford County from January 1, 2008 to December 31, 2018; however, Strafford County did experience impacts from Hurricane Sandy. Hurricane Sandy was the last hurricane to hit the region during the period of October 26 to November 8, 2012. While Strafford County was not included in the public assistance or direct federal assistance declaration, Madbury did experience some damage due to heavy rain and sustained wind speeds, which needed emergency repair. The database does report one tropical storm event, which is detailed as follows:

Tropical Storm Irene (August 28, 2011) - brought a prolonged period of strong and gusty winds and heavy rain to the state. The high winds snapped or uprooted numerous trees throughout the state causing more than 160,000 customers to lose electrical and/or communication services. The heavy rains caused rivers and streams throughout the state to flood causing damage to bridges, roads, and property. The strongest winds across the state began Sunday morning in southern areas and spread northward during the day. Winds continued to be gusty overnight as the storm moved away from the area. Observed maximum wind gusts included 63 mph at Portsmouth, 52 mph at Concord, and 51 mph at Manchester. On the top of Mt. Washington, winds gusted to 104 mph as the storm approached and 120 mph as it moved away. The combination of wet soil and the prolonged period of strong and gusty winds brought down numerous trees throughout the state. One person was killed and three people were injured across the state due to falling trees or branches. Rainfall amounts across the state ranged from 1.5 to 3 inches across southeastern New Hampshire. Local impacts included rain, heavy at times, and gusts of wind that resulted in a few small trees down. There was no major damage or flooding.

Potential Future Impacts on Community

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

Madbury remains vulnerable to hurricane hazards, including high winds, heavy rainfall, and inland flooding; therefore the recurrence potential of hurricane and tropical storm hazards is moderate. Given that the 2017 Atlantic hurricane season was hyperactive, which featured 17 named storms (tying it with 1936 as the fifth-most active season since reliable records began in 1851) and three that were major hurricanes (Harvey, Irma, and Maria), it is likely that the region will be impacted by a significant storm of tropical origin within the foreseeable future. The 2018 hurricane season produced 15 (7 hurricanes and 8 tropical storms/depressions) named storms. Both hurricane Florence and Michael were category 4 storms and produced catastrophic damage in the Carolinas and the Florida Panhandle.

Estimated Loss Potential

Based on the moderate ranking and assessed value of residential, commercial, and utilities structures, there is approximately $7,596,386 in estimated potential losses from impacts associated from hurricanes and tropical storms.

Tornado & Downburst

Overview	
Hazard Type	Tornado & Downburst
Location/Extent	Town-wide – dependent upon tornado track
Severity	3.0
Probability	1
Overall Threat	3.0 (Moderate)

Description of the Hazard

A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud with winds in excess of 200 mph, often accompanied by violent lightening, peripheral high winds, severe hail, and severe rain. Tornadoes develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down they become a force of destruction.

Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. 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. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison to a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

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

Extent of the Hazard

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

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

Past Impacts and Events

Tornadoes are rare in New Hampshire. The NCDC Storm Events database (NCDC 2018) lists only seven tornadoes that have impacted Strafford County since 1950. One was an EF-0 event (65-85 mph); one was an EF1 event (73-112 mph); and five were EF2 events (111-135 mph). Over the course of the past six decades, there haven't been any fatalities, 0

injuries, but approximately $2.9 million in property damages associated with tornados. The majority of property damage was sustained during an event that took place in 1981. The most recent touchdown was in 2008.

Table 17: Tornado Data for Strafford County

Date	Magnitude	Death	Injuries	Property Damages
06/09/1953	EF1	0	0	250
05/14/1963	EF2	0	0	25,000
05/03/1976	EF2	0	0	250,000
06/22/1981	EF2	0	0	2,500,000
08/02/1993	EF0	0	0	5,000
07/06/1999	EF2	0	0	0
07/24/2008	EF2	0	0	126,000
	TOTAL	0	0	$2,906,000

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

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

In July 2008, an F2 tornado and high winds created a path of destruction through five New Hampshire counties that destroyed homes, displaced families, downed trees and forest lands and closed major state roadways. The impact to residents was extensive, with over 100 homes rendered uninhabitable. Phone and electric service was cut off to over 12,500 customers. One fatality is attributed to a building collapse, and local hospitals reported numerous physical injuries associated with this severe storm.[7] Since the July 2008 tornado, the NCDC Storm Events database reports that eleven tornados have hit New Hampshire; however, none have hit Strafford County. The most recent event occurred in June 2018 in Bath/Lincoln in Grafton County.

In June 2018 there was a severe storm event that hit part of southeastern New Hampshire. Tornado warnings were issued in Durham and Lee. A partial funnel cloud appeared in Durham, but never touched down. Tt was a localized event and Madbury experienced only rain and a few wind gusts.

[6] NOAA. U.S. Tornado Climatology (https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology)
[7] Homeland Security and Emergency Management. State Multi-Hazard Mitigation Plan Update 2018.

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

- ∴ Franklin, NH – October 30, 2012: Several large trees came down, landing on two summer homes, completely demolishing one. No injuries were reported.
- ∴ Plaistow, NH – July 18, 2016: Hundreds of trees were brought down closing numerous roads, thousands without power, significant property damage.
- ∴ Barrington, NH – July 20, 2017: In the area of Route 125, dozens of trees blown down, thousands of people without power across multiple towns, multiple roads closed.

There was a large downburst (late 1980s) that occurred near Cherry Lane and Moharimet Drive. Several condos in the Dover area along Route 155 sustained heavy damage. In July 2017, there was a significant microburst that impacted portions of French Cross Road and Moharimet Drive. This event produced several downed trees that blocked roads, took down power lines and hit homes and cars (mostly in Dover). Debris in the roads created challenges for emergency service access and mutual aid.

While tornados are not common, they would cause significant impacts in the Town. The probability of reoccurrence of a downburst may be higher. A tornado or downburst can impact the entire jurisdiction and may cause greater damage in more densely populated areas.

Potential Future Impacts on Community

There have been 7 reported tornadoes over the course of 68 years in Strafford County; the average annual probability of recurrence, therefore, is 10.3% (7/68 x 100). The probability may be slightly higher if local reports of tornadoes were considered; however, this 10.3% probability is for all of Strafford County – not just Madbury. The actual probability for Madbury should be much lower, considering the great dependence of impact upon the actual track of any tornado. The NCDC identified two tornadoes that touched down relatively close (Strafford and New Durham) to the Town, which would suggest the average annual probably of recurrence to be less than 3%. The tornado recurrence probability for Madbury, therefore, is relatively low.

Estimated Loss Potential

Based on the Moderate hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $7,596,386 in estimated potential losses from impacts associated from tornadoes and downbursts.

Severe Winter Weather

Overview	
Hazard Type	Severe Winter Weather
Location/Extent	Town-wide
Severity	2.0
Probability	3
Overall Threat	6.0 (High)

Description of the Hazard

Winter snow and ice events are common in New Hampshire. The National Climatic Data Center (NCDC 2018) Storm Events database reports 34 severe winter weather events, which include: 2 blizzards, 30 heavy snow events, and 2 winter storms (nor'easters) that have impacted Strafford County from January 1 2013 to December 31, 2018.

Heavy snow typically brings significant snow removal costs along with delays in transportation schedules. Wet snow can result in major infrastructure damage from heavy snow loads and has been the cause of human harm during long periods of shoveling, including back injuries and in some cases heart attacks to older individuals. The most severe damage, though, often comes from ice storms and winter nor'easters.

The State's Multi-Hazard Mitigation Plan Update 2018 identifies four types of winter storms:

- ∴ *Heavy snowstorms*: A storm that deposits 4" or more in depth of snow in 12 hours or less; or 6" or more in depth in 24 hours or less.
- ∴ *Blizzards*: A violent snowstorm with winds blowing at a minimum speed of 35 miles (56 kilometers) per hour and visibility of less than one-quarter mile (400 meters) for three hours
- ∴ *Nor'easter*: A large weather system traveling from south to north, passing along the coast. As the storm's intensity increases, the resulting counterclockwise winds which impact the coast and inland areas in a Northeasterly direction. Winds from a Nor'easter can meet or exceed hurricane force winds.
- ∴ *Ice Storms*: An event that occurs when a mass of warm, moist air collides with a mass of cold, arctic air. The less dense warm air will rise and the moisture may precipitate out in the form of rain. When this rain falls through the colder, denser air and comes in contact with cold surfaces, ice will form and may continue to form until the ice is as thick as several inches.

Extent of the Hazard

Snow and ice storms are a Town-wide hazard.

Sperry-Piltz Ice Accumulation Index

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

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

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

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

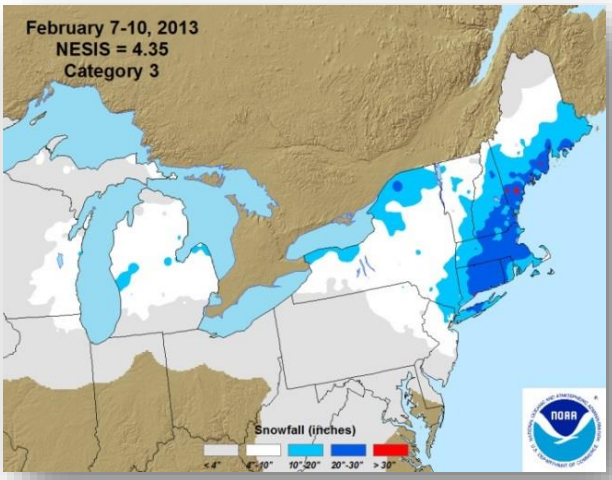
Past Events and Impacts

Four events of those listed in the NCDC database are of particular note for their severity:

The Ice Storm of 1998: (January 7th – 9th) was a severe ice storm that is recognized as the worst event in recent memory. Ice accreted several inches thick on trees, power lines, and other exposed surfaces causing many people in those areas to lose electrical service. Statewide, the storm knocked out power to about 55,000 customers, an estimated 125,000 people. Those impacted had to contend with snow, additional freezing rain, rain, slippery roads, falling ice and other debris, sub-zero temperatures, strong winds, and dangerous wind chills. Local impacts included long-term power outages (upwards of 7+ days), 1 fatality associated with carbon monoxide poisoning, school closures, and challenges with traffic at busy intersections. Local impacts included major tree damage, electric power interrupted for several days, and school closures. Locally, this storm produced long-term power outages, flooding in basements, isolation issues and slight panic after several days, gas station without power to provide fuel, increases in emergency call volumes, and no propane deliveries for generators.

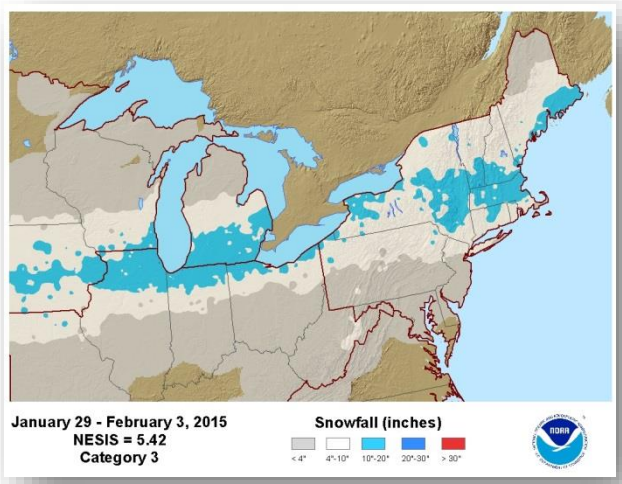
The Ice Storm of 2008 (December 11th – 12th) was a major winter storm that brought a mixture of snow, sleet, and freezing rain. The greatest impact in the state was in southern and central New Hampshire where a significant ice storm occurred. Following the ice storm, recovery and restoration efforts were negatively impacted by additional winter weather events that passed through the state. The freezing rain and sleet ranged from 1 to 3 inches, ice accretion to trees and wires in these areas generally ranged from about a half inch to about an inch. The weight of the ice caused branches to snap, and trees to either snap or uproot, and brought down power lines and poles across the region. About 400,000 utility customers lost power during the event, with some customers without power for two weeks. Property damage across northern, central and southeastern NH was estimated at over $5 million. Locally, this storm produced long-term power outages, flooding in basements, isolation issues and slight panic after several days, gas station without power to provide fuel, increases in emergency call volumes, and no propane deliveries for generators.

The Blizzard of 2013 – NEMO (February 8th-9th) was an area of low pressure developed rapidly off the Carolina coast late on the 7th and early on the 8th. The storm moved very slowly northeast during the 8th and 9th as it continued to intensify. By the morning of the 10th, the storm was located just to the east of Nova Scotia. The storm brought heavy snow, high winds, and blizzard conditions to the southeastern part of the state. Snowfall amounts were generally 18 inches or more in the southeast where blizzard conditions caused considerable blowing and drifting snow. In western and northern sections, snowfall amounts were in the 4 to 18 inch range. Southeastern New Hampshire had blizzard conditions for about 3 to 10 hours.



The NCDC Regional Snowfall Index for the stations near Madbury reported between 18 and 24 inches of snow (Rochester and Nottingham) and 12 to 18 inches (between Epson and Northwood) from February 8-February 10, 2013. According to the NH Union Leader, wind gusts of over 30-miles-per hour were expected to occur with the storm; however, the NH Electric Co-op reported only minor power outages.[8] This storm brought heavy snow and loss of power in some location in Town; however, there was no major damage.

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



Juno was ranked on the NESIS as a 'major' event based on the area affected, the amount of snow, and the number of people living in the path of the storm. The Regional Snowfall Index for the station near Madbury reported between 18 and 24 inches from January 25-January 28th, 2015[9]. Similar to the storm in 2013, this snow storm brought heavy bands of snow and wind, causing blizzard-like conditions. This storm brought heavy snow, the town implemented emergency protective measures; snow removal assistance; and school closures

[8] New Hampshire Union Leader. February 9, 2013.
http://www.unionleader.com/apps/pbcs.dll/article?AID=/20130209/NEWS1101/130209041/0/OPINION02
[9] http://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=rsi&theme=rsi

The March 2018 nor'easter brought roughly 25" of snow. The town implemented emergency protective measures; snow removal assistance; and school closures. The night portion of Town Meeting was postponed; however, election ballots went on as scheduled.

Extended Power Failures

When discussing extended power failure in this plan, it is referring to power failure that can last for a period of days or weeks. Many things can cause power failure: downed power lines (due to storm, wind, accident, etc.); failure of public utilities to operate or failure of the national grid. Extended power failure can present not only lighting difficulties but also heating, water supply and emergency services. Various storm events have knocked out power for several days. In Madbury, there have been extended power outages on occasion; the worst in recent years was the ice storm of 2008 where power was out for over a week in some places. Additional events to add are the Halloween Snow Event (2011), which produced heavy, wet snow and leaf-on conditions that resulted in downed trees and caused major power outages throughout the town. The Thanksgiving Day snow event in late November (2017) produced heavy, wet snow that resulted in sporadic power outages and disrupted travel plans for the holiday weekend, including major delays at airports and hazardous travel on local and state roadways.

Potential Future Impacts on Community

Madbury will continue regularly to receive impacts from severe, regional winter weather events.

Estimated Loss Potential

Based on the High hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$15,192,772** in estimated potential losses from impacts associated from severe winter weather.

Severe Thunderstorms & Lightning

Overview	
Hazard Type	Severe Thunderstorm and Lightning
Location/Extent	Town-wide (sporadic)
Severity	2.0
Probability	3
Overall Threat	6.0 (High)

Description of the Hazard

As defined by NOAA, a thunderstorm is a rain shower during which thunder is heard. Because thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is the result of convection, which is the upward atmospheric motion that transports whatever is in the air (such as moisture) with it. A thunderstorm is classified as severe if it has hail one inch or greater, winds gusting in excess of 50 knots (57.5 mph), or a tornado. Thunderstorm-related hazards

that could impact Madbury include: high winds and downburst, lightning, hail, and, torrential rainfall. Thunderstorms and severe thunderstorms are a Town-wide hazard. They are most likely to occur in spring and summer.

As defined by the National Severe Storms Laboratory, lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges builds up enough, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning. The flash of lightning temporarily equalizes the charged regions in the atmosphere until the opposite charges build up again.

Table 18: Lightning Activity Scale

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

Lightning can cause significant, sometimes severe, damage. Lightning strikes can cause direct damage to structures and serious injury or death to people and animals. Extensive damage also commonly results from secondary effects of lightning, such as electrical power surges, wildfire, and shockwave. According to lightning fatality data collected by the National Oceanic and Atmospheric Administration (NOAA) over the last decade, lightning kills an average of 27 people each year in the United States. There were 272 fatalities (213 were men; 59 were women) in the United States from 2009 to 2018 – none were in New Hampshire. In 2019, there have been no fatalities so far.

Extent of the Hazard

Lightning heats air to a temperature of 50,000 degrees Fahrenheit and causes the air to expand and contract rapidly, which causes thunder. A lightning strike occurs very quickly but can occur multiple times during a storm.

Past Events and Impacts

Thunderstorms are common in New Hampshire but can be considered generally less severe than in other areas of the country, such as the Great Plains states. Severe thunderstorms do occur in New Hampshire, though. The NCDC database lists 13 reported events of severe thunderstorm winds in Strafford County from January 1, 2013 to December 31, 2018. Two events took place in in Madbury; on May 31, 2017 a severe thunderstorm downed trees on power lines, and on July 20, 2017 a severe thunderstorm downed several trees. There was likely lightning during these events; however, there were not reports of damage and will continue to occur annually.

From 1959 to 2016, there have been eight fatalities associated with lightning strikes in New Hampshire. The NCDC database lists zero reported lightning events in Strafford County from January 1, 2013 to December 31, 2018.

Finally, hail is a fairly common part of thunderstorms in New Hampshire, but damaging hail is apparently not. The damage that can result from hail is mostly to cars and windows. The NCDC Storm Events database lists 6 reported hailstorms in Strafford County from January 1, 2013 to December 31, 2018. One event took place in Madbury; a thunderstorm on August 3, 2018 produced 0.75-inch hail.

Potential Future Impacts on Community

The annual recurrence probability of thunderstorms in general is effectively 100%. Madbury will continue to experience thunderstorms and should expect to sustain significant damage periodically.

Estimated Loss Potential

Based on the High hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$15,192,772** in estimated potential losses from impacts associated from severe thunderstorms and lightning.

Wildfire

Overview	
Hazard Type	Wildfire
Location/Extent	Town-wide (Unfragmented, wooded areas)
Severity	1.7
Probability	1
Overall Threat	1.7 (Low)

Description of the Hazard

Wildfire is defined as an uncontrolled and rapidly spreading fire. A forest fire is an uncontrolled fire in a woody area. Forest fires occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassland areas. Madbury is a rural Town, and much of the land cover of the Town is unfragmented woodland and grassland. Exposure to natural factors, such as lightning, that start wildfires is consequently high.

Extent of the Hazard

The National Wildfire Coordinating Group (NWCG) categorizes the size of a wildfire in six classes depending on acres burned, ranging from less than ¼ acre to greater than 5,000 acres (see box to the right). The US Forest Service's surface fire behavior fire characteristics chart illustrates primary fire behavior values including the spread rate and the intensity of the fire, which can be used to compare predicted and observed fire behavior and to describe potential fire behavior.[10]

The National Wildfire Coordinating Group (NWCG) defines the size of a wildfire as:

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.

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

Past Impacts and Events

There was an increased incidence of large wildland fire activity in the late 1940s and early 1950s that is thought to be associated, in part, with debris from the Hurricane of 1938. Significant woody "fuel" was deposited in the forests during that event. Large fires burned in rural, suburban, and urban areas, including one fire of over 1,500 acres in Salem and Atkinson, and numerous large fires in Farmington and Rochester which spread in to southern Maine.[11] Here, 70+ years later, New Hampshire officials are again concerned about the high fuel load created by the 1998 and 2008 ice storms that hit New Hampshire. The NCDC Storm Events database lists 0 reported wildfires in Strafford County from January 1, 2013 to December 31, 2018. According to the planning committee Madbury sees a few small grass-fires a couple times each year. The largest in recent memory occurred in 2006 behind the public safety building and was caused by sparks from the railroad. A large open field fueled the blaze, but there were no major injuries, fatalities, or significant loss to public infrastructure. Over the past five years, there have been at least two smaller fires in this area.

Potential Future Impacts on Community

The probability of occurrence of wildfires in the future is effectively impossible for the Hazard Mitigation Committee to predict due to the dependence of wildfire on the occurrence of the causal hazards and the variability of numerous factors that affect the severity of a wildland fire. Cherry Lane is vulnerable to potential future fires as it is in the wildland-urban interface zone. In general, if a wildfire occurred in one of the large, unfragmented woodland areas, the cost of the timber loss would probably be in the range of several million dollars.

Estimated Loss Potential

Based on the Low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$1,519,277** in estimated potential losses from impacts associated from wildfire.

Earthquakes & Landslide

Overview	
Hazard Type	Earthquake & Landslide
Location/Extent	Town-wide and areas with steep slopes (>25%)
Severity	3.0
Probability	1
Overall Threat	3.0 (Moderate)

Description of the Hazard

The USGS defines an earthquake as a term used to describe both sudden slip on a fault, and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, avalanches, and tsunamis. Larger earthquakes usually begin with slight

[11] Homeland Security and Emergency Management. State Multi-Hazard Mitigation Plan Update 2018.

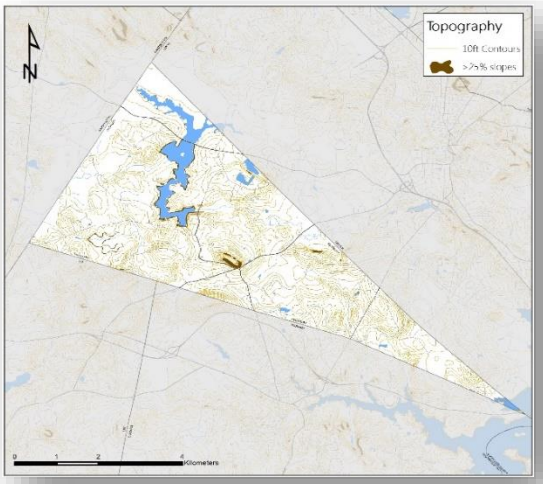
tremors but rapidly take the form of one or more violent shocks and are followed by vibrations of gradually diminishing force called aftershocks.[12] Earthquakes in the Northeast are not associated with specific know faults.

Due to the geology of the region, the area impacted by an earthquake in the Northeast can be up to 40 times greater than the same magnitude event occurring on the West coast. Earthquakes can occur at any time without warning. An earthquake can impact all areas of the jurisdiction. People at greatest risk from earthquakes are those who live in unreinforced masonry buildings build on filled land or unstable soil.[13]

The USGS defines a landslide as the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting," which denotes any down-slope movement of soil and rock under the direct influence of gravity. The term "landslide" encompasses five modes of slope movement: falls, topples, slides, spreads, and flows. These are further subdivided by the type of geologic material (bedrock, debris, or earth). Debris flows (commonly referred to as mudflows or mudslides) and rock falls are examples of common landslide types.

Landslides could occur in Madbury in areas with steep slopes, where soils and loose bedrock formations would tend to slough off and move en masse downhill under gravity. Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. In Madbury, the topology is relatively flat and there are not a significant number of steep slopes in the town. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely quite high in steep slope areas; however, there are only approximately 364 acres (4.7%) of steep slopes greater than 25% in Madbury.

Map 8: Steep Slopes in Madbury (Source: SRPC, 2019)

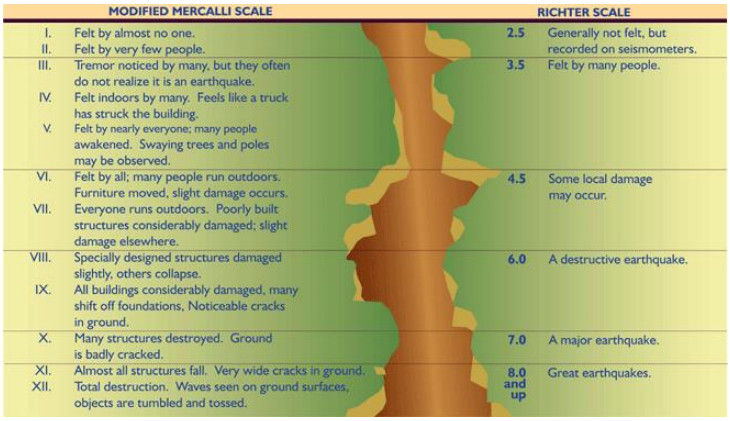


Extent of the Hazard

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

[12] The Northeast States Emergency Consortium Earthquake Hazards. http://nesec.org/earthquakes-hazards/.
[13] http://nesec.org/earthquakes-hazards/
[14] USGS. Earthquake Hazard Program. http://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale.

The Modified Mercalli Intensity (MMI) scale was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects experienced at a given place and therefore has a more meaningful measure of severity.[15]



While no universally accepted standard or scientific scale has been developed for measuring the severity of all landslides, severity can be measured several other ways:

- Steepness/grade of the Slope (measured as a percent)
- Geographical Area
    - Measured in square feet, square yards, etc.
    - More accurately measured using LiDAR/GIS systems
- Earthquake, either causing the event or caused by the event (measured using the Moment Magnitude Intensity or Mercalli Scale)

There are also multiple types of landslides:

- Falls: A mass detaches from a steep slope or cliff and descends by free-fall, bounding, or rolling
- Topples: A mass tilts or rotates forward as a unit
- Slides: A mass displaces on one or more recognizable surfaces, which may be curved or planar
- Flows: A mass moves downslope with a fluid motion. A significant amount of water may or may not be part of the mass

Like flooding, landslides are unique in how they affect different geographic, topographic, and geologic areas. Therefore, consideration of a multitude of measurements is required to determine the severity of the landslide event.

Past Impacts and Events

Due to the state's location in an area of moderate seismic activity earthquakes are a common event in New Hampshire, but significantly damaging earthquakes are not. The Northeast States Emergency Consortium (NESEC, 2016) website presents a history of earthquake in the Northeast and documents that New Hampshire is an area of high earthquake probability. Three hundred and sixty earthquakes occurred in New Hampshire from 1638 to 2016. Approximately 40-50 earthquakes are detected in the Northeast annually.[16] However, New Hampshire has only experienced ten earthquakes of significant magnitude (Richter Magnitude 4.0 or greater) in that time period (one was located in Maine). There have

[15] USGS. Earthquake Hazard Program. http://pubs.usgs.gov/gip/earthq4/severitygip.html.
[16] http://nesec.org/earthquakes-hazards/

been no local impacts of earthquakes. Within the last five years, there was a minor landslide off Garrison Lane along Gerrish Brook. The residential property lost part of the lawn up to a shed. A bank stabilization project was implemented by NRCS.

Earthquakes are on average an annual occurrence but significant quakes have an annual probability of occurrence (based on the 1638 to 2016 period) of about 2.6%.

Table 19: Notable Historic Earthquakes in NH 1638-2012 (Magnitude 4.0 or Greater)

Location	Date	*Intensity MMI Scale*	Magnitude *Richter Scale*
Central New Hampshire	June 11, 1638	-	6.5
Portsmouth	November 10, 1810	V	4.0
Near Hampton	July 23, 1823	IV	4.1
Ossipee	October 9, 1925	VI	4.0
Ossipee	December 20, 1940	VII	5.5
Ossipee	December 24, 1940	VII	5.5
West of Laconia	January 19, 1982	-	4.7
Northeast of Berlin	October 20, 1988	-	4.0
Southeast of Berlin	April 6, 1989	-	4.1
Hollis Center (Maine)	October 16, 2012	-	4.0

[Source: Northeast States Emergency Consortium, 2016]

Potential Future Impacts on Community

Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely quite high in steep slope areas. The Hazard Mitigation Committee did not have the expertise available to analyze the actual probability of landslide in Madbury. The USGS (1997) classifies landslide incidence regionally as very low (less than 1.5% of land area involved). The local probability in Madbury will depend on specific soil/rock types and upon the probability of initiating events; however, it should be noted that there are areas in Madbury with slopes greater than 25%.

Estimated Loss Potential

Based on the Moderate hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$7,596,386** in estimated potential losses from impacts associated from earthquakes and landslides.

Extreme Temperatures

Overview	
Hazard Type	Extreme Temperatures
Location/Extent	Town-wide
Severity	1.7
Probability	2
Overall Threat	3.3 (Moderate)

Description of the Hazard(s)

Extreme temperatures can be describes as heat waves and cold waves (or winter storm and extreme winter conditions.

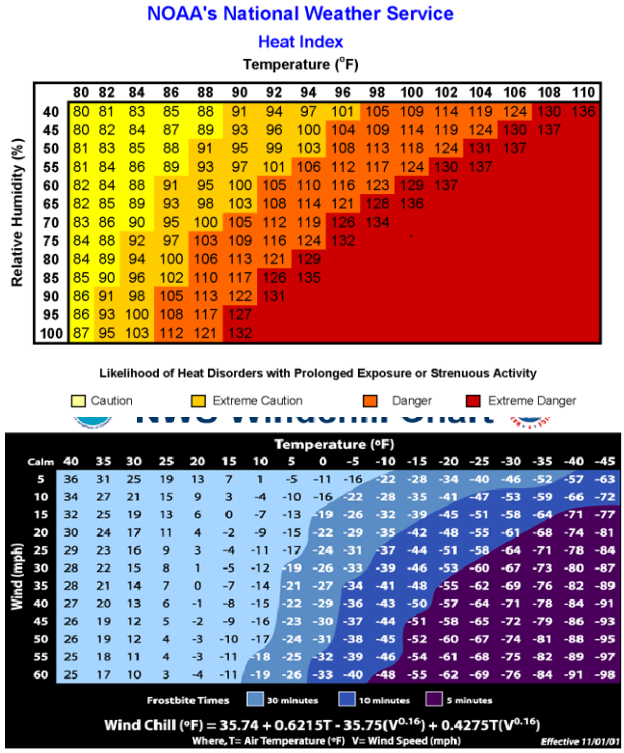
A *heat wave* is a prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region. Heat kills by pushing the human body beyond its limits. In extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."[17]

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

Extent of the Hazard

Extreme Heat

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



Extreme Cold

What constitutes extreme cold varies by region. Characteristics of an extreme cold event in northern states include temperatures at or below zero for an extended period of time. According to the National Weather Service (NWS), extreme cold is a daily concern during the winter months for northern states. The NWS Wildchill Temperature index calculates the dangers from winter winds and freezing temperatures (Source: NWS)

[17] International Federation of Red Cross and Red Crescent Societies. Climatological hazards: extreme temperatures. http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/extreme-temperatures/

Past Impacts and Events

According to a 2014 study of climate change by Climate Solutions New England, Climate Change in Southern New Hampshire, from 1970 to 1999, southern New Hampshire experienced an average of seven days per year above 90°F each year. This is projected to increase to 22 days per year under a low emissions scenario to nearly 50 days per year under a high emissions scenario. Between 1980 and 2009, an average of one day per year reached 95°F in southern New Hampshire. By the end of the century, the number of days per year over 95°F is expected to increase as much as six to 22 days per year. The average daytime maximum temperature on the hottest day is expected to increase to as much as 98°F to 102°F (depending on emissions scenario), compared to the historical average of 93°F.[18] Between 1960 and 2012, there was an average of 8.3 days per year greater than 90°F recorded in Durham (closest of 4 stations to Madbury). During this time the hottest day of the year averaged 95.0°F.[19] There have been no historical cases to date for extreme heat in Madbury. Durham provides a regional cooling shelter that could be uses in extreme heat waves.

Between 1960 and 2012, the average temperature of the coldest day of the year was -14.5°F in Durham (the closest of four stations to Madbury included in the study).[20] Between 1980 and 2009, there were an average of 164 days per year under 32°F and 16 days per year under 0°F in southern New Hampshire. By the end of the century, southern New Hampshire is expected to see 20 fewer days below 32°F and only about 2 to 5 days per year under 0°F. In February 2018, during a particularly cold stretch, there may have been residents that traveled to Durham to use the regional warming station. This tends to happen a few times a year.

Potential Future Impacts on Community

Annual average temperatures may increase on average by 3-5°F by 2050 and 4-8°F by 2100[21] A larger concern is during the winter and with stretches of extreme cold. If there are power outages, additional issues (especially with first-time homebuyers) emerge including pipes freezing and basement flooding.

Estimated Loss Potential

Based on the Moderate hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$7,596,386** in estimated potential losses from impacts associated from extreme temperatures.

Drought

Overview	
Hazard Type	Drought
Location/Extent	Town-wide
Severity	1.0
Probability	2
Overall Threat	2.0 (Low)

[18] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014
[19] Ibid
[20] Ibid
[21]

Description of the Hazard

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

Extent of the Hazard

The National Drought Monitor classifies the duration and severity of the drought using precipitation, stream flow, and soil moisture data coupled with information provided on a weekly basis from local officials. There are five magnitudes of drought outlined in the New Hampshire State Drought Management Plan: Exceptional, Extreme, Severe, Moderate, and Abnormally Dry. At the development of this Plan, Madbury was a little over a year and a half removed from an extreme drought.

Past Impacts and Events

While the impacts of drought are typically not as damaging and disruptive as floods or storm events, the impacts of long-term drought or near drought conditions can impact crops and the water supply.

Periods of drought have occurred historically in New Hampshire. Six droughts of significant extent and duration were evident in the 20th century as noted below in Table 20. The most severe drought recorded in New Hampshire occurred from 1960 to 1969. This drought encompassed most of the northeastern United States (1956-1966). The drought of 1929-1936 was the second worst and coincided with severe drought conditions in large areas of the central and eastern United States. The drought of 2001-2002 was the third worst on record.[22]

Table 20: Severe Drought Conditions in New Hampshire

Dates	Area Affected	Magnitude	Remarks
1929 – 1936	Statewide	-	Regional; recurrence interval 10 to > 25 years
1939 – 1944	Statewide	Severe Moderate	Severe in southeast NH and moderate elsewhere in the State. Recurrence interval 10 to > 25 years.
1947 – 1950	Statewide	Moderate	Recurrence interval 10 to >25 years
1960 – 1969	Statewide	Extreme	High Pollen Count, High Fire Danger, and high prices for produce, wells dried up, rivers, ponds and reservoirs became mud holes. Foggy mornings disappeared. Water Emergencies and Restrictions. Wild birds had trouble getting fish.

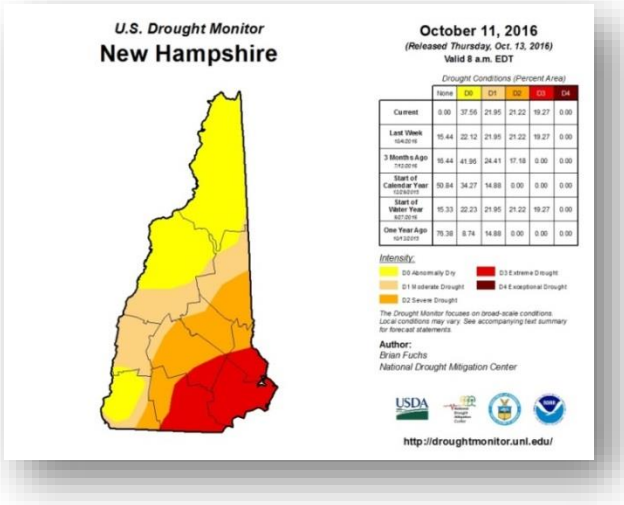
[22] NHDES. Drought Management Program. Publications. *NH Drought Historical Events*. http://des.nh.gov/organization/divisions/water/dam/drought/documents/historical.pdf

2001 – 2002	Statewide	Severe	Numerous forest fires. Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred.
2016-2017	Statewide	Extreme	Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred. Hundreds of private wells failed.

In more recent years, drought has again become a problem in New Hampshire. In 1999, a drought warning was issued by the Governor's Office. In March 2002, all counties in New Hampshire with the exception of Coos County were declared in Drought Emergency. This was the first time that low-water conditions had progressed beyond the Level Two, Drought Warning Stage.

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

Drought conditions continued and intensified into 2016 in New Hampshire and in Southeast New Hampshire in particular. The drought was due to a combination of a below average snowpack in the spring, little precipitation to recharge the groundwater, an increase of evapotranspiration (the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants) in the summer, and the inability of New Hampshire watersheds to store large volumes of water due to their geology.



In October 2016, at the peak of the drought, nearly 20% of the state was categorized as being in extreme drought. One hundred and sixty community water systems had reported implementing a water restriction or ban, and 13 municipalities had reported implementing voluntary or mandatory outdoor use bans in the state. Locally, there were a handful of shallow-dug wells that went dry. During times of prolonged drought, the town hall can offer water for "every-day services" (not necessarily for drinking) during an emergency.

Potential Future Impacts on Community

The National Drought Mitigation Center website (NDMC 2004) emphasizes that reliable drought prediction for regions above 30°N latitude is effectively impossible. With extreme variation in environmental conditions due to climate change possibly on the rise and population increases, drought probability may grow in the future and put more of a strain on long-term water resources. Currently, drought possibility seems moderate. The large amount of water resources and relatively sparse population in New Hampshire have tended to minimize the impacts of drought events in the region,

but this regional protection may be endangered in the future with increases in drought frequency or severity, especially in the State's densely populated areas along the seacoast and south-central NH.

Estimated Potential Losses

Based on the Low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$1,519,277** in estimated potential losses from drought.

Public Health Threats

Overview	
Hazard Type	Public Health Threats
Location/Extent	Town-wide
Severity	1.3
Probability	2
Overall Threat	2.7 (Moderate)

Description of the Hazard

Epidemic

As defined by the CDC, and epidemic is "the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time."[23] In addition to being categorized by the type of transmission (point-source or propagated), epidemics may occur as outbreaks or pandemics. As defined in the State Hazard Mitigation Plan, an outbreak is a sudden increase of disease that is a type of epidemic focused to a specific area or group of individuals. A pandemic is an epidemic that spreads worldwide, or throughout a large geographic area.

Epidemics may be caused by infectious diseases, which can be transmitted through food, water, the environment or person-to-person or animal-to-person (zoonoses), and noninfectious diseases, such as a chemical exposure that causes increased rates of illness. Infectious disease that may cause an epidemic can be broadly categorized into the following groups[24]:

- Foodborne (Salmonellosis, Ecoli)
- Water and Foodborne (Cholera, Giardiasis)
- Vaccine Preventable (Measles, Mumps)
- Sexually Transmitted (HIV, Syphilis)
- Person-to-Person (TB, Aseptic meningitis)
- Arthropodborne (Lyme, West Nile Virus)

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

[24] Homeland Security and Emergency Management. State Multi-Hazard Mitigation Plan Update 2018.

- Zoonotic (Rabies, Psittacosis)
- Opportunistic fungal and fungal infections (Candidiasis).

An epidemic may also result from a bioterrorist event in which an infectious agent is released into a susceptible population, often through an enhanced mode of transmission, such as aerosolization (inhalation of small infectious disease particles).[25] For the purposes of this Plan, widespread drug and substance abuse may also be considered epidemics. If an epidemic were to happen in the region, Madbury would use the POD in Dover.

Lyme Disease

Lyme disease, which is spread to humans by the bite of an infected tick, is a growing threat in New Hampshire. New Hampshire has one of the highest rates of Lyme disease in the U.S.

Radon

Radon is a radioactive gas which is naturally occurring as a result of the typical decay of uranium commonly found in soil and rock (especially granite). Radon has carcinogenic properties and is a common problem in many states; New Hampshire has some isolated areas that are among the highest levels of radon in the United States according to the US Environmental Protection Agency (EPA). Whether or not a particular type of granite emanates radon is dependent on the geochemistry of that particular granite, some types are a problem and some are not. In other parts of the country, radon is associated with certain black shales, sandstones, and even limestones. The EPA has estimated that radon in indoor air is responsible for about 13,600 lung cancer deaths in this country each year (EPA document, EPA 811-R-94-001, 1994).[26]

Arsenic

Arsenic is a semi-metal element that is odorless and tasteless. Arsenic is a hazard because it can enter drinking water supplies, either from natural deposits in the earth or from agricultural and industrial practices.[27] Wells drilled into New Hampshire's bedrock fractures have about a 1 in 5 probability of containing naturally occurring arsenic above 10 parts per billion. In addition, wells within short distances (~50 feet) can present very different water quality because of our highly fractured bedrock. Arsenic in water has no color or odor, even when present at elevated levels. Therefore, the only way to determine the arsenic level in your well water is by testing.

Extent of the Hazard

The magnitude and severity of infectious diseases is described by its speed of onset (how quickly people become sick or cases are reported) and how widespread the infection is. Some infectious diseases are inherently more dangerous and deadly than others, but the best way to describe the extent of infectious diseases relates to the disease occurrence:

- Endemic – Constant presence and/or usual prevalence of a disease or infection agent in a population within a geographic area
- Hyperendemic – The persistent, high levels of disease occurrence

[25] Ibid
[26] Ibid
[27] EPA. Arsenic in Drinking Water. (http://water.epa.gov/lawsregs/rulesregs/sdwa/arsenic/index.cfm)

- Cluster – Aggregation of cases grouped in place and time that are suspected to be greater than the number expected even though the expected number may not be known
- Epidemic – An increase, usually sudden, in the number of cases of a disease above what is normally expected
- Outbreak – The same as epidemic, but over a much smaller geographical area
- Pandemic – Epidemic that has spread over several countries or continents, usually affecting many people

Past Impacts and Events

Epidemic

While not an infectious disease outbreak, New Hampshire is currently among those states in the Northeast combating a serious opioid epidemic. In 2016, there were 437 opioid-related overdose deaths – a rate of 35.8 deaths per 100,000 persons – nearly 3 times higher than the national rate of 13.3 deaths per 100,000[28]. Over the past several years, there have been four opioid overdose reversals using Narcan. In 2016, police officers will be receiving recertification in advanced AED, Narcan, and CPR training.

Leading causes have been from heroin and/or fentanyl. New Hampshire has some of the highest percentages of illicit drug use among young adults in not just the Northeast, but the entire country. Carfentanyl has emerged as an additional drug that is causing significant problems. Wentworth Douglas Hospital offers in-house training to all emergency responders.

Lyme Disease

The number of New Hampshire residents diagnosed with Lyme disease has increased over the past 10 years. In 2016, the rate of cases reported in Strafford County was 177 cases and a rate of 138.9 per 100,000 persons, which is significantly higher than the Healthy People 2010 science-based 10-year national objective for improving the health of all Americans objective of 9.7 cases per 100,000 persons.[29] It is unclear as to how many cases were reporting in Madbury. According to the NH Division of Public Health Services, Strafford, Rockingham, and Hillsborough Counties have some of the highest reported cases of Lyme disease in New Hampshire. Between 2011 and 2016, Strafford has experienced roughly an average of 175 cases each year. The town should work on providing additional information on Lyme disease prevention.

Radon

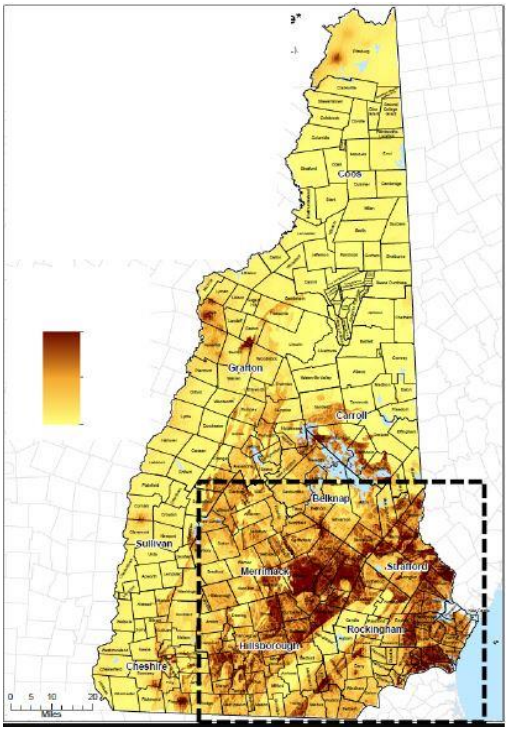
Exposure is a significant hazard in New Hampshire. According to a NH Bureau of Environmental & Occupational Health (BEOH) study looking at >15,000 indoor radon test results in single-family dwellings, households in northern, eastern, and southeastern regions of New Hampshire especially tend to have nominally high concentrations of radon in air or water (BEOH 2004); however, values in excess of the US Environmental Protection Agency's 4.0 picocurie per liter (pCi/L) action guideline have been found in nearly every community in New Hampshire. Values exceeding 100 pCi/L have been recorded in at least eight of New Hampshire's ten counties. The highest indoor radon reading in New Hampshire known to NHDES is greater than 1200 pCi/L; higher values probably exist. In Madbury, >49.9% of homes tested by homeowners

[28] National Institute on Drug Abuse. Opioid-Related Overdose Deaths. https://www.drugabuse.gov/drugs-abuse/opioids/opioid-summaries-by-state/new-hampshire-opioid-summary

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

from 1987 to 2008 tested at or above the radon action level of 4.0 pCi/L. The probability of significant radon exposure is high.[30] In recent years, the Madbury water board has been conducting testing for radon.

Arsenic



From 1975 until 2001, the federal maximum contaminant limit (MCL) for arsenic in water supplied by public water systems was 50 parts per billion, because the health effects of exposure to lower concentrations was not recognized. Based on an exhaustive review of the new information about arsenic's health effects, in January 2001 EPA established a goal of zero arsenic in drinking water. At the same time, EPA adopted an enforceable MCL of 10 parts per billion (ppb) based on balancing treatment costs and public health benefits. Studies have shown that chronic or repeated ingestion of water with arsenic over a person's lifetime is associated with increased risk of cancer (of the skin, bladder, lung, kidney, nasal passages, liver or prostate) and non-cancerous effects (diabetes, cardiovascular, immunological and neurological disorders). The same studies found that dermal absorption (skin exposure) of arsenic is not a significant exposure path; therefore, washing and bathing do not pose a known risk to human health.[31] According to a public health study released in 2019 on arsenic and uranium in well water, conducted by the N.H. Biomonitoring Program, has been published by the state Department of Health and Human Services, Madbury has a high probability of arsenic contamination in groundwater above the US EPA's maximum contaminant level. Previous studies suggest that where arsenic is found in bedrock, uranium may also be found.

Contamination of public drinking water wells to elevated levels of the unregulated contaminant perfluorooctane sulfonic acid (PFOS) has become an emerging threat; however, natural occurring radionuclides (radium, uranium) found in private drinking water supplies is also an important public safety hazard.

Potential Future Impacts on Community

With the occurrence of worldwide pandemics such as SARS, H1N1 and Avian Flu, Madbury could be susceptible to an epidemic and subsequent quarantine. While all individuals are potentially vulnerable to the hazard of an epidemic, epidemics often occur among a specific age group or a group of individuals with similar risk factors and exposure.[32] Lyme disease will continue to impact public health, and with changes in climate, in particular warmer winters, higher rates of Lyme disease will be an ongoing concern.

Radon, arsenic, and other potential groundwater containments will continue to need to be addressed. There have been reports by the EPA that lung cancer deaths nationwide can be attributed to radon exposure, but nothing inclusive has been determined at this point. With assistance from epidemiological health experts, for future plan updates the

[30]NHDES https://www.des.nh.gov/organization/divisions/air/pehb/ehs/radon/documents/radon_by_town.pdf
[31] New Hampshire Environmental Services. Drinking Water and Groundwater Bureau. Arsenic in Drinking Water Fact Sheet.
[32] Homeland Security and Emergency Management. State Multi-Hazard Mitigation Plan Update 2018.

Committee may be able to use the life-table or concentration risk analysis methodologies in the EPA study (EPA 2003) together with demographic and behavioral health data to arrive at a reasonable estimate of risk.

Heroin and drug epidemic remains an ongoing problem.

Estimated Potential Losses

Based on the Moderate hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$7,596,386** in estimated potential losses from impacts associated from public health threats.

Hazardous Materials

Overview	
Hazard Type	Hazardous Materials
Location/Extent	Town-wide
Severity	1.3
Probability	1
Overall Threat	1.3 (Low)

Description of the Hazard

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

Extent of the Hazard

Incidents involving hazardous materials could potentially occur at any residence or business or along any road; however, it is more likely that a spill would occur along Route 4, 9 (at the Bellamy Reservoir), 108 and 155 (at the railroad), as these are major transportation corridors that often have trucks carrying bio-diesel fuel and other harmful chemicals through Town.

Past Impacts and Events

In Madbury, large trucks carrying fuel (oil, gas, propane) are a concern as accidents along the Route 4, 9, 108 and 155 corridors could contaminate important waterbodies including the Bellamy Reservoir, which is the primary drinking water source for the City of Portsmouth. There is also the rail line that cuts through Town, which makes 24 trips daily (12 passenger/12 freight), carrying numerous loads of hazardous materials. There have no recent impacts.

Potential Future Impacts on Community

Any accident involving trucks carrying hazardous waste along Route 4, 9, 108 and 155 are potential future threats.

Estimated Potential Losses

Based on the Low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$1,519,277** in estimated potential losses from hazardous materials impacts.

Coastal Hazards

Overview	
Hazard Type	Coastal Hazards
Location/Extent	Low-lying areas along the Bellamy River; at the confluence of the Oyster River and Little Bay; and Johnson Creek
Severity	1.0
Probability	1
Overall Threat	1.0 (Low)

Description of the Hazard

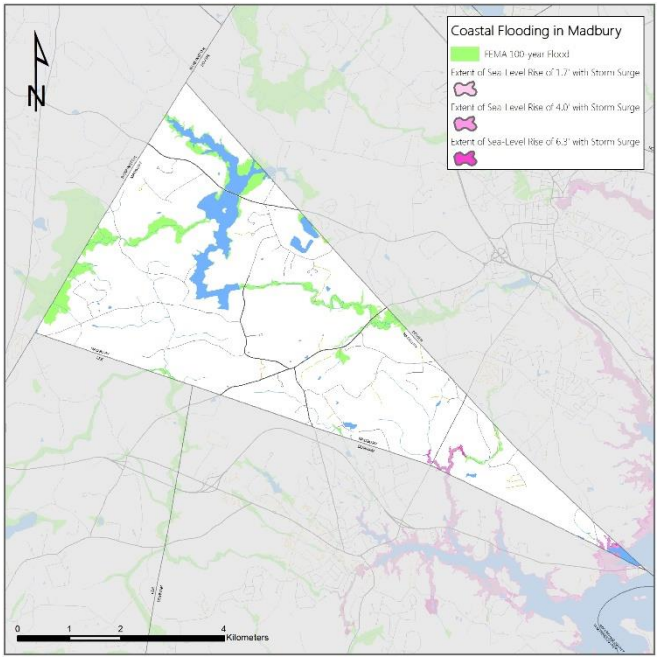
Coastal hazards are often associated with storm surge, extreme precipitation events, and sea-level rise can be devastating to human health and safety, public and private structures and facilities, and the economies of coastal and inland coastal communities.

Extent of the Hazard

The depth of a coastal flood event is determined by a combination of several factors such as storm intensity, forward speed, storm area size, coastline characteristics, angle of approach to the coast, and tide height. Severity can vary significantly based on both speed of onset (how quickly the floodwaters rise) and the flood event duration. Nor'easters can impact the region for several days and produce a storm surge with or without the addition of inland runoff from heavy precipitation.

Madbury is an inland coastal community, one of seventeen communities in the New Hampshire Coastal Zone, but has limited risk and vulnerability regarding flooding caused by wave action. However, storm surges brought on by large storm events like hurricanes and nor'easters, accompanied by high tides and potential sea level rise are valid concerns around low-lying areas along the Bellamy River; at the confluence of the Oyster River and Little Bay; and Johnson Creek. These areas are all within the coastal floodplain area, making them particularly vulnerable to flooding from seasonal high tides, coastal storms, and sea-level rise.

Map 9: Potential Sea Leve Scenarios (Source: SRPC, 2019)



Past Impacts and Events

To the best of the Committee's knowledge Madbury has not experienced any coastal flooding to date; however, as sea levels rise the town can expect to see minor impacts in the southeastern portion of town along the Bellamy River, as well as along Johnson Creek. There are no major critical facilities impacted, but the town should consider the potential impacts to Route 4 in Durham as this transportation asset does act as an emergency evacuation route. Under the SLR 6.3ft + storm surge scenario Route 108 over Gerrish Brook is shown as having minor impacts that should also be considered during long-term planning efforts

Potential Future Impacts on Community

In 2014, the Coastal Risk and Hazards Commission (CRHC) released their Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends report that provides the best available and relevant scientific information to inform decision-makers. The report projects that New Hampshire's coast could see a range of 0.6ft to 2.0ft of sea level rise by the year 2050. By 2100, that range could be from 1.6ft all the way to 6.6ft depending on different emission scenarios.

In 2017, NOAA released a report titled Global and Regional Sea Level Rise Scenario for the US that indicates global sea-level projections may be in the range of 6.6ft to 8.9ft of rise by 2100 under the highest scenario. These results take into consideration the instability of the Antarctic ice-sheet and indicate that these higher outcomes may be more likely than previously thought. While these projections are based on models and there is always a high level of uncertainty, the trend continues to go up – not down.

According to the CRHC report annual precipitation (not extreme events) is expected to increase by as much as 20% with most increases occurring during winter and spring during this century. Extreme precipitation events are expected to increase in frequency and in the mount of precipitation produced; however, it is unclear as to how much those events will increase. The town's vulnerability to storm surge and sea-level are low. Increases in extreme precipitation events in future will be a higher priority.

Estimated Potential Losses

Based on the Low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$1,519,277** in estimated potential losses from hazardous materials impacts.

Hazards Not Included in this Plan

The State of New Hampshire identifies avalanches, coastal flooding, and solar storms and space weather as hazards in the State Multi-Hazard Mitigation Plan Update of 2018. Avalanches and solar storms and space weather are not included in this Plan for the Town of Madbury. Avalanches were not identified by the present or past Planning Committee as a local hazard since there are no significant mountains or topographical features, where avalanches would be likely to or have occurred in the past. Lastly, the planning committee did not have enough knowledge to determine if solar storms and space weather deserved to be recognized in this plan update as a hazard. The Town will re-evaluate the need to include additional hazards to this Plan during subsequent updates of the Plan.

Chapter 7: Action Plan

Past Mitigation Strategies

During past updates the Planning Committee developed a list of strategies to implement over the course of the Plan's life-cycle. Table 20 summarizes those strategies, and provides updated information as to if the strategy was accomplished or not.

Table 20: Accomplishments Since Last Plan Adoption

Proposed Mitigation Action	Update 2019
1) Design and implement a public education campaign to target those residents who reside within the dam inundation zone. Set up mechanisms to engage those who may be affected in the case of dam failure.	Removed Action. This action was not completed as previously written and needs to be revised. The planning committee agreed that a GIS analysis using the updated dam inundation areas could be overlaid with tax parcel data to determine the correct property owner to send outreach materials.
2) Streamline radio functions between emergency responders during an event. Utilize one frequency to communicate from command post at the police station to emergency responders, and other municipal staff.	Completed. Radio improvements have taken place over the last several years, which has led to improved communication between police and fire. At the 2019 town meeting, voters approved money for additional improvements.
3) Work closely with the City of Portsmouth and the Water Treatment Facility operators to develop an emergency plan for any hazardous spills for the Route 9 and Mill Hill Road crossings at the Bellamy Reservoir.	Removed Action. This action was not completed as previously written and needs to be revised. The City of Portsmouth has a spill control plan; however, the town should develop a new action that deals with how first responders in Madbury can aid with limited capacity until additional help arrives.
4) During the first 72 hours of any large-scale event there is a waiting period for state and federal agencies to get organized and aid. Madbury will compile an inventory of short-term resources for any long-term event to be utilized immediately by emergency responders and impacted residents.	Deferred Action. This action has not been completed and will be carried forward in the updated plan with slight revisions.
5) Promote conservation of open space to separate areas from high-hazard wildfire areas.	Completed Action. While not solely focusing on wildfires, the town has put several easements into conservation including areas along the Bellamy River, Kingman Farm, and Powder Major that provide multi-hazard benefits (flooding, wildfire).

Proposed Mitigation Action	Update 2019
6) Identify specific at-risk populations that may be vulnerable in the event of long-term power outages.	Completed Action. The town has identified specific at-risk populations in its hazard mitigation plan. Carriage Hill Assisted Living and School both have generators in the event of lost power. Many residents in town have local generators.
7) Conducting maintenance and performing prevention cleanup activities in areas along the railroad, which has a history of flammable conditions, in order to reduce risk.	Deferred Action. This action has not been completed and the issue within the right-of-way has gotten worse. This action will be carried forward in the updated plan with slight revisions.
8) Using local fire departments to conduct education programs in schools and municipal buildings.	Completed Action. While there is limited capacity, the fire department does provide public education, including classroom evacuations and other National Fire Protection Association programs.
9) Placing a higher priority on the continued development of usable water supplies for fire protection. As property is subdivided within the Town, there is a need to add water supplies that not only benefit newly added homes, but also existing infrastructure.	Removed Action. This action was not completed as previously written and needs to be revised. The planning committee agreed that this action needs to be amended into a land use planning recommendation – possibly site and subdivision regulations that require and enforce the construction of cisterns to provide additional fire protection.
10) Establishing new dry hydrant and cistern locations throughout the Town. Developing agreements with local property owners when/if needed.	Completed Action. Fire protection infrastructure is addressed within the town's ongoing capital improvements program.
11) Maintain transportation infrastructure by identifying and assessing potential areas (road/culverts) of concern and using the culvert inventory report produced by the Strafford Regional Planning Commission to prioritize replacement, repair, and upgrade schedules to mitigate future flooding.	Completed Action. The town may not have used the culvert inventory report but has been proactive in replacing and upgrading culverts as needed, including Hayes Road and Cherry Lane.
12) Encourage wind engineering measures and construction techniques to better mitigate against high winds.	Completed Action. All new construction will be required to adhere to building codes that address high winds; however, there may be several manufactured homes on Bunker Lane that were built before more stringent codes and do not have adequate tie downs installed.

Proposed Mitigation Action	Update 2019
13) Implement a public outreach campaign during the rollout of the new draft FEMA floodplain maps that will be available for comment beginning in 2014. Engage residents who are currently part of the NFIP and encourage those who wish to know more to become actively involved during the review of the new maps.	Completed Action. Town staff attended public comment sessions that were held at UNH to provide feedback on the draft maps. The town held a public hearing to discuss the zoning amendments. The maps and zoning amendments were adopted at town meeting in 2015. All maps and the revised zoning ordinance is posted on the town's website.
14) Consider adopting and enforcing updated building code provisions to reduce earthquake damage risk.	Removed Action. This is no longer applicable.
15) Posting warning signage at local parks, country fairs, and other outdoor venues during the summer months.	Removed Action. This is no longer applicable.

Status Update:

Completed Action – This program was implemented as a mitigation action item since the last updated plan was developed

Deferred Action – At the time of developing this plan, more time is required for completion

Removed Action – This existing program is no longer a priority to the Town

Ongoing Action – This program will occur throughout the life of the plan

Existing Mitigation Strategies

During the update the Planning Committee developed a list of existing programs and strategies that were ongoing planning mechanisms to help reduce impacts from future hazards. Table 21 summarizes those programs, and provides information on the effectiveness, any changes in priority, and a list of recommendations to improve them during the next life-cycle of this plan.

Table 21: Existing Programs and Policies

Existing Program	Description	Effectiveness	2019 Update
Building Codes	Establishes regulations for the design and installation of building systems	Good	The town is currently using the 2009 IBC for commercial buildings, and the IRC for residential. Madbury is waiting for the state to adopt the new codes. At the time of this plan update, the state building code review board was trying to get legislation passed to adopt the 2015 codes.
Local Emergency Operations Plan (LEOP)	Defined notification procedures and actions that should be taken in different emergency situations.	Good	The LEOP was last fully updated in 2015 with a grant from HSEM to fund an outside consultant. The next update is scheduled for 2020. HSEM funding is available to update these plans.
Stormwater Infrastructure Maintenance	Responsible for catch basins, culverts cleaning, ditch maintenance, structure upkeep and maintenance	Good	The town has completed several culvert replacements including Hayes Road over Dube Brook and Cherry Lane. Nute Road over the Bellamy River is scheduled for replacement in 2020. The town has used the culvert analysis in the C-RiSe vulnerability assessment to prioritize future culvert replacement and will continue to make necessary repairs as needed.
Tree Maintenance	Utility companies (Eversource) and the Town have tree maintenance programs to clear trees and limbs from power lines and roadways.	Excellent	Eversource, in partnership with the town, has clear-cut a significant amount of tree limbs, which has resulted in a substantial decrease in the number of emergency calls during large storm events.
Evacuation and Notification	Evacuation and notification procedures are defined in Madbury's LEOP	Good	The evacuation/notification process that is outlined in the town's EOP is reviewed every five years. Over the last five-year plan cycle there have been no large-scale evacuations; however, town staff and volunteers remain prepared.

Existing Program	Description	Effectiveness	2019 Update
Emergency Backup Power	Offers temporary shelter during extended periods without power	Good	The Town Hall, Police, Fire, Elementary School, Portsmouth Water Treatment Plant, and the Carriage Hill Assisted Living (private) are all equipped with generators. Many residents have purchased stand-by generators to handle the 3 to 5-day event. In those circumstances, which are mostly seasonal in nature, residents have shown self-sufficiency. Events that last longer than 5 days become more problematic.
Hazardous Materials Response Team	The town does not currently have a member on the START Hazardous Materials Emergency Response Team, a regional effort to combine resources to mitigate hazardous materials incidents. On-going training, education and acquisition of resources are important for the team	Good	While the town does not currently have a member on the START Team, they do have mutual aid to help in cases of a hazardous spill and pay for support at the local level.
Fire Department Mutual Aid Program	Seacoast Chief Fire Officers Mutual Aid District.	Good	Communication has improved with the Department using the same frequency; however, some inter-operability issues remain. The 2018-2024 CIP references a joint project to upgrade hardware, mobile vehicle radios, and portable radios. Grant funds are being researched.
Police Department Mutual Aid Program	Strafford County Chiefs and State Police (Mutual Aid)	Good	The town is part of a mutual aid system that offers part-time for populations less than 3,000 people. This includes an average of 16 hours a day with additional support from the State Police for tactical accidents and fatalities.
Floodplain Management	Local ordinance to regulate development in the floodplain, and other activities to reduce risk.	Excellent	The town's ordinance is strong and exceeds current NFIP standards. There may be opportunities to streamline the process when an application comes before the board as a special exception. The town should consider adding both the 100- and 500-year floodplains onto their zoning map. The town should also review the new model ordinance that was developed by the statewide floodplain coordinator.

Existing Program	Description	Effectiveness	2019 Update
Master Plan	A guiding document used to manage Madbury's growth and development through local land use regulations.	Good/Average	The town has been participating in an ongoing update to the 2003 master plan for the past several years. While most of the data is now out of date, the town has not experienced significant changes. Most of the components of the town's long-term vision, which was reassessed in a 2015 vision survey, remains the same.
Capital Improvements Program (CIP)	A program that helps to address improvement projects over a period of time.	Excellent	Each year, the planning board adopts a new plan. The 2018-2024 CIP is in place to assist in identifying needed improvements and significant additions to the town's infrastructure and to schedule them in a priority over a six-year period

Effectiveness:

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

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

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

Poor – The existing program is negatively impacting the community

The Planning Committee's Understanding of Multi-Hazard Mitigation Strategies

The Planning Committee determined that any strategy designed to reduce personal injury or damage to property that could be done prior to an actual disaster would be listed as a potential mitigation strategy.

This decision was made even though not all projects listed in Tables 22 (New Mitigation Actions) and 23 (Implementation Plan) are fundable under FEMA HMA grant programs. The Planning Committee determined that this Plan was in large part a management document designed to assist the Board of Selectmen and other Town officials in all aspects of managing and tracking potential emergency planning strategies. For instance, the Planning Committee was aware that some of these strategies are more properly identified as readiness issues. The Planning Committee did not want to "lose" any of the ideas discussed during these planning sessions and thought this method was the best way to achieve that objective.

The Planning Committee identified eleven new strategies and is carrying over two additional actions from the previous (2014) iteration to implement during the life of this Plan. These strategies are intended to supplement existing programs and the ongoing and not yet completed mitigation strategies identified in previous plan updates. When identifying new strategies, the Planning Committee balanced several factors including capacity to implement strategies, priority projects, existing strategies, policies, and programs, the hazard ranking, and whether a strategy will reduce risk associated with multiple hazards. All hazards identified in this Plan were considered; however, due to the low probability of some, and frequency of others – not every hazard was given an associated action. For example, a strong tornado may result in large amounts of damage but has a very small probability of occurring. Another example is severe thunderstorms and lightning. These storms happen multiple times each summer with varying degrees of damage. At the time of this plan update, the Planning Committee agreed that other hazards were more important to address and allocate limited resources to.

Future Mitigation Strategies

The Committee identified several new mitigation strategies to reduce vulnerability to hazards. The Committee focused on identifying the best appropriate strategies for the community and the hazards it is most vulnerable based on the vulnerability assessment. Some of the mitigation strategies are strategies for multiple hazards. The goal of each proposed mitigation strategy is reduction or prevention of damage from a multi-hazard event.

New mitigation strategies are listed in Table 22, which also includes a feasibility assessment and prioritization of each hazard.

Feasibility & Prioritization

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

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

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

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

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

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

Table 22: Future Mitigation Actions & STAPLEE

New Mitigation Project	S	T	A	P	L	E	E	Total
As part of the ongoing update to the master plan, the town should identify areas that may be susceptible to environmental hazards, including but not limited to steep slopes, wildfire, and flooding to determine where development should and should not occur.	3	3	3	3	3	3	3	21
Add current floodplain map to the Planning Board's website under the "Maps" section, and to the town's subdivision regulations to coincide with Article XIII Special Flood Hazard Area Requirements.	3	3	3	3	3	3	3	21
Improve the way in which all hazards education on mitigation techniques and preparedness are disseminated to residents. This may include exploring additional ways to send out information that doesn't rely solely on having power and an internet connection (NH Alerts & Code Red), advocating for more residents to sign up for emergency alerts, creating neighborhood route maps, and developing a list of addresses (using assessing data) for door-to-door notification.	3	3	3	3	3	3	3	21

New Mitigation Project	S	T	A	P	L	E	E	Total
Consider developing a process or actions that would improve engagement with first time homebuyers and ensure they are aware of existing resources during an emergency. The town may include providing information in the community calendar or an additional step when new residents register to vote.	3	3	3	3	3	3	3	21
Work with the Strafford Regional Planning Commission to overlay the dam inundation layer with the most recent tax parcels to develop a list of owners that would be impacted if the Bellamy Dam were to fail. As a follow up, the town should ensure that those owners are aware they are within the dam inundation zone and provide information on flood insurance options.	3	3	3	3	3	3	3	21
Update existing site and subdivision regulations to include more stringent language on the criteria and maintenance of fire aid infrastructure and other water resources that would ensure adequate fire protection for new development.	2	3	3	2	3	3	3	19
	Regulatory changes can be challenging to pass			Regulatory changes can be challenging to pass				

New Mitigation Project	S	T	A	P	L	E	E	Total
Seek funding to conduct a floodplain analysis that would assess the major river systems in town. The study should mimic what has been recently completed in the Town of Lee and include various build-out scenarios and use increased precipitation projections to delineate flood zones based on future conditions.	2	3	3	2	3	2	3	19
	New data may not be supported as it deals with future conditions			Misinformation about flood insurance		Cost to match grant		
Investigate the feasibility of setting up a shelter at the Moharimet Elementary School, which would include addressing capacity and resource challenges.	3	2	3	3	3	2	3	19
		Coordination of multiple departments				Cost challenges		
Research options to create a Community Emergency Response Team (CERT) for the town to have a list of volunteers that meet certain requirements, including training to handle emergency situations.	3	2	2	3	2	3	3	18
		Uncertainty w/ different types of events	Uncertainty w/ different types of events		Potential liability issues w/ volunteers			
Use the culvert analysis referenced in the C-RiSe vulnerability assessment to prioritize future culvert replacements and repairs.	3	3	3	3	3	2	2	19
						Cost to implement	State permitting	
Purchase and install lightning rod at the Emergency Operations Center to protect all back-up systems in case of a strike and associated power surge.	3	3	3	3	3	2	3	20
						Cost to purchase equipment		

New Mitigation Project	S	T	A	P	L	E	E	Total
* Explore ways to improve and streamline the process in which the town would request and receive emergency resources from state/federal agencies through WebEOC, including sandbags, fuel, vehicles, and additional manpower, during the first 72-hours of a major event. This may include additional WebEOC training for emergency personnel and improved coordination between local departments.	3	3	2	3	3	2	3	19
			Relying on state and federal agencies			Cost of resources		
* Develop a list of options on how to address ongoing maintenance activities and preventative cleanup challenges along the railroad to reduce future wildfire risk. One action could be to involve the regional planning commission to determine if this is a regional challenge and if a regional approach is most suitable.	3	1	1	3	2	2	3	15
		Challenges dealing with PanAM railroad	Challenges dealing with PanAM railroad		Easements and legal authority	Who pays?		

*Deferred actions with slight revisions from the 2014 Plan.

Implementation Schedule for Prioritized Strategies

After reviewing the finalized STAPLEE numerical ratings, the Team prepared to develop the Implementation Plan (Table 23). To do this, the Team developed an implementation plan that outlined the following:

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

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

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

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

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

In addition to the prioritized mitigation projects, Table 23, Implementation Plan, includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN).

Table 23: Implementation Plan

New Mitigation Project	Type of Hazard	Affected Location	Type of Activity	Responsibility	Funding	Cost Effectiveness *Low = < $5,000* *Medium = $5,000 - $10,000* *High = > $10,000*	Timeframe *Ongoing* *6 months - 1 year* *1 - 2 years* *2 - 5 years*
As part of the ongoing update to the master plan, the town should identify areas that may be susceptible to environmental hazards, including but not limited to steep slopes, wildfire, and flooding to determine where development should and should not occur.	Multi-Hazard	Town-wide	Local Planning & Regulations	Planning Board	Local	Low	1-2 years
Add current floodplain map to the Planning Board's website under the "Maps" section, and to the town's subdivision regulations to coincide with Article XIII Special Flood Hazard Area Requirements.	Flooding	Special Flood Hazard Areas	Local Planning & Regulations	Planning Board	N/a	Low	6 months-1 year
Improve the way in which all hazards education on mitigation techniques and preparedness are disseminated to residents. This may include exploring additional ways to send out information that doesn't rely solely on having power and an internet connection (NH Alerts & Code Red), advocating for more residents to sign up for emergency alerts, creating neighborhood route maps, and developing a list of addresses (using assessing data) for door-to-door notification.	Multi-Hazard	Town-wide	Education & Awareness Program	Board of Selectmen	Local	Low	6 months-1 year

Consider developing a process or actions that would improve engagement with first time homebuyers and ensure they are aware of existing resources during an emergency. The town may include providing information in the community calendar or an additional step when new residents register to vote.	Multi-Hazard	Town-wide	Education & Awareness Program	Town Clerk, Code Enforcement, and Fire Department	Local	Low	6 months-1 year
Work with the Strafford Regional Planning Commission to overlay the dam inundation layer with the most recent tax parcels to develop a list of owners that would be impacted if the Bellamy Dam were to fail. As a follow up, the town should ensure that those owners are aware they are within the dam inundation zone and provide information on flood insurance options.	Dam Failure	Dam Inundation Zones	Local Planning & Education and Awareness	SRPC & Administrative Assistant	Local	Low	6 months-1 year
Update existing site and subdivision regulations to include more stringent language on the criteria and maintenance of fire aid infrastructure and other water resources that would ensure adequate fire protection for new development.	Wildfire	Town-wide	Local Planning & Regulations	Planning Board, Fire Department, and SRPC	Local	Moderate	1-2 years
Seek funding to conduct a floodplain analysis that would assess the major river systems in town. The study should mimic what has been recently completed in the Town of Lee and include various build-out scenarios and use increased precipitation projections to delineate flood zones based on future conditions.	Flooding	Flood Prone Areas	Local Planning & Regulations	Planning Board & Board of Selectmen	Local and Grants (NHDES Coastal Program)	High	2-5 years
Investigate the feasibility of setting up a shelter at the Moharimet Elementary School, which would include addressing capacity and resource challenges.	Multi-Hazard	Moharimet Elementary School	Emergency Preparedness	EMD, Police, & Fire Departments	Local	Low	1-2 years

Research options to create a Community Emergency Response Team (CERT) for the town to have a list of volunteers that meet certain requirements, including training to handle emergency situations.	Multi-Hazard	Town-wide	Emergency Preparedness	Board of Selectmen	Local and Grants (HSEM – EMPG)	Low	1-2 years
Use the culvert analysis referenced in the C-RiSe vulnerability assessment to prioritize future culvert replacements and repairs.	Flooding	Specific Stream Crossings	Local Planning	Road Agent	Local	Low	1-2 years
Purchase and install lightning rod at the Emergency Operations Center to protect all back-up systems in case of a strike and associated power surge.	Severe Thunderstorm and Lightning	EOC	Equipment Purchase	Fire Department	Local and Grants (HSEM – EMPG)	Moderate	2-5 years
Explore ways to improve and streamline the process in which the town would request and receive emergency resources from state/federal agencies through WebEOC, including sandbags, fuel, vehicles, and additional manpower, during the first 72-hours of a major event. This may include additional WebEOC training for emergency personnel and improved coordination between local departments.	Multi-Hazard	Town-wide	Emergency Preparedness	EMD, Police, and Fire Departments	Local	Low	6 months-1 year
Develop a list of options on how to address ongoing maintenance activities and preventative cleanup challenges along the railroad to reduce future wildfire risk. One action could be to involve the regional planning commission to determine if this is a regional challenge and if a regional approach is most suitable.	Wildfire	Along Existing Railroad	Local Planning	Fire Department & SRPC	Local	Low	1-2 years
*Deferred or ongoing actions from the 2013 Plan. Previous implementation notes were reaffirmed. Ongoing actions will be completed throughout the life of the plan.							

Chapter 8: Monitoring, Evaluation, and Updating the Plan

Introduction

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

Multi-Hazard Plan Monitoring, Evaluation, and Updates

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

Changes will be made to the Plan to accommodate projects that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities or funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, will be reviewed as well during the monitoring and update of the plan to determine feasibility of future implementation. In keeping with the process of adopting this multi-hazard mitigation plan, a public meeting to receive public comment on plan maintenance and updating will be held during the annual review period and before the final product is adopted by the Board of Selectmen. Chapter 9 contains a representation of a draft resolution for Madbury to use once a conditional approval is received from FEMA.

Integration with Other Plans

The prior 2014 plan was used to help inform the 2015 local emergency operations plan, draft chapters of the master plan, and other planning activities such as capital improvements planning for transportation infrastructure improvements and culvert replacements.

The local government will refer to this Plan and the strategies identified when updating the Town's Master Plan, Capital Improvements Program, Zoning Ordinances and Regulations, and Local Emergency Operations Plan. The Board of Selectmen and the Hazard Mitigation Committee will work with Town officials to incorporate elements of this Plan into other planning mechanisms, when appropriate. The Emergency Management Director along with other members of the Hazard Mitigation Committee will work with the Planning Board to suggest including information developed for the updated Hazard Mitigation Plan into appropriate Town's Master Plan chapters.

Chapter 9: Plan Adoption

Conditional approval email received by SRPC from HSEM on August 9, 2019.

Good afternoon!

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

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

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

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

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

Sincerely,

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

Hazard Mitigation Staff:
Alexx Monastiero, State Hazard Mitigation Officer / Alexxandre.Monastiero@dos.nh.gov / (603) 223-3627
Kayla Henderson, State Hazard Mitigation Planner / Kayla.Henderson@dos.nh.gov / (603) 223 3650
Whitney Welch, Asst. Chief of Planning / Whitney.Welch@dos.nh.gov / (603) 223-3667
Julia Moreland, Program Assistant / Julia.Moreland@dos.nh.gov / 603-223-3633

Signed Certificate of Adoption

CERTIFICATE OF ADOPTION

Town of Madbury New Hampshire
Board of Selectmen
A Resolution Adopting the Madbury, NH Multi-Hazard Mitigation Plan Update 2019

Conditionally Approved: August 9, 2019

WHEREAS, the Town of Madbury authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and received funding from the NH Office of Homeland Security and Emergency Management under a Pre-Disaster Mitigation (PDM) grant and assistance from Strafford Regional Planning Commission in the preparation of the Madbury, NH Multi-Hazard Mitigation Plan Update 2019; and

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

WHEREAS, the Madbury, NH Multi-Hazard Mitigation Plan Update 2019 contains several potential future projects to mitigate hazard damage in the Town of Madbury; and

WHEREAS, a duly-noticed public meeting was held by the Madbury Board of Selectmen on August 30, 2019 to formally approve and adopt the Madbury, NH Multi-Hazard Mitigation Plan Update 2019.

NOW, THEREFORE BE IT RESOLVED that the Madbury Board of Selectmen adopts the Madbury, NH Multi-Hazard Mitigation Plan Update 2019.

ADOPTED AND SIGNED this day of August 30, 2019

Frederick W Green
Madbury Board of Selectmen, Chair

Madbury Board of Selectmen

Madbury Board of Selectmen

Eric Fiegenbaum
Town Seal or Notary

ERIC N. FIEGENBAUM
MY COMMISSION EXPIRES MARCH 13, 2024
NOTARY PUBLIC
NEW HAMPSHIRE

Date August 30, 2019

Final Approval Letter from FEMA

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

FEMA

Alexxandre Monastiero, State Hazard Mitigation Officer
New Hampshire Department of Safety, Homeland Security and Emergency Management
33 Hazen Drive
Concord, New Hampshire 03303

Dear Ms. Monastiero:

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. Our Agency has been notified that your office completed its review of the Multi-Hazard Mitigation Plan Update 2019 Town of Madbury, NH and approved it effective **September 6, 2019** through **September 5, 2024** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

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

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

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

Sincerely,

16 SEP 2019

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

WRW:ms

cc: Fallon Reed, Chief of Planning, New Hampshire

Appendices

Appendix A: Bibliography

Appendix B: Planning Process Documentation

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

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

Appendix E: Maps

Appendix A: Bibliography

Documents

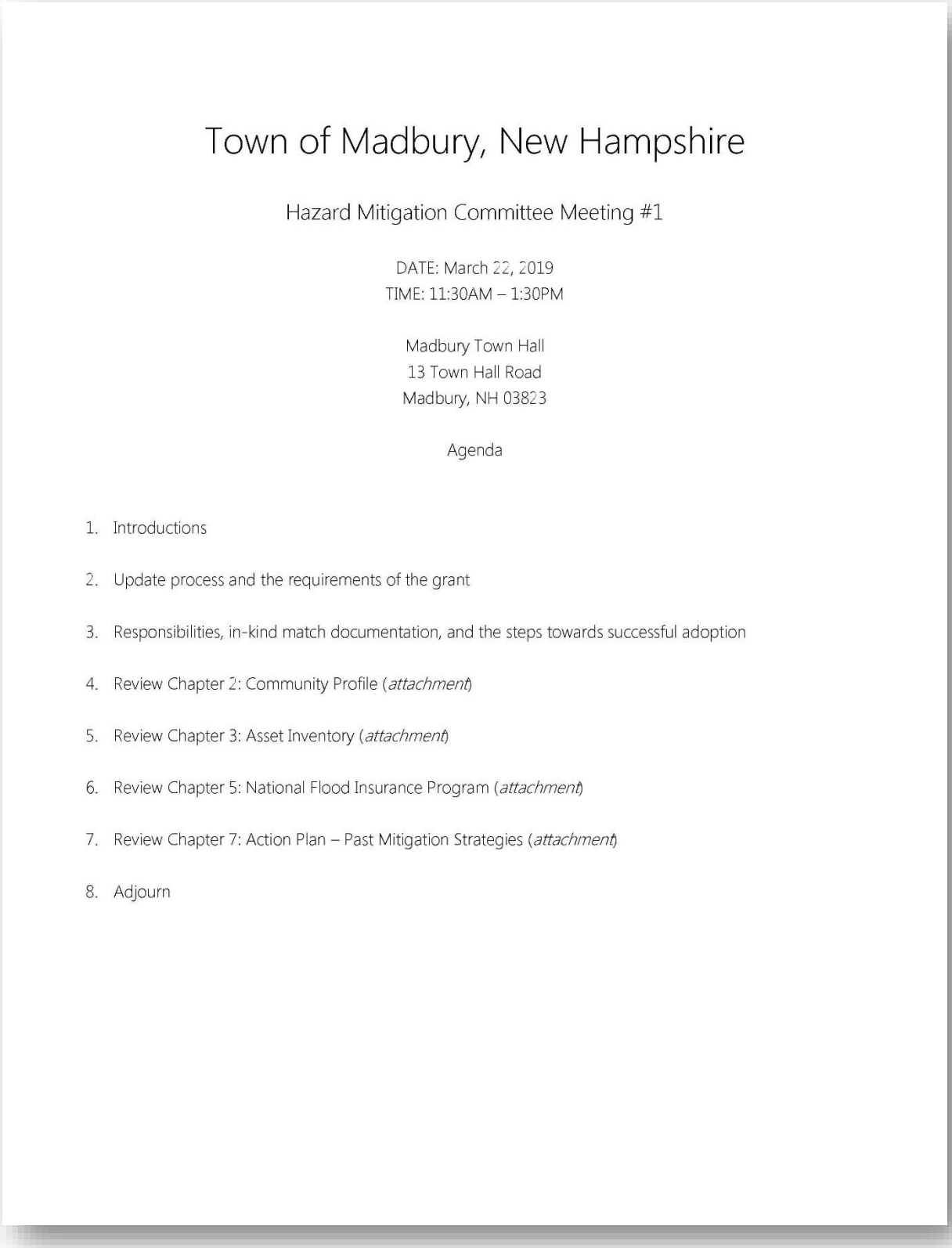
- Local Mitigation Plan Review Guide, FEMA, October 1, 2011
- Multi-Hazard Mitigation Plans
    - Town of Rollinsford, 2016
- State of New Hampshire Multi-Hazard Mitigation Plan (2018) - State Hazard Mitigation Goals
- Disaster Mitigation Act (DMA) of 2000, Section 101, b1 & b2 and Section 322a http://www.fema.gov/library/viewRecord.do?id=1935
- Economic & Labor Market Information Bureau, NH Employment Security, 2015; Census 2010 and Revenue Information
- NCDC [National Climatic Data Center, National Oceanic and Atmospheric Administration]. 2018. Storm Events

Photos

- Eric Fiegenbaum, Administrative Assistant, Town of Madbury

Appendix B: Planning Process Documentation

Agendas



Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #1

DATE: March 22, 2019
TIME: 11:30AM – 1:30PM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

Agenda

1. Introductions
2. Update process and the requirements of the grant
3. Responsibilities, in-kind match documentation, and the steps towards successful adoption
4. Review Chapter 2: Community Profile (*attachment*)
5. Review Chapter 3: Asset Inventory (*attachment*)
6. Review Chapter 5: National Flood Insurance Program (*attachment*)
7. Review Chapter 7: Action Plan – Past Mitigation Strategies (*attachment*)
8. Adjourn

Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #2

DATE: April 11, 2019
TIME: 9:00AM – 11:00AM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

Agenda

1. Introductions

2. Old Business
    a. Review meeting notes (*Meeting_Notes_032219*)
    b. Review action items (*Action_Items_041119*)
    c. Review revised asset inventory table (*Critical_Facilities_032219*)

3. New Business
    a. Review Chapter 6: Declared Disasters (*Chapter6_Hazards_Mitigation_Strategies.docx*)
    b. Review Chapter 6: Hazard Descriptions (*Chapter6_Hazards_Mitigation_Strategies.docx*)
    c. Review Chapter 6: Hazard Vulnerability Ranking (*Chapter6_Hazards_Mitigation_Strategies.docx*)
    d. Review Chapter 7: Existing Mitigation Strategies (*Existing_Mitigation_Strategies_041119.docx*)

4. Next meeting date

5. Adjourn

Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #3

DATE: May 9, 2019
TIME: 9:00AM – 11:00AM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

Agenda

1. Introductions

2. Old Business
    a. Review meeting notes (*Meeting_Notes_041119.docx*)
    b. Review action items (*Action_Items_050919.docx*)
    c. Review past mitigation actions (*Past_Actions_050919.docx*)

3. New Business
    a. Review Chapter 7: Existing Mitigation Strategies (*Existing_Mitigation_Strategies_050919.docx*)
    b. Brainstorm new mitigation actions and fill out implementation plan (*New_Mitigation_Actions.xlsx*)
        i. Go through STAPLEE Method to rank each hazard (*STAPLEE_Method.docx*)

4. Next meeting date

5. Adjourn

Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #4

DATE: June 6, 2019
TIME: 9:00AM – 11:00AM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

Agenda

1. Introductions

2. Old Business
    a. Review meeting notes (*Meeting_Notes_050919.docx*)
    b. Review action items (*Action_Items_060619.docx*)
    c. Review existing mitigation strategies (*Existing_Strategies_060619.docx*)

3. New Business
    a. Review mitigation actions that were developed during the May meeting and fill out the implementation plan using the STAPLEE Method to rank each action (*STAPLEE_Method.docx*)
    b. Review final maps (large scale hard copies will be available at the meeting)

4. Question and Answer with HSEM representative

5. Next Steps for Adoption

6. Adjourn

Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #1

DATE: March 22, 2019
TIME: 11:30AM – 1:30PM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
Jim Davis	Asst Fire Chief	hootnholler@comcast.net	
Justin Corrow	Building Inspector	bimadbury@comcast.net	
Eric Fiegenbaum	Selectmen's Assist.	adminmadbury@comcast.net	
Robert Gaetjens, MD, MPH	Health Officer	Robert.Gaetjens@gmail.com	
Fritz Green	Selectman	Fritz.Green.Barre@gmail.com	

Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #2

DATE: April 11, 2019
TIME: 9:00AM – 11:00AM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
Jim Davis	Asst Fire Chief		—
Eric Fiegenbaum	Administrator		1 hour
Justin Corrow	Building Inspector		½ hr.
Joe McGraw	Police Chief		
[illegible]	Selectman		

Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #3

DATE: May 9, 2019
TIME: 9:00AM – 11:00AM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
MARK AVERY	MADBURY PLANNING BOARD	MADPLANBOARD@GMAIL.COM	2 hrs
ERIC FIEGENBAUM	ADMIN	ERIC@LEFH.NET	1.5 HRS
FRITZ GROSSK	SELECTMAN		.5
LIZ DUPPEE	CONTRACT PLANNER	efd.planning@gmail.com	0.5
Justin Corron	Building Inspector	bi madbury@comcast.net	.5
JOE McCORMACK	Police chief		
Jim Davis	Asst Fire Chief	Hoorahroller@comcast.net	.5

Town of Madbury, New Hampshire

Hazard Mitigation Committee Meeting #4

DATE: June 6, 2019
TIME: 9:00AM – 11:00AM

Madbury Town Hall
13 Town Hall Road
Madbury, NH 03823

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
MARK AUGRY	MADBURY PLANNING BOARD	MAP PLAN BOARD @gmail	2
ERIC FIEGENBAUM	ADMINISTRATION	administmadbury@comcast.net	1
Justin Corrow	Building Inspector	bimadbury@comcast.net	1
FRITZ GAMSBY	SELECTMAN		1

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

I. RIVERINE MITIGATION

A. Prevention

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

1. Planning and Zoning[33] - Land use plans are put in place to guide future development, recommending where - and where not - development should occur and where it should not. Sensitive and vulnerable lands can be designated for uses that would not be incompatible with occasional flood events - such as parks or wildlife refugees. A Capital Improvements Program (CIP) can recommend the setting aside of funds for public acquisition of these designated lands. The zoning ordinance can regulate development in these sensitive areas by limiting or preventing some or all development - for example, by designating floodplain overlay, conservation, or agricultural districts.

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

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

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

4. Stormwater Management - Development outside of a floodplain can contribute significantly to flooding by covering impervious surfaces, which increases storm water runoff. Storm water management is usually addressed in subdivision regulations. Developers are typically required to build retention or detention basins to minimize any increase in runoff caused by new or expanded impervious surfaces, or new drainage systems. Generally, there is a prohibition against storm water leaving the site at a rate higher than it did before the development. One technique is to use wet basins as part of the landscaping plan of a development. It might even be possible to site these basins based on a watershed analysis. Since detention only controls the runoff rates and not volumes, other measures must be employed for storm water infiltration - for example, swales, infiltration trenches, vegetative filter strips, and permeable paving blocks.

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

B. Property Protection

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

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

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

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

4. Floodproofing - If a building cannot be relocated or elevated, it may be floodproofed. This approach works well in areas of low flood threat. Floodproofing can be accomplished through barriers to flooding, or by treatment to the structure itself.
    a. Barriers: Levees, floodwalls and berms can keep floodwaters from reaching a building. These are useful, however, only in areas subject to shallow flooding.
    b. Dry Floodproofing: This method seals a building against the water by coating the walls with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, etc. are closed either permanently with removable shields or with sandbags.
    c. Wet Floodproofing: This technique is usually considered a last resort measure, since water is intentionally allowed into the building in order to minimize pressure on the structure. Approaches range from moving valuable items to higher floors to rebuilding the floodable area. An advantage over other approaches is that simply by moving household goods out of the range of floodwaters, thousands of dollars can be saved in damages.

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

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

C. Natural Resource Protection

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

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

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

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

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

D. Emergency Services

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

1. Flood Warning - On large rivers, the National Weather Service handles early recognition. Communities on smaller rivers must develop their own warning systems. Warnings may be disseminated in a variety of ways, such as sirens, radio, television, mobile public address systems, or door-to-door contact. It seems that multiple or redundant systems are the most effective, giving people more than one opportunity to be warned.
2. Flood Response - Flood response refers to actions that are designed to prevent or reduce damage or injury, once a flood threat is recognized. Such actions and the appropriate parties include:

a. Activating the emergency operations center (emergency director)
b. Sandbagging designated areas (Highway Department)
c. Closing streets and bridges (police department)
d. Shutting off power to threatened areas (public service)
e. Releasing children from school (school district)
f. Ordering an evacuation (Board of Selectmen/emergency director)
g. Opening evacuation shelters (churches, schools, Red Cross, municipal facilities)

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

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

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

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

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

E. Structural Projects

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

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

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

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

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

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

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

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

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

F. Public Information

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

1. Map Information - Flood maps developed by FEMA outline the boundaries of the flood hazard areas. These maps can be used by anyone interested in a particular property to determine if it is flood-prone. These maps are available from FEMA, the NH Homeland Security and Emergency Management (HSEM), the NH Office of Strategic Initiatives (OSI), or your regional planning commission.

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

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

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

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

.

II. EARTHQUAKES

A. Preventive

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

B. Property Protection

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

C. Emergency Services

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

D. Structural Projects

1. Slope stabilization

III. DAM FAILURE

A. Preventive

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

B. Property Protection

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

C. Emergency Services

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

D. Structural Projects

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

IV. WILDFIRES

A. Preventive

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

B. Property Protection

1. Retrofitting of roofs and adding spark arrestors
2. Landscaping to keep bushes and trees away from structures
3. Insurance rates based on distance from fire protection

C. Natural Resource Protection

1. Prohibit development in high-risk areas

D. Emergency Services

1. Fire Fighting

V. WINTER STORMS

A. Prevention

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

B. Property Protection

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

C. Natural Resource Protection

1. Maintenance program for trimming trees and shrubs

D. Emergency Services

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

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

FEMA's Hazard Mitigation Assistance (HMA) grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs[34]:

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

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

HMA Grant Programs

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

A. Hazard Mitigation Grant Program (HMGP)

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

What is the Hazard Mitigation Grant Program?

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

Who is eligible to apply?

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

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

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

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

How are potential projects selected and identified?

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

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

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

B. Pre-Disaster Mitigation (PDM)

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

Program Overview

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

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

C. Flood Mitigation Assistance (FMA)

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

Program Overview

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

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

Types of FMA Grants

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

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

Appendix E: Maps

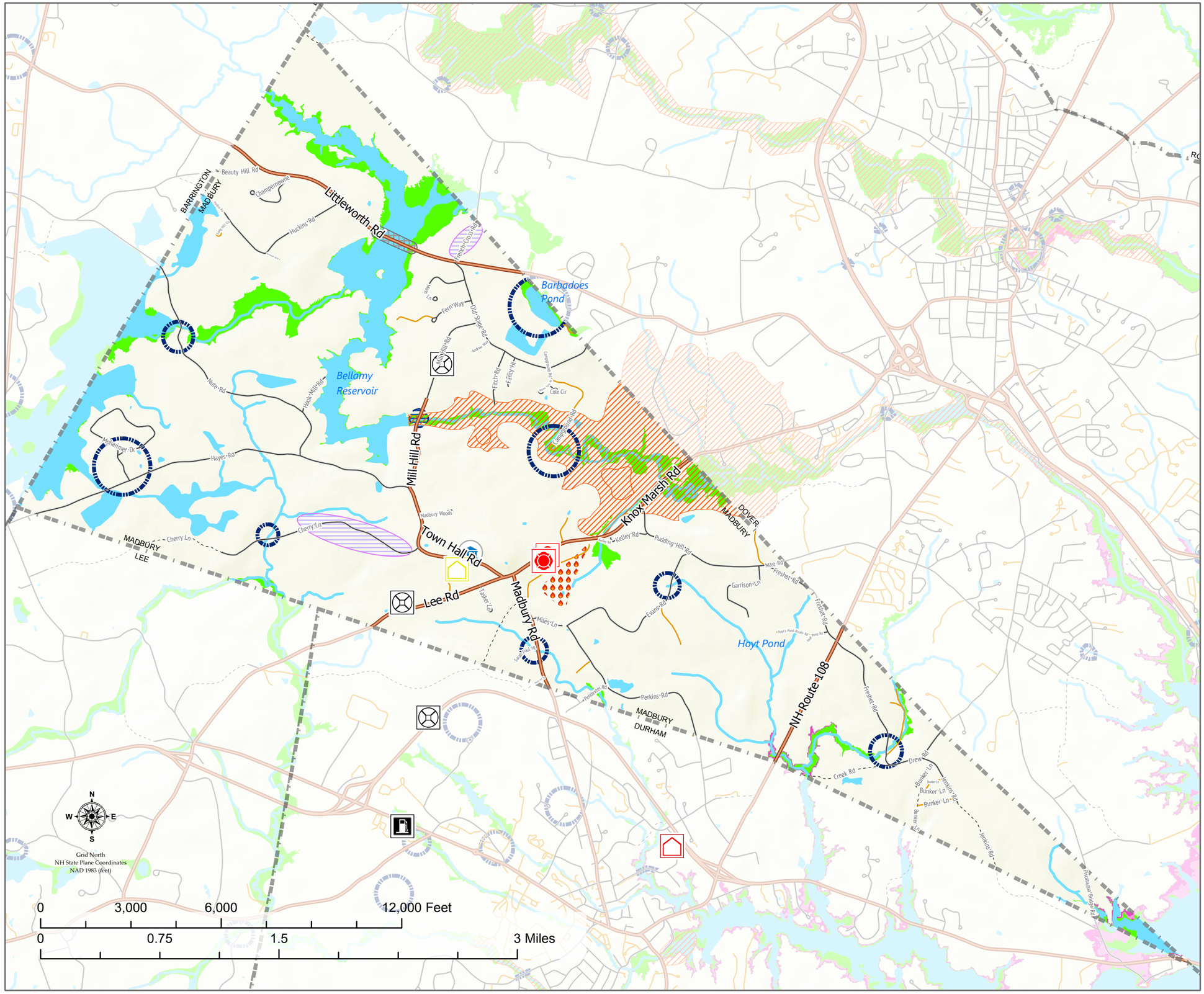
Maps

- Emergency Response Facilities
- Non-Emergency Response Facilities
- Critical Facilities
- Vulnerable Populations to Protect
- Water Resources

Emergency Response Facilities & Past and Potential Hazards

2019 Hazard Mitigation Plan

MADBURY, NH



Emergency Response Facilities (ERF)

Type

- Administrative Office & Communication
- Primary Regional Shelter
- Backup Shelter
- Emergency Fuel
- Emergency Medical Evacuation
- Emergency Operations Center

Base Layers

Water Resources

- Lakes and Ponds
- Rivers, Brooks, Streams

Hazard Type

- Fire
- Dam Breech
- Downburst
- Lightning
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain

SLR Storm Scenarios

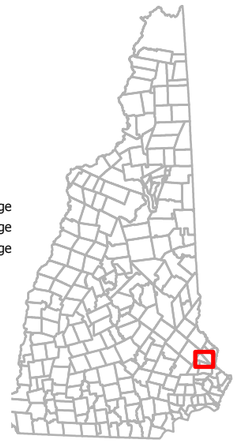
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Transportation

Roads

Class

- State
- Local
- Private
- Not Maintained
- Lake Ponds Names



DATA SOURCES

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

Prepared by: Strafford Regional Planning Commission
150 Wakefield St, Suite 12, Rochester, NH 03867
T: (603) 994-3500 F: (603) 994-3504 Em: srpc@strafford.org

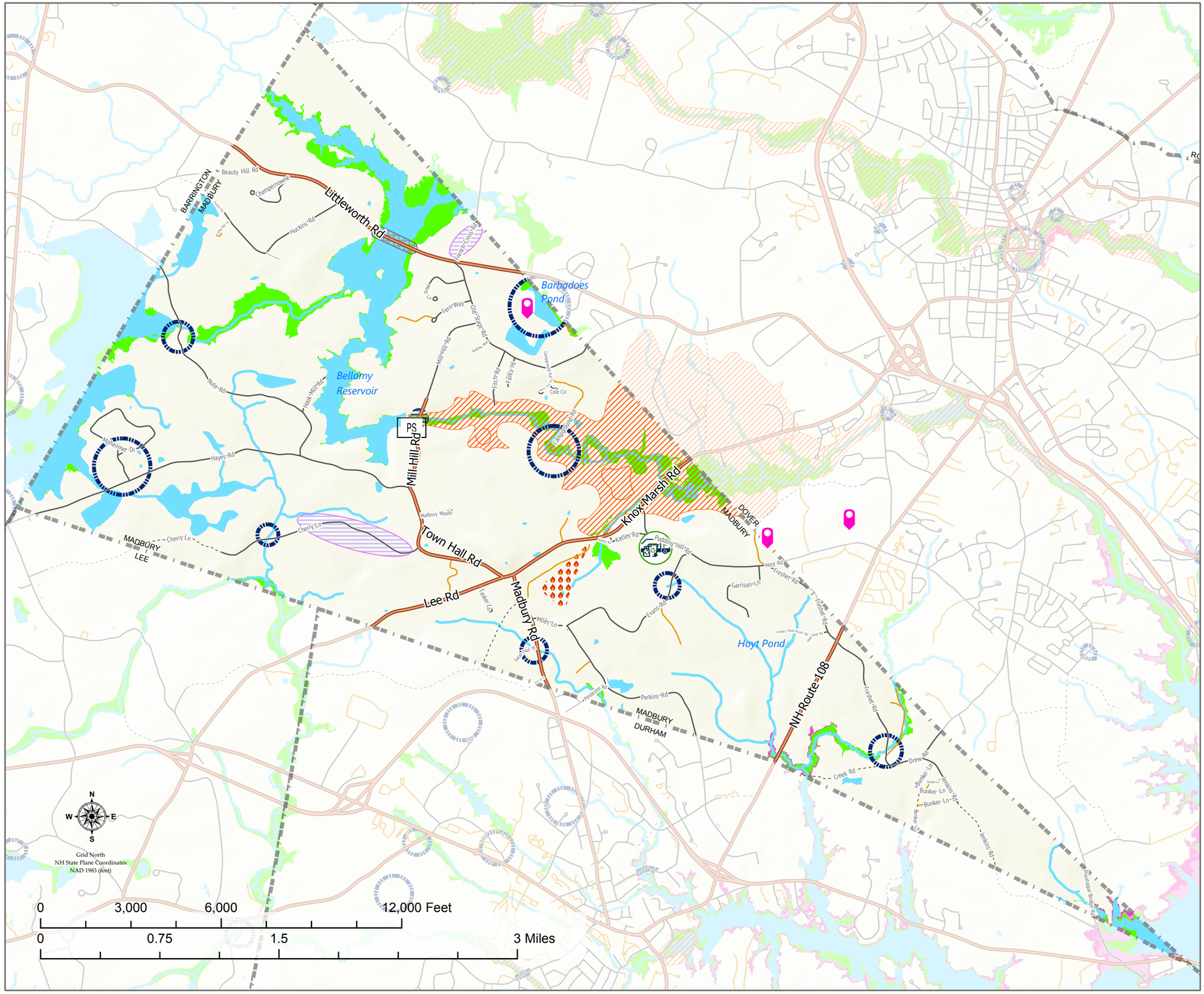
Water Resources & Past and Potential Hazards
Date: June 2019
Path:M:\Region\OEM_haz_mit\2018_2019_Updates\Madbury_Update\Maps

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

Strafford REGIONAL PLANNING COMMISSION

Non-Emergency Response Facilities & Past and Potential Hazards 2019 Hazard Mitigation Plan

MADBURY, NH



Non-Emergency Response Facilities (NERF)

Type

- Potential Resources
- Water Treatment Plant
- Transfer Station
- PS Pump House

Base Layers

Water Resources

- Lakes and Ponds
- Rivers, Brooks, Streams

Hazard Type

- Fire
- Dam Breech
- Downburst
- Lightning
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain

SLR Storm Scenarios

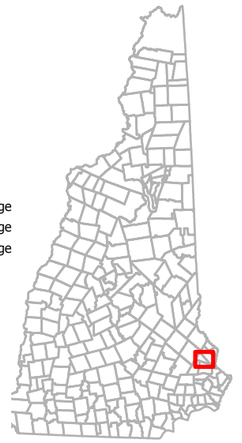
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Transportation

Roads

Class

- State
- Local
- Private
- Not Maintained
- Lake Ponds Names



DATA SOURCES

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

Prepared by: Strafford Regional Planning Commission
150 Wakefield St, Suite 12, Rochester, NH 03867
T: (603) 994-3500 F: (603) 994-3504 Em: srpc@strafford.org

Water Resources & Past and Potential Hazards
Date: June 2019
Path:M:\Region\OEM_haz_mit\2018_2019_Updates\Madbury_Update\Maps

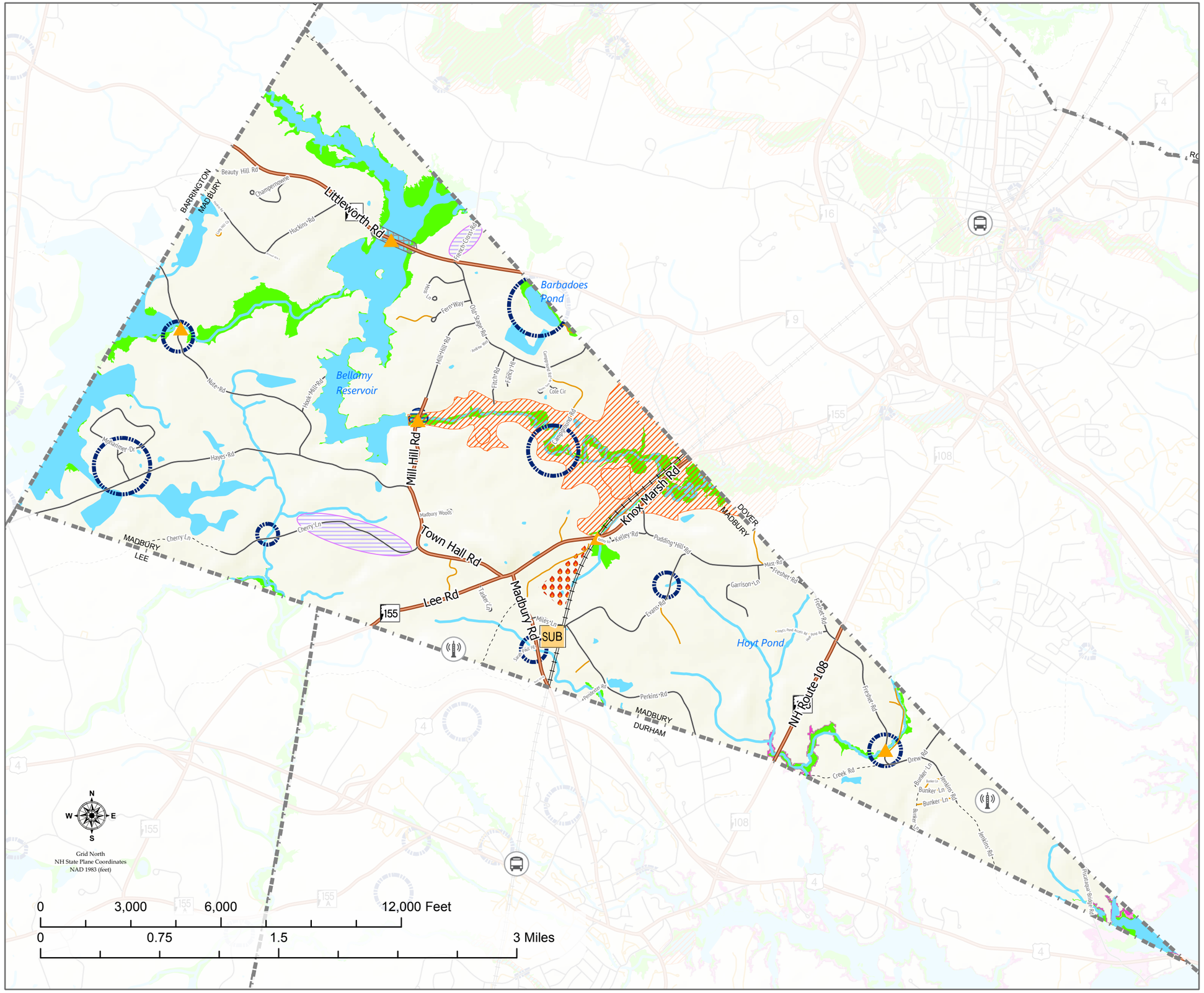
Maps prepared by Strafford Regional Planning Commission are for planning purposes only.

Strafford REGIONAL PLANNING COMMISSION

Critical Infrastructure & Past and Potential Hazards

2019 Hazard Mitigation Plan

MADBURY, NH



Critical Infrastructure (CI)

Type

- Bridges
- Amtrak Downeaster
- Communication Function
- SUB Power Substation
- High Hazard

Base Layers

Water Resources

- Lakes and Ponds
- Rivers, Brooks, Streams

Hazard Type

- Fire
- Dam Breech
- Downburst
- Lightning
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain

SLR Storm Scenarios

- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

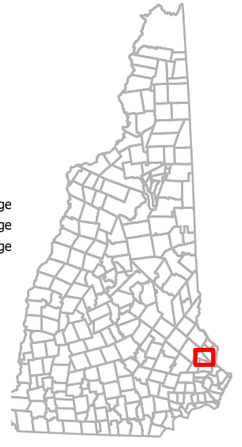
Transportation

Roads

Class

- State
- Local
- Private
- Not Maintained

Lake Ponds Names



DATA SOURCES

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

Prepared by: Strafford Regional Planning Commission
150 Wakefield St, Suite 12, Rochester, NH 03867
T: (603) 994-3500 F: (603) 994-3504 Em: srpc@strafford.org

Water Resources & Past and Potential Hazards
Date: June 2019
Path:M:\Region\OEM_haz_mit\2018_2019_Updates\Madbury_Update\Maps

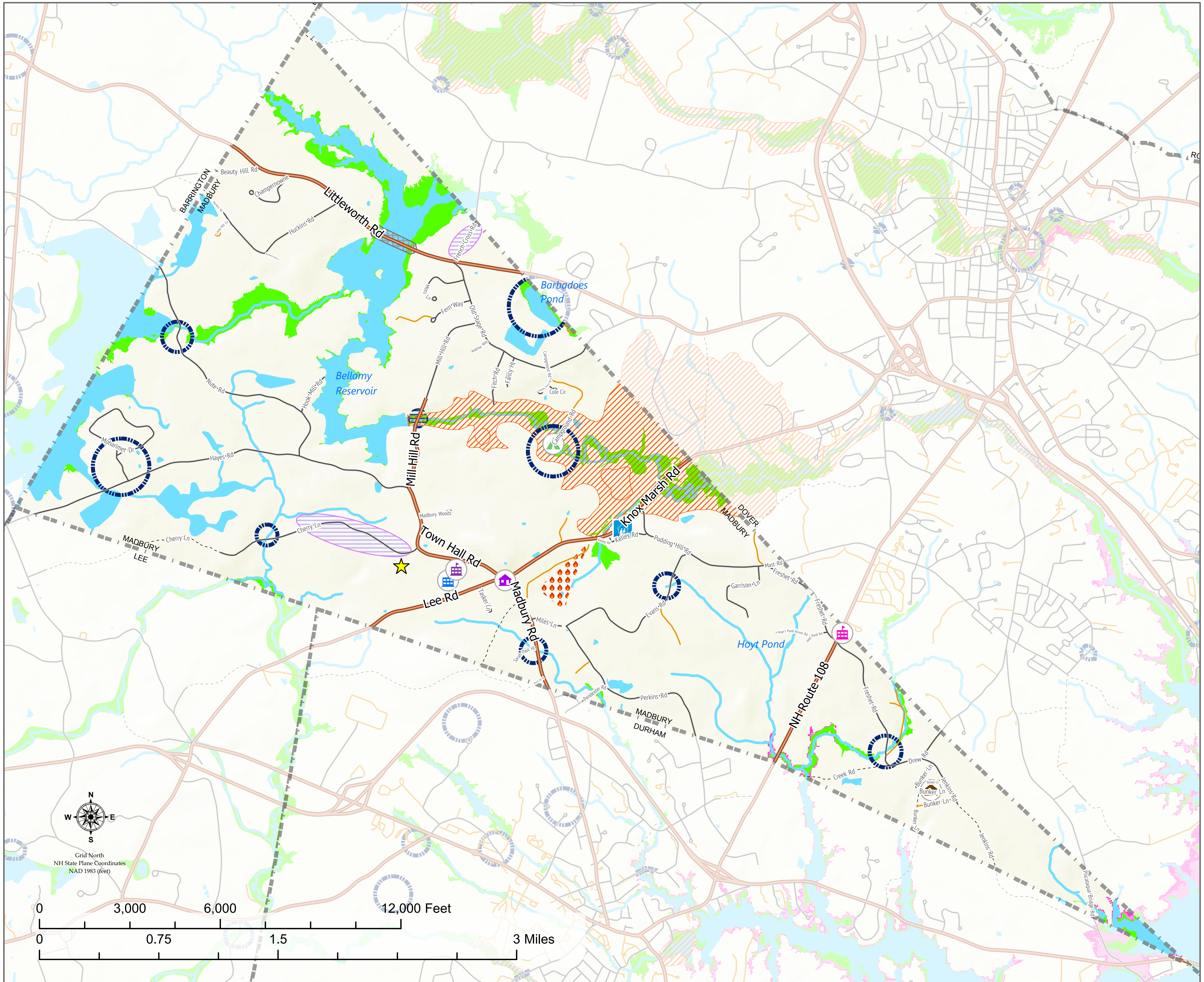
Maps prepared by Strafford Regional Planning Commission are for planning purposes only.

Strafford REGIONAL PLANNING COMMISSION

Vulnerable Populations to Protect & Past and Potential Hazards

2019 Hazard Mitigation Plan

MADBURY, NH



Vulnerable Populations to Protect (VPP)

Type

- School
- School (Children)
- After School Program
- Large Gatherings
- Manufactured Housing Park
- Student Housing
- Campground
- Assisted Living

Base Layers

Water Resources

- Lakes and Ponds
- Rivers, Brooks, Streams

Hazard Type

- Fire
- Dam Breech
- Downburst
- Lightning
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain

SLR Storm Scenarios

- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Transportation

Roads

Class

- State
- Local
- Private
- Not Maintained
- Lake Ponds Names

DATA SOURCES

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

Prepared by: Strafford Regional Planning Commission
150 Wakefield St, Suite 12, Rochester, NH 03867
T: (603) 994-3500 F: (603) 994-3504 Em: srpc@strafford.org

Water Resources & Past and Potential Hazards
Date: June 2019
Path:M:\Region\OEM_haz_mit\2018_2019_Updates\Madbury_Update\Maps

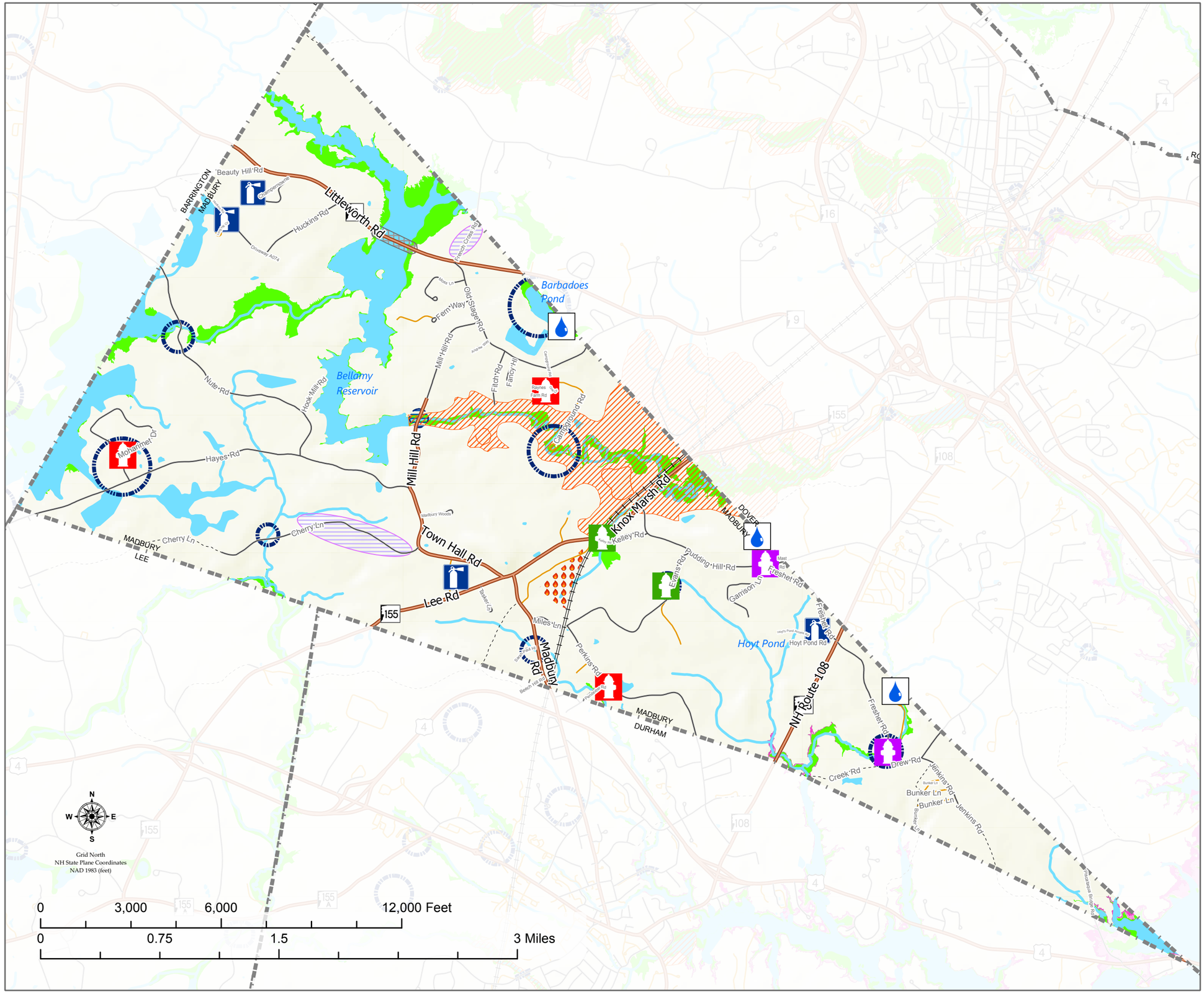
Maps prepared by Strafford Regional Planning Commission are for planning purposes only.

Strafford
REGIONAL PLANNING
COMMISSION

Water Resources & Past and Potential Hazards

2019 Hazard Mitigation Plan

MADBURY, NH



Water Resources (WR)

- Drinking Water Well
- Cistern - Auxiliary Fire Aid
- Dry Hydrant - Auxiliary Fire Aid
- Gravity Main Hydrant - Auxiliary Fire Aid
- Auxiliary Fire Aid, Pressure Hydrant

Base Layers

Water Resources
- Lakes and Ponds
- Rivers, Brooks, Streams

Hazard Type
- Fire
- Dam Breech
- Downburst
- Lightning
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain

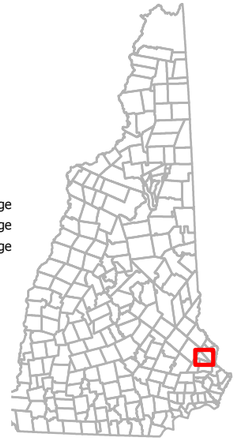
SLR Storm Scenarios
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Transportation

Roads

Class
- State
- Local
- Private
- Not Maintained

Lake Ponds Names



DATA SOURCES

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

Prepared by: Strafford Regional Planning Commission
150 Wakefield St, Suite 12, Rochester, NH 03867
T: (603) 994-3500 F: (603) 994-3504 Em: srpc@strafford.org

Water Resources & Past and Potential Hazards
Date: June 2019
Path:M:\Region\OEM_haz_mit\2018_2019_Updates\Madbury_Update\Maps

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

Strafford REGIONAL PLANNING COMMISSION